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CEOs Retreat, PPA 32nd Annual Conference and Trade Exhibition, Koror, Palau 2025

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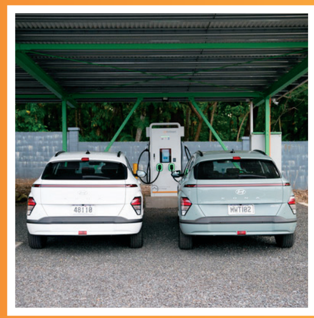

PPA

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

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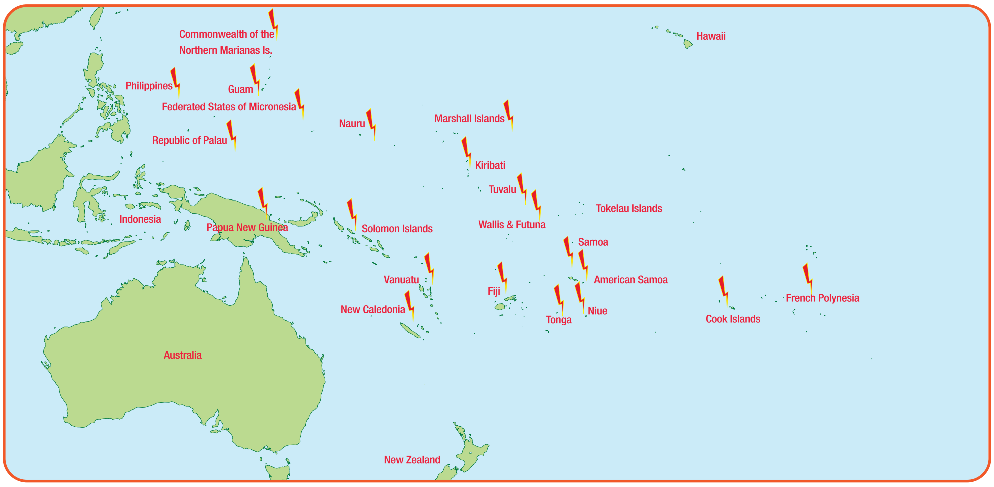

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Editor's Note

Gordon Chang
Executive Director

Ni sa Bula vinaka and Greetings from Suva.

The recent 32nd Annual Conference and Trade Exhibition, Utility Board Members Workshop and the Engineers' Workshop held in Koror, Republic of Palau, was a successful event for the Pacific Power Association. There was record attendance with some 250 delegates travelling from various part of the region and the world to attend the event and a record number of 40 exhibitors participating in the Trade Exhibition.

The success of the event is in no small part reflective of the untiring effort of the Board, Management and staff of Palau Public Utilities Corporation Ltd, the host utility, and the Government of the Republic of Palau which backed the efforts of the utility in hosting the conference. I take this opportunity to thank all the Allied members, Active members, affiliate members and the Development Partners who sponsored the PPA Conference and make this conference a great success.

The PPA Secretariat would like to welcome the new Allied members, Hadron Energy, Yachiyo Engineering Co., Ltd, Pramac Generac Australia Pty Ltd, Solar Pacific Pristine Power INC., and SicuroUSA who joined this last quarter. In additional, the PPA Secretariat would like to remind the allied members who have withdrawn their membership that they can rejoin their membership any time appropriate to them. The Secretariat acknowledges continuous support of those members that provided their articles and advertisements for this issue.

At the PPA Conference the PPA Board members endorsed the PPA Strategic Plan 2025-2029 and Strategic Plan and Implementation Plan Approach. In addition, the PPA Board also endorsed the ADB Project Management Unit MOU. These two documents will be provided to Development Partners to provide funding support for these activities.

The 54th Pacific Islands Forum Leaders Meeting was held in Honiara, Solomon Islands, from 8 – 12 September 2025 whereby leaders were supposed to endorse the merging of the PPA Secretariat with SPC. However, this was not endorsed as the Government of Nauru had intervened and called for more dialogue with the team who had prepared this paper. I am recommending to the PPA Board that they should work with their various governments to see this paper is included again the Leaders agenda for future consideration.

Thank you.

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Recent Renewable Transition Experiences, Issues and Lessons in Palau

Clarence Kitalong Jr., EPO Manager (Electric Power Operations),
Palau Public Utilities Corporation

Palau Renewable Energy Background

- Palau rooftop PV solar & IPP1 Solar Farm development followed national goals

Renewable Energy Goals from Leadership :

- 20% by 2020 –Palau Energy Policy (2010) –President Johnson Toribiong
- 45% by 2025 –NDC 2015 "Paris Agreement" –President RemengesauJr
- 100% by 2032 –target of President SurangelWhipps Jr from 2022 "Our Oceans Conference"

- Rooftop PV Solar
  - Rooftop PV promoted over the years. Policy adjusting to higher PV presence
  - DRECF I (Disaster Resilient Clean Energy Financing) program started ~2022 Summer, 1st installation ~October.
  - DRECF II –Increased PV for commercial customers
  - Continued Efforts for Rooftop solar beginning to conflict with IPP1 Solar Farm & PPUC
    - Ex 1: Large installations had large and immediate impact on grid. Low-loading generators on weekends. Large/fast fluctuations with weather
    - Ex 2: IPP1 Solar Farm costs to PPUC lower than cost of rooftop
- Most recently, Large solar PV addition: IPP1 Solar Farm 13MW, 10MWh
  - Journey (consultants assistance critical) (ADB & technical consultants)
    - RFP process 1-2years? (Solar Pacific, Juwi)
    - Power Purchase Agreement negotiations
    - Solar Farm Construction (Started April 2022-Completed June2023)
      - IPP Connection Point Switchgear (Connected July 18, 2023)
      - BSJ Switchgear (BSJ01,02,03,08,09) Connected July 25, 2023)

IPP1 Solar Farm Installation & Integration

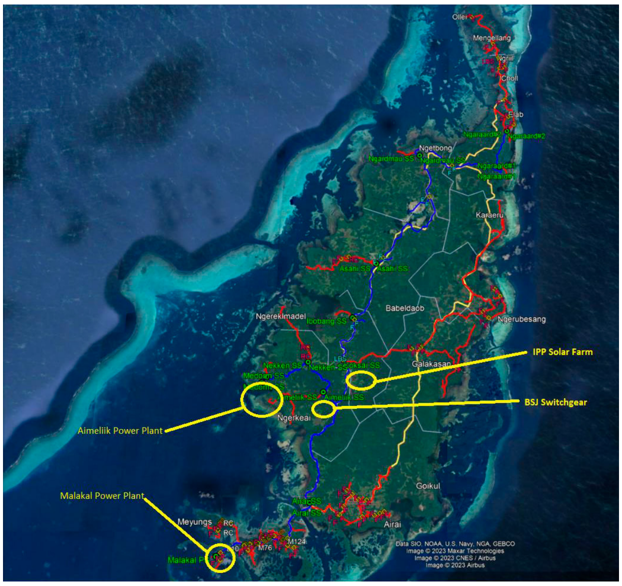
Palau Main Grid
Peak Load ~13MW

Base generation are three 5MW diesel gensets. (4 x 5MW gensets have been Palau's foundation for electricity)

2 Power Plants
Aimeliik Power Plant
Malakal Power Plant

Transmission & Distribution Fuses, S&C Tripsavers
Substations & Protection Relays

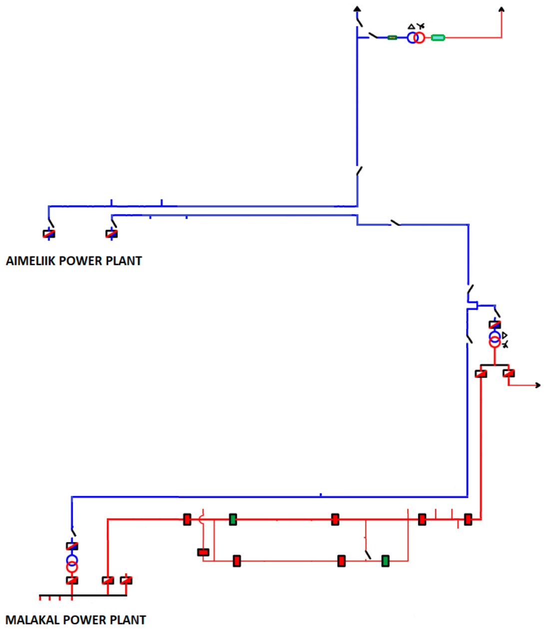
Recent addition (end of 2023)
IPP1 Solar Farm
BSJ Switchgear for IPP1



Before IPP Solar Farm

Peak Load ~13MW peak load.
Base generation 3 x 5MW diesel generators

S&C Tripsavers

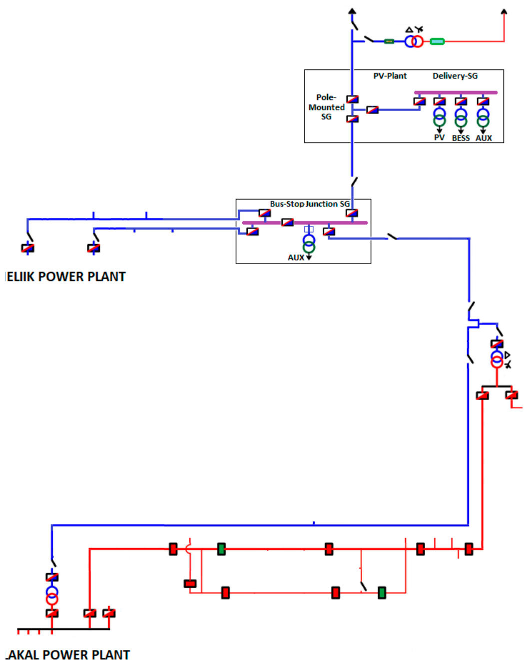


After IPP Solar Farm Installation

Solar Farm completed June 2023
Construction April 2022 - June 2023 (10 months)
(~13MW PV, ~12MWhr BESS)

IPP Connection to Grid July 18, 2023
Noja Reclosers
Limited to 1MW injection
Bypass switches

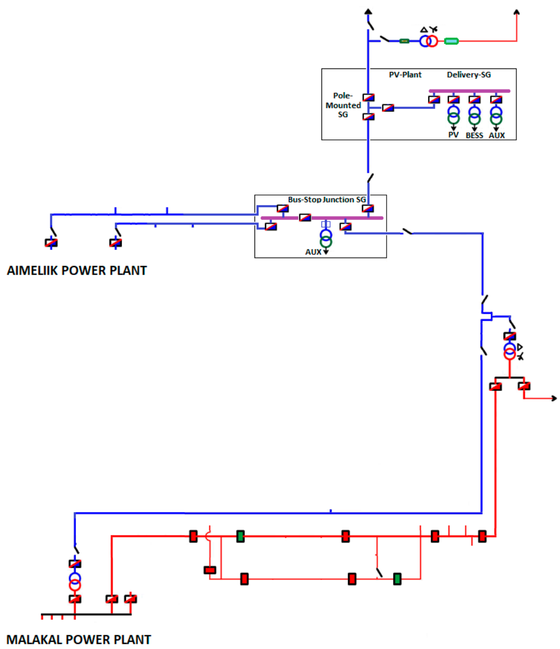
BSJ Switchgear Installation
Connected July 25



After IPP Solar Farm Installation

- PV at first increased slowly; Ramp Rate observation (MGC and Operation adjustments)
  - July 18 IPP1 connected. 1MW
  - July 25 BSJ connected. Increased PV injection.
  - Aug 26 2MW
  - Sept 14 4MW
  - Oct 12 6MW (low loading gens)
  - Oct 22 Off 1 DG (2 gen operation)
  - Nov Regular 2 gen operation
  - Dec Reliability Test

- Ramp Rate challenges
- Communications simple – phones & messaging apps
- Manual operation

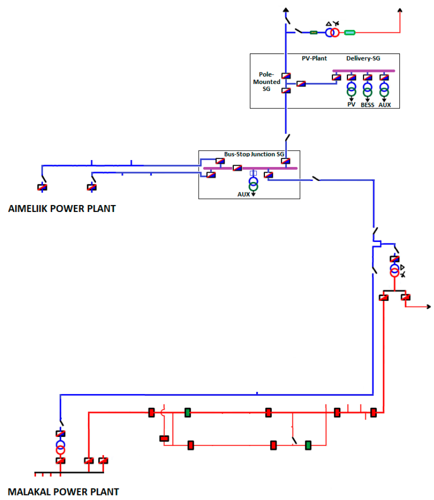


Past initial Installation Phase. Staring 2024.

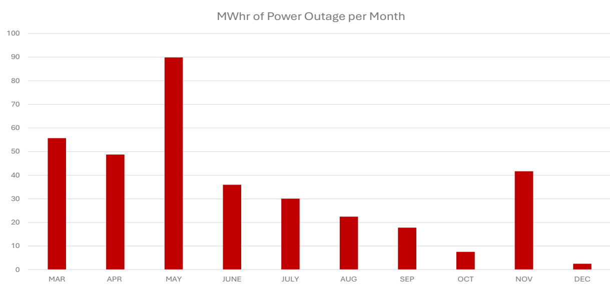
Jan	–	Improved MGC, turning off 2 DG (1 DG op)
Feb	–	more 1 gen op. Voltage regulation issues. 1st clue Gen Batt
Mar	–	large 1 gen op (high PV injection). Power outages.
Apr	–	Reduced injection. Split Grid recovery.
May	–	Reduced injection. Lost 2 major gensets. 1 for 76 days.
Jun	–	Limited injection. Split Grid. Fuel loss.
Jul	–	Gen batt replaced. Grid reconnected. Increased injection.
Aug	–	Cautious injection. 2 gen operation min

Island wide power outages reduced PV Injection.
- Switchgear network unfamiliar (internal capacity building)
- Equipment failure
  - HV Breakers, protection relays
  - Genset
  - Genset control panel

Protection Relays & SCADA key to troubleshooting

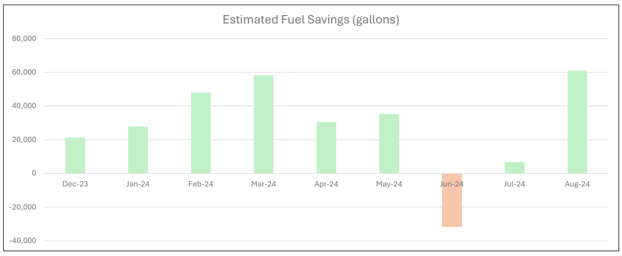


MWhrs of Power Outage from 2023 March to 2023 December

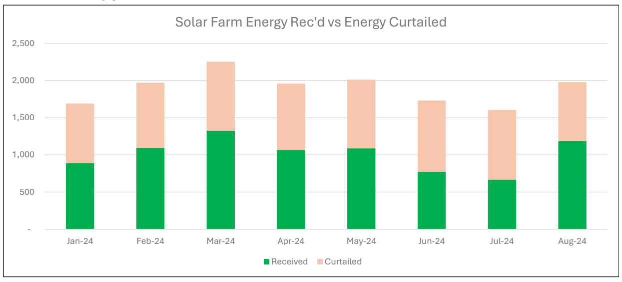


2024 January to August IPP Injection

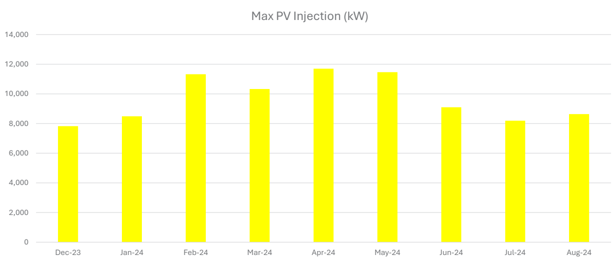
- Estimated Fuel Savings



- Energy Received
- Energy Curtailed

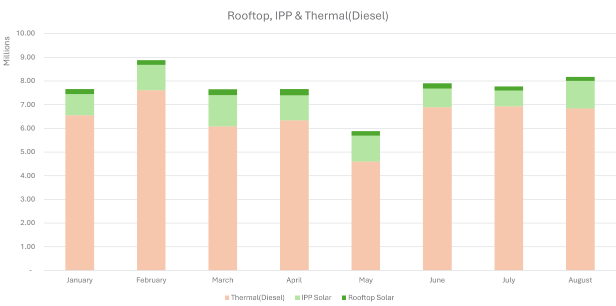


- 2024 January to August IPP Injection
  - Max power injected
  - High PV penetration on main grid Approaching 90%



	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24
Total E (kWh)		1,411	1,971	2,253	1,959	2,012	1,731	1,605	1,978
Energy Rc'd (kWh)	778	891	1,090	1,327	1,065	1,089	775	669	1,186
Energy Curtailed(kWh)		800	881	927	894	923	956	936	792
Max Power Injected(kW)	7,825	8,495	11,330	10,329	11,702	11,467	9,101	8,190	8,639
Est. Fuel Savings(gallons)	21,250	27,823	47,966	58,230	30,566	35,264	-31,559	6,779	61,001
Days shut down 2 DGs		7	18	22	5	9	1	1	0
%Energy rec'd		53	55	59	54	54	45	42	60
% Energy curtailed		47	45	41	46	46	55	58	40

- 2024 January to August Rooftop PV, IPP & Diesel Generation energy comparison



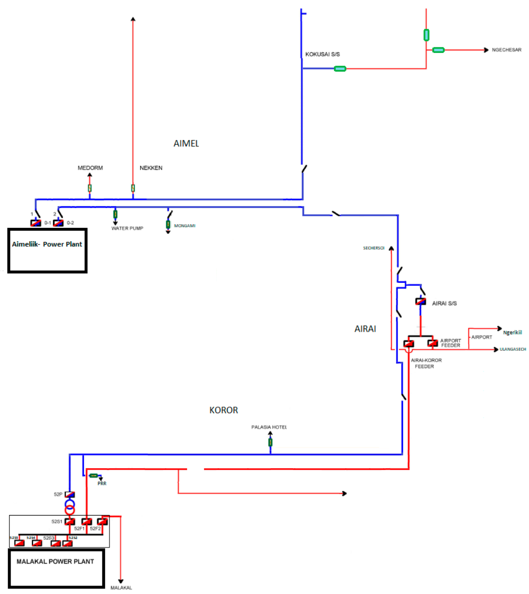
Rooftop Solar	3%	2%	3%	3%	3%	3%	2%	2%
IPP Solar	12%	12%	17%	14%	19%	10%	9%	14%
Thermal(Diesel)	86%	86%	80%	83%	78%	87%	89%	84%

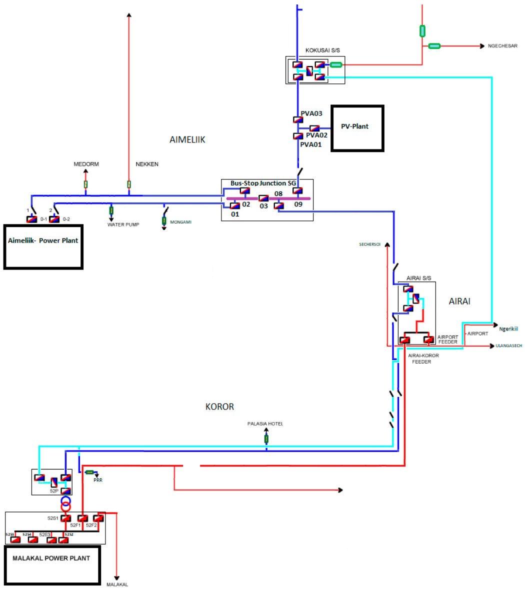
Progress to 2025

Lessons from 2024: Cost of higher Renewables

- Renewables add complication. Requires capacity building
- Expert assistance critical (PPA negotiation, construction, reliability tests, operations, etc..)
- Relationship with IPP, consultants and contractors is important
- RE requires a robust Grid. Existing vulnerabilities Magnified. Significant costs to improve.
- Record keeping/ logging critical for understanding
- Public and Leadership awareness and accurate understanding and support is critical.
- Curtailment cost pressure
  - High Curtailment from IPP1. Near 50%
  - Costs rise with each outage and grid transition
- Policy, Grid Codes necessary
- Forecasts challenges
  - (customer load growth slower than anticipated, rooftop PV growth faster than anticipated)

Progress 2023 -> 2024 ->2025





Progress 2025

Jan – Beginning of year. Cautious operation. Minimum 2 gensets.

Feb – Scheduled outages and support for JICA project.
MGC Parallel charing progress.

Mar – Scheduled outages and support for JICA project.

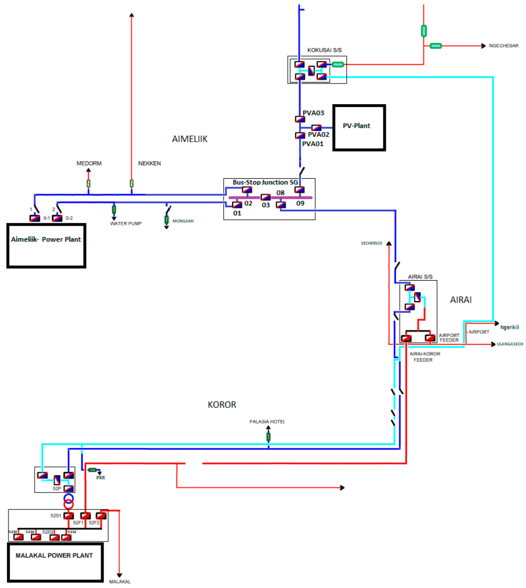
Apr – Scheduled outages and support for JICA project.

May – Scheduled outages and support for JICA project.

Jun – New 34.5kV Kokusai & Malakal Substations operational.
New 34.5kV Transmission Line in service.
Completed most of JICA project and scheduled outages
Pacific Mini-games starts. Split Grid.

Jul – Pacific Mini-games complete. Grid restored.
Auto-mode test conducted & completed.

Aug – Lowest Curtailment of IPP1 Solar Farm to date.
Major work by JICA to complete new 34.5kV Line.
- Numerous scheduled outages for line work.
Major improvement in Tree Trimming.
Improved Protection Relays settings (values & auto-reclose)
NCC/IPP Operations & MGC improvements
Significant reduction in Curtailment



Progress 2024 ->2025

- Increased capacity building internally & with outside experts (continuing progress)
  - Improved understanding and communication at ground level. Faster, more effective response and preventive measures
- Maintaining positive relationship with IPP1. Continued communication and discussions.
- Major improvements to Grid. (Work during year)
  - Newly installed 34.5kV transmission line by JICA.
  - Aggressive Tree Trimming
  - Continued improvements to Protection equipment (improved auto reclose implementation, settings adjust, etc)
- Improved data record keeping & collection (In progress).
- Public and Government relationship continued efforts
- Major reduction in Curtailment.
  - August 2025 exhibiting record low curtailment – below 18%
  - Reduced outages, improved operations, Improved MGC, improved protection
- Policy, Grid Codes. New Grid Code Implemented.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The Technology Landscape for a Transitioning Utility

Richard Coomber, Technical Manager,
Elemental Group Consulting

There are a number of well recognised impacts from the transition to renewables:

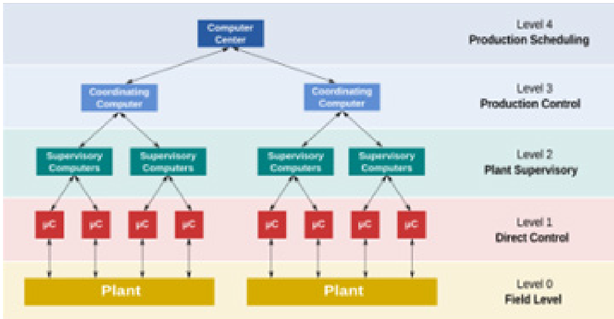
- Generation moves from there being a few large high inertia plants to still having those, but with significant complimentary intermittent renewables plants, along with an increasing amount of rooftop solar and batteries. BESS may increasingly provide spinning reserve.
- The Grid, traditionally a national centralised hub with spokes/feeders, becomes de-centralised, with significant Distributed Energy Resources (DER) remote generation and battery storage.
- Distribution becomes a two way activity with generators and consumers expecting compensation for their participation in the market and the energy they inject.
- Demand Management and Time of Use Tariffs will likely be required to motivate use of daytime PV generation, reduce peaks and reduce overall diesel based generation

Utility Management and Operations need to adjust to these changes. Traditional approaches of centralized response from generation, and human based reactive activity won't be able to react quickly enough and won't be able to deal with the complexity of the network. Technology is required.

Key components of the Technology Landscape:

1. **SCADA, Monitoring and Dispatch.**

SCADA is typically already being utilized for Engine/Generator management. All renewable generation will have its own SCADA. These SCADA implementations are at Level 0, and 1 of a typical SCADA hierarchy:



Acknowledgement: SCADA - Wikipedia

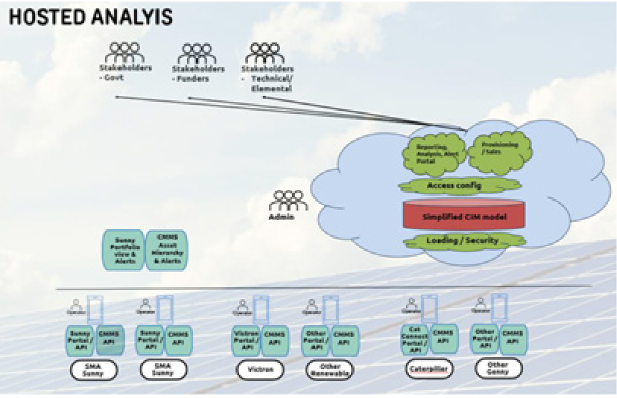
In some cases, for instance for a grid forming BESS, the Level 1 direct control will require algorithms to define BESS behavior. An advanced level 1 device will be required for this. For a transitioning utility a supervisory level 2 SCADA will be required to provide an overview of all generation. With a variety of generation sources and potentially changing grid forming requirements, dispatch management is required to optimize generation. The dispatch management might for instance use the intermittent renewables as baseload, with a BESS for grid forming, up to the limits of storage capacity, at which time diesel generation needs to be available. Dispatch Management is implemented with algorithms at Level 3.

For an advanced network there would be switchgear SCADA enabling remote isolation and backfeeding.

A new requirement arises for the transition utility – Low Voltage (LV) monitoring. Knowing what is going on at the end of a long feeder has always been a challenge and typically anecdotal customer and operations input is used. With rooftop solar and EV charging, there is the possibility for all sorts of under and over voltage/frequency events and invertor misbehaviors. Data on LV network conditions is therefore required. Such monitoring can be implemented in a number of ways with specialist Internet of Things (IOT) devices on switchgear, lines or transformers. Utilising Smart Meter Network Operation Data (NOD) is a strong possibility. The LV monitoring data needs to be integrated and visible at Level 3.

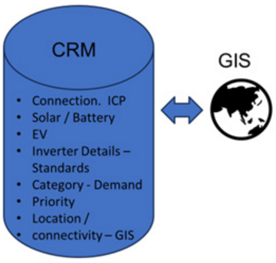
Monitoring also applies to remote microgrids. If these are based on a standard invertor technology, then the vendor portal can provide the basis for this. If there are multiple invertor or generator types, then an aggregating approach will be required.

Monitoring outlying generation



2. Customers – Customer Relationship Management (CRM) System

It may not be possible or appropriate to know much about prepay customers. However for customers with special requirements or connections, managing customer data will be required. Visualisation of this in GIS will be invaluable, when for instance understanding network behavior in relation to customer behavior:



3. Network Model

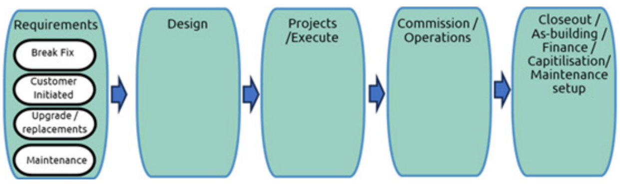
When renewables are proposed it is typical to execute grid studies and understand the alignment between the generation and the utility grid code or grid requirements. The grid study will typically result in a grid model. The grid model can be operationalised to, for instance, evaluate application for Distributed Energy Resources (DER) connections – what is a capacity of the lines and local demand:

Acknowledgment: Powerco https://www.powerco.co.nz/get-connected/utility-scale-generation

4. Work and Asset Management

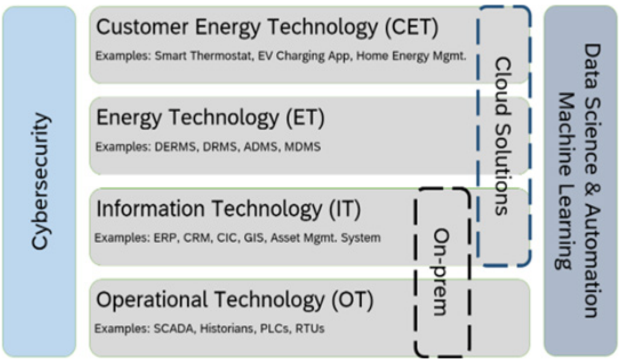
As a utility, what is our core business or activity, what is it we do all day?

- Is it satisfying customers / Stake holders? That is why we do what we do.
- Delivering Electricity / Power Quality / SAIDI / SAIFI? That is what we do.
- We think in organizational functions, but 70% of what we do is a supply chain of human and physical resources – that integrates across the functions to deliver the assets required for electricity supply. This is Work Management, and it is how we do things, and is our core business. All activities flow through these steps:



Having systems and processes that deliver Work Management in a coherent, integrated way will make this core activity most effective: ERP / Asset Management, GIS, Design Tools, project management, network access, CRM, CIC – Call center, planned outage notifications.

5. Overall Technology Landscape



When it comes to the next big requirement or opportunity in your utility, it may be tempting to press on with the next tranche of renewables or a big BESS, but at some point it will be clear that it is becoming increasingly difficult to manage and maintain that which you have, and that the renewables benefits aren't being achieved. It may be prudent to invest in technology based capability, along with human and process capability improvements as well.

In the landscape above there are many acronyms and even layers of technology that have not been described in this article. They are higher, aspirational aspects that are interesting to mature, advanced utilities. Focusing on the lower levels, plus cyber security, provides the foundations for advancing the transition and maturing toward the higher level opportunities.

Managing Renewable Energy E-Waste in the Pacific Island Countries

Leon Roose, Chief Technologist, Grid System Technologies Advanced Research Team (GridSTART), Hawaii Natural Energy Institute

I. Introduction

The State of Hawaii has been at the forefront of the transition to renewable energy (RE) in the Pacific islands for over two decades. Similar to many Pacific Island Countries (PICs), Hawaii's clean energy transition is heavily reliant on solar photovoltaics (PV) for RE generation, as well as lithium-ion batteries (LIBs) for both battery energy storage systems (BESS) and the electrification of transportation. As of 2024 (only one-third of the way to achieving its 100% RE goal), Hawaii had already installed over 6 million PV panels – enough to circle the moon. With respect to batteries, Hawaii has already installed roughly 6.5 million kilograms (kg) of utility-scale BESS, with another 9 million kg of LIBs installed in electric vehicles (EVs).

As these high volumes of RE products reach end life (EoL), Hawaii is facing major challenges in managing all the associated "e-waste." For small island economies, e-waste typically is only transported away if there is a business case for its removal. In larger markets such as the U.S. mainland and Japan, the EoL process for handling RE e-waste (RE-waste) generally follows a "reverse logistics chain" consisting of six steps from the final point of product placement back to the origin of the raw materials: (1) collection; (2) transport; (3) dismantling; (4) separation; (5) refinement; and (6) reuse. However, RE-waste streams in Hawaii pose significant risk due to the high cost and sometimes inability to transport them away.

The alternatives for addressing e-waste on small and remote islands generally include shipping it away, landfilling, stockpiling, reuse, recycling and extended producer responsibility (EPR) laws. As the PICs follow in Hawaii's footsteps in pursuit of their RE goals, the current situation in Hawaii may serve as a preview of things to come elsewhere in the Pacific. Indeed, challenges associated with geographic isolation, small populations and inability to achieve critical mass may be more acute in smaller PICs than in Hawaii.

When considering e-waste management strategies, it is important to distinguish between traditional types of e-waste such as televisions and computers, and newer forms of RE-waste, which primarily consist of PV panels and LIBs. As discussed in turn below, the preferred approaches for handling traditional e-waste, PV panels and LIBs differ greatly due to the varied nature of the equipment and existing laws, rules and regulations.

II. Traditional E-Waste

EPR laws hold producers responsible for the EoL management of their products and shift the financial burden of waste management from taxpayers and local governments to producers. However, especially for isolated small island markets, imposing EPR laws creates a very real risk that suppliers will simply decline to import their goods into those jurisdictions. For merchandise such as PV panels that are produced by a myriad of manufacturers all over the world, it is also difficult to identify who produced what and enforce compliance from overseas. Further, given the relatively long useful lives of clean energy products, there is no guarantee that the manufacturer will still be in business when the time comes to dispose of their imported equipment.

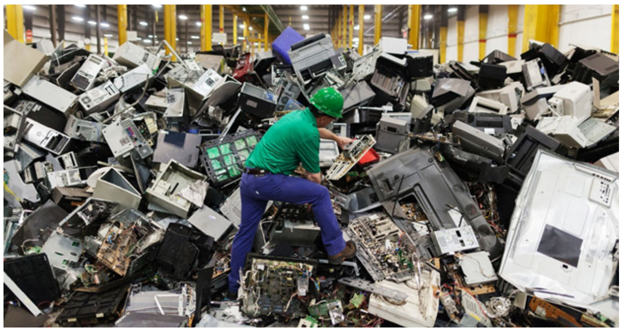


Figure 1 – E-Waste at a Recycling Plant on the U.S. Mainland (Source: National Geographic)

Hawaii has an EPR-like framework for "non-hazardous electronic devices" (e.g., TVs, computers, printers) that requires manufacturers to annually remove from Hawaii an amount of e-waste equivalent to 70% of the weight of the devices that they imported to Hawaii in the previous year. As an alternative to physically removing e-waste from Hawaii, importers of electronic devices have the option to purchase e-waste removal credits from other importers who exceeded their e-waste removal requirement in the same year. Manufacturers who do not meet their e-waste removal quota in a given year are fined for each pound of their shortfall.

III. Renewable Energy E-Waste

Although Hawaii's clean energy transition began nearly 20 years ago, the impacts related to RE-waste from PV panels and LIBs reaching EoL have only recently come into the spotlight as a looming crisis. Currently in the PICs, there is no national or regional EoL plan, network or concentration point for RE-waste. Issues related to the disposal of RE-waste in the PICs are becoming increasingly tangible, with shipping being the great unknown for reverse logistics to achieve circular economy outcomes.

Currently, there is no natural business case for transporting most RE-waste out of the PICs. For example, even in some of the larger PICs such as Samoa where disposal of commercial and RE-waste is left to the private sector, there is a lack of private sector EV dismantlers, EV authorized workshops, EV logistics experts, black mass producers, refiners or manufacturers[1]. For the PICs, the ability to effectively manage increasing volumes of RE-waste will likely turn on two critical factors: (1) the ability to safely and cost-effectively transport the RE-waste off-island; and (2) the ability to have the RE-waste accepted at larger regional hubs for processing. Understanding these factors will be critical for the PICs to chart a path forward to address the impacts of increasing accumulations of RE-waste on small island economies.

A. PV Panels

In Hawaii, the choices for disposing of PV panels at EoL are relatively straightforward. Hawaii's framework for traditional non-hazardous e-waste does not apply to PV panels, as PV panels are statutorily classified as a "hazardous" waste that needs to be disposed of in special landfills or sold for reuse. Given that the hazards posed by EoL PV panels are much less severe than the hazards posed by LIBs (which pose major explosion and fire hazards), it is possible that Hawaii's framework for non-hazardous e-waste could be applied to PV panels if PV panels were reclassified as "non-hazardous." Currently, however, used PV panels in Hawaii are managed by a network of private companies and initiatives that collect them for recycling or refurbishment, often shipping them to mainland facilities for processing. The cost to dispose of a PV panel in Hawaii is approximately $1.38 for landfilling, $28 for recycling and $15 for shipping[2].

Figure 2 – Pretreated PV Modules at a Recycling Plant in Germany (Source: International Energy Agency).

As noted above, there is no natural business case for recycling most RE-waste, and PV panels are no exception. In small island markets, demand for used equipment is limited due to falling prices and improved technologies for new equipment, difficulty in assessing whether used equipment is in good working order, lack of standards for quality and performance, and restrictions on interconnecting legacy equipment to utility power systems. Recycling also is not feasible due to laws/regulations prohibiting crushing, shredding or otherwise treating equipment that contains hazardous materials, the high cost of pretreating to remove hazardous materials, the low value of recovered materials and the low cost of mining new materials – all of which contribute to a lack of operational recycling centers. Even in Australia where there are significantly greater economies of scale, the cost for recycling a PV panel is approximately $AUD 28 (~$US18) – six times the $AUD 4.50 (~$US3) cost of sending the same panel to a landfill[3].

Only about 17% of a PV panel's components (namely the aluminum frame and junction box) are economic to recycle. The remaining 83% of the panel's materials (e.g., glass, silicon, polymer back sheeting) are not economic to recycle and instead treated as waste. As a result, the cost to recycle and/or ship a PV panel typically exceeds the value of the recycled materials; and therefore, EoL PV panels are increasingly being stranded on the islands to which they were initially imported. Notably, there are already an estimated 260,000 PV panels in the PICs. Regardless of the low value proposition for recycling PV panels, the reality is that EoL PV panels will eventually need to be shipped

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1 See Sergio Quiros Navas, *Strategies and Solutions for End-of-Life Batteries in Samoa* (presented at the Asian Development Bank 2025 Asia Clean Energy Forum conference).

2 See University of Hawaii System Annual Report, Report to the 2023 Legislature, Annual Report from the Hawaii Natural Energy Institute, *Recommendations on Waste Management of Clean Energy Products in Hawaii* (December 2022).

3 See Stewert Williams, *Key Insights for Renewable Energy Recycling Regulatory Framework in the Pacific* (presented at the Asian Development Bank 2025 Asia Clean Energy Forum conference).

away due to limitations on storage space on small islands. In other words, the economic and importantly other societal costs of stockpiling EoL PV panels in the PICs will eventually exceed the straight economic cost to ship them away[4].

One potential way of improving the value proposition for recycling RE waste is to leverage economies of scale. In this regard, consideration should be given in the PICs to developing a "hub-and-spoke" network for handling RE-waste, which connects multiple independent locations (spokes) to a central location (hub). The concept of hub-and-spoke networks is already being implemented in other PIC industries. For example, in the fisheries context, the Majuro Lagoon in the Marshall Islands serves as a hub for sorting skipjack tuna from purse seiner fishing vessels prior to being transshipped to Asia for canning.

In the context of PV panels in the PICs, the hub-and-spoke concept could be applied to specific islands serving as recycling hubs – particularly if they are centrally located along common shipping routes, are cost-competitive, and have sufficient infrastructure, technical capacity and financial resources. Even on islands where PV panel recycling is not economically feasible, there may be opportunities to utilize those hub locations as PV panel collection and transport depots, from which the panels can be more cost-effectively transported in larger quantities to recycling locations. In any event, given the relatively high cost of PV panel recycling and low volume/value of the recycled materials, it appears that some level of government support/subsidization will be required to effectively address EoL PV panels in the PICs.

B. Lithium-ion Batteries

It is important to distinguish between highly hazardous RE-waste such as LIBs that pose a fire or explosion risk, and less-hazardous RE-waste such as PV panels that can be shipped in a manner and at a cost similar to common cargo. Hawaii's framework for non-hazardous e-waste clearly does not apply to LIBs, which pose significant explosion, fire and electrical hazards that place them amongst the most dangerous forms of e-waste.

While high shipping costs are generally accepted as a part of life in the PICs, the costs for shipping LIBs are significantly higher than the costs for shipping PV panels due to additional costs for pretreating, packing, fire suppression and insurance. Already high shipping costs for LIBs are continuing to rise due to increasingly strict regulations on the transport of hazardous e-waste and insurance companies raising their premiums to address growing numbers of undeclared shipments. For example, the costs in Hawaii to dispose of a 1 kg LIB are approximately $2.20 for recycling, $7.70 for shipping equipment in new/good condition, and $25 for shipping equipment in damaged, defective or recalled (DDR) condition. In addition, more and more shippers and ports are unwilling to accept hazardous e-waste cargos – especially EoL DDR LIBs. Moreover, some jurisdictions (including Hawaii) have laws and regulations that make it effectively impossible to secure bonding for certain hazardous e-waste shipments[5].

As a result of high shipping costs and other restrictions on shipping batteries, EoL LIBs are effectively stranded on the islands to which they were initially imported. Notably, as an early adopter of EVs, Fiji already has a number of EoL EV batteries stranded within its borders. Although there is an established lead battery manufacturer in Fiji (Pacific Batteries), they do not deal in LIBs[6].

In July 2025, the Matson shipping company suspended all EV and plug-in hybrid electric vehicle (PHEV) shipments to Hawaii, citing growing safety concerns related to LIBs. The decision followed several high-profile maritime incidents involving LIB fires, including the June 2025 sinking of the 600-foot Morning Midas cargo ship in the North Pacific. According to Matson, the company "continues to support industry efforts to develop comprehensive standards and procedures to address fire risk posed by lithium-ion batteries at sea and plans to resume acceptance of them when appropriate safety solutions that meet our requirements can be implemented." As the global maritime industry confronts these emerging challenges, regulatory bodies including the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) have released new guidance for LIB shipping, requiring compliance with both domestic regulations and the International Maritime Dangerous Goods (IMDG) code. Whereas it was already difficult to ship DDR LIBs[7] out of Hawaii

4 See id.

5 See University of Hawaii System Annual Report, Report to the 2023 Legislature, Annual Report from the Hawaii Natural Energy Institute, *Recommendations on Waste Management of Clean Energy Products in Hawaii* (December 2022).

6 See Stewert Williams, Key *Insights for Renewable Energy Recycling Regulatory Framework in the Pacific* (presented at the Asian Development Bank 2025 Asia Clean Energy Forum conference).

7 See Mike Shuler, gCaptain daily, *Matson Suspends Electric Vehicle Shipments Over Battery Fire Concerns* (July 21, 2025).

prior to Matson's suspension of EV shipping, it now appears that removing even undamaged LIBs may soon be more difficult, if not impossible.

Figure 3 – Morning Midas Cargo Ship Afire Prior to Sinking in the North Pacific (Source: Datamar News).

As an alternative to incurring the high cost of shipping EoL LIBs out of Hawaii, a significant volume of LIBs are beginning to appear in landfills. However, landfilling is generally not a workable alternative for disposing of LIBs due to obvious safety issues, existing laws and regulations that bar the disposal of hazardous materials, the high cost to test for hazardous waste, lack of human capacity to process e-waste, and facilities refusing to accept e-waste. Unable to dispose of their RE-waste, holders of EoL LIBs such as automobile dealerships that service EVs may have no choice but to stockpile used batteries, giving rise to major explosion and fire hazards. Even if such hazards could be cost-effectively mitigated, similar to the case with PV panels, stockpiling is a temporary solution at best, and certainly not a sustainable solution on small islands with finite land area.

Breaking LIBs Down into Black Mass

One way of making LIBs safe for transport is to break them down into "black mass," the powdery, dark material that remains after shredding LIBs during recycling. Black mass represents the simplest level of processing/producing an exportable product that can then be shipped. Once reduced to black mass, a LIB no longer poses any electrical, fire or explosion hazard, but remains a valuable source of metals such as lithium, cobalt and nickel, which can be extracted and sold in black mass markets such as those currently existing in South Korea, Japan and Singapore.

In larger markets/economies, reuse, refurbishment and recycling may be cost-effective strategies for reclaiming the value of used LIBs. For example, in Japan, Nissan and Sumitomo Corporation have entered into a joint venture named the 4R Energy Corporation focused on the "four Rs": Reuse, Resell, Refabricate, Recycle used LIBs from EVs. 4R applies these processes to give used EV batteries a second life, primarily by grading them for various applications such as: high-performance units for new EVs; industrial applications such as forklifts and large energy storage systems; and even backup power systems for facilities. However, such circular economy strategies are not currently feasible alternatives for handing RE-waste in the PICs due to legal/regulatory restrictions and economies of scale. Even if LIBs can be reused or refurbished in the PICs, the reality is that they will eventually become unusable, and ultimately require removal/disposal at their final EoL.

In Hawaii, a leading e-waste collector named "E-Opala" is working on a solution to address the inability to ship EoL LIBs out of the islands. Under E-Opala's planned solution, undamaged LIBs would continue to be shipped to the U.S. mainland for the time being; but DDR LIBs would be shredded or otherwise broken down into black mass, and then shipped to the mainland at standard shipping rates. E-Opala has observed that even with the small scale of its operations, the company's LIB shredding equipment may be cost-effective to operate – especially when compared to the high cost or impossibility of shipping DDR LIBs from Hawaii to the U.S. mainland. At present, the primary obstacle to more fully implementing E-Opala's DDR LIB shredding process is an existing Hawaii law that prohibits the crushing and shredding of LIBs.

It appears that E-Opala's approach for handling DDR LIBs could serve as a model for addressing the difficulties associated with shipping hazardous LIBs in the PICs. In light of Matson's recent suspension of its EV shipping operations, E-Opala could consider shredding undamaged batteries as well (as opposed to just DDR batteries as initially planned). Expanding the breadth of its shredding operations may actually improve the value proposition for E-Opala's battery recycling operations by unlocking greater economies of scale.

Figure 4 – Lithium-ion Battery Shredder (Source: Sure Origin Group).

Creating a hub-and-spoke network for LIB recycling is yet another potential strategy for realizing economies of scale. In the LIB context, the spokes would be represented by the islands seeking to export used LIBs for processing, with the hubs represented by centralized locations where LIBs can be cost-effectively broken down into black mass for recycling or even refurbished for reuse. Identification of the best candidates to serve as LIB recycling hubs may depend on a number of factors. At the outset, some countries do not even accept imports of used LIBs. For example, China has banned the import of used LIBs, and Europe has only just recently permitted the first import of used LIBs from the United Kingdom. For the PICs, South Korea – where approximately 50% of used LIBs are recycled – appears to be a good continental option for a LIB recycling hub (although market links would need to be established).

1. Containerizing LIBs for Safer Shipping

Another way that LIBs can be more safely transported overseas is to use an EoL LIB storage container, similar to one currently being utilized in Samoa. Samoa's EoL EV storage container features anti-explosive and fire control systems, as well as an air-cooling system, and can safely store up to six EV LIBs for up to 20 years. Although costly to acquire and operate, there may be opportunities for multiple PICs to share a single EoL EV storage container by taking turns using it to ship LIBs to larger processing hubs. Similarly, Tesla sells containers capable of safely encasing a single Tesla EV battery for shipping. Notwithstanding these types of technical mitigations, the question remains whether they will be adequate to alleviate the concerns of shippers, their insurers and their regulators regarding the hazards of transporting LIBs.

Figure 5 – Samoa's EoL EV LIB Storage Container (Source: UNDP).

IV. Policy Support for RE-Waste Management

Aside from breaking LIBs down into black matter and encasing them in explosion/fire-proof containers, there may be other innovative solutions to the problem of shipping LIBs. Regardless of the ultimate solution(s), it is important for PICs to align their RE-waste handling, removal, storage and transport with commonly accepted international standards, as well as address the widespread problem of unregulated dumping. The difficulty of transporting RE-waste in general and LIBs in particular appears to be the first obstacle that needs to be addressed.

Addressing the transportation of RE-waste will require substantial technical and financial support to create a regional governmental framework for handling RE-waste. The framework will need to be aligned with region-wide policies, laws and regulations that enable RE-waste to be handled in a safe, orderly and cost-effective manner. Given that every PIC has its own set of policies, laws and regulations, this is something that may need to be addressed on a country-by-country basis. For most small PICs, this will entail building an RE-waste management system almost completely from scratch. For some larger PICs, there may be opportunities to leverage existing stakeholders such as manufacturers and established recyclers.

Potential avenues for technical and financial support for RE-waste management in the PICs could be in the form of developing technologies for breaking LIBs down into black mass and safely containing LIBs during shipping; financing the construction of RE-waste depots and processing facilities on key islands; purchasing LIB shipping containers; capacity building on RE-waste management; providing insurance for shippers of LIBs; and any other alternative strategies that may show promise. Once the issues associated with transporting and processing RE-waste have been addressed, the PICs will be better-positioned to explore tapping larger RE-waste recycling markets overseas to realize economies of scale and potentially turn the currently costly burden of RE-waste into an economic resource.

Accelerating the Green Energy Transition: Hybrid Floating Solutions for Island Resilience

Jeremy Szopa, New Caledonia Country Manager, Karpowership

Island nations across the Pacific face a unique energy challenge: small and fragile grids, dependence on imported fuels, and vulnerability to natural disasters. At the same time, the transition to cleaner energy is essential to safeguard both communities and ecosystems. What is needed are solutions that can provide reliable power today while supporting long-term sustainability and energy independence.

With over 25 years of experience and a 10,000 MW Powership fleet, Karpowership delivers flexible and scalable solutions that respond directly to these challenges. Our Powerships can be grid-connected in under 30 days, requiring no land and immediately reducing emissions compared to aging diesel plants. For island nations, this means faster access to reliable baseload power while creating space for renewable energy to grow.

Reliable Energy Today: LNG-Powered Powerships

Many islands continue to rely on costly diesel generation, exposing them to volatile fuel prices and high emissions. Liquefied Natural Gas (LNG) offers a practical bridge — cleaner than coal and oil, yet reliable enough to provide round-the-clock power.

Karpowership integrates LNG into its floating power ecosystem with multi-fuel capability, supported by LNG Terminal Ships (LNGTSs) and LNG Carriers. This provides governments with immediate cleaner power without the delays or land use of new construction.

Key Advantages for Island Nations:

- Deployment in under 30 days with no land requirement
- Cleaner, more affordable alternative to diesel and coal
- Flexible, scalable capacities ranging from 30 MW to 500 MW
- Reliable baseload power that supports renewable integration
- Energy security through integrated LNG supply and regasification

Our next-generation Powerships are also being designed with advanced sustainability features — from Carbon Capture, Utilization, and Storage (CCUS) to readiness for future low-carbon fuels like hydrogen, ammonia, and renewable natural gas. This ensures that islands investing in today's solutions can seamlessly evolve toward tomorrow's net-zero goals.

Hybrid Pathways to Renewable Integration

While Powerships provide immediate security, Karpowership is also investing in solar PV, battery energy storage systems (BESS), geothermal, and waste-to-power projects. These hybrid systems expand renewable penetration while maintaining stability — a critical need for small island grids where intermittency can otherwise cause instability.

Battery storage plays a central role, capturing excess renewable energy and releasing it during periods of low generation or high demand. This reduces dependence on imported fuels, lowers costs, and strengthens resilience against natural disasters.

Hybrid Benefits for Island Nations:

- Greater renewable energy penetration without risking blackouts
- Reliable 24/7 power through BESS support
- Reduced exposure to global fuel price shocks
- Optimized use of abundant local solar or geothermal resources
- Stronger grid resilience to storms and demand fluctuations

Conclusion: Partnering for a Sustainable Future

For Pacific Island nations, energy solutions must be immediate, adaptable, and sustainable. Karpowership provides that foundation today, offering LNG-powered Powerships for instant relief, hybrid systems that grow renewables, and advanced designs that prepare for future fuels.

By working together with island governments, we are committed to delivering not just cleaner power, but energy resilience that protects communities, supports economic growth, and safeguards the fragile environments of the Pacific.

Powering The Pacific's Future: Why Smart Grids are a Necessity

Ross Waddington, CEO,
Pacific Island Renewables

For Pacific nations, the journey towards a sustainable energy future is not just an environmental goal; it's an urgent economic imperative. Island power systems which are reliant on imported diesel fuel face unique challenges: high import costs, vulnerability to climate change, and small, fragile, outdated grids. Ambitious renewable energy targets require a fundamental transformation, from passive, "dumb" networks to intelligent, resilient smart grids.

The limits of conventional grids

Passive grids are now at the end of their lifespan and are being replaced around the world. The days of electricity being generated at central diesel plants, transmitted over long distances, and distributed to consumers with minimal communication or control are nearing their end.

Without real-time data or digital modelling, operators cannot assess the impact of new renewable connections, forecast weak points, or manage outages efficiently. The result is a system with high costs, poor power quality, and limited renewable integration.

Trying to add modern solar and wind power to this old infrastructure is like trying to use an electric supercar on an old dirt track: It simply doesn't work.

What is a smart grid?

The smart grid emerges as a game-changer—an adaptive ecosystem that uses digital communication, real-time data, and advanced analytics to manage electricity flow intelligently. It enables a two-way flow of both power and information. Modern smart grids feature self-healing automation; using AI and IoT sensors, they can detect faults, isolate problems, and reroute power, often before customers notice an interruption.

Through advanced metering, the smart grid provides a detailed understanding of energy use, enabling dynamic pricing and empowering consumers to take control of their energy usage. We are starting to see this roll out in Europe, with consumers being able to access off-peak energy prices at certain times, and better power management between traditional generators and renewable sources like solar and wind farms.

Microgrid capabilities allow localized grids to disconnect and operate independently using solar and batteries during storms or outages, building crucial resilience for island communities.

The Smart Grid Architecture Model (SGAM) framework (Figure 1) is a standardized, three-dimensional model used to visualize and plan the complex components and interactions of a modern smart electrical grid. This serves as the model that today's smart grids are being built to.

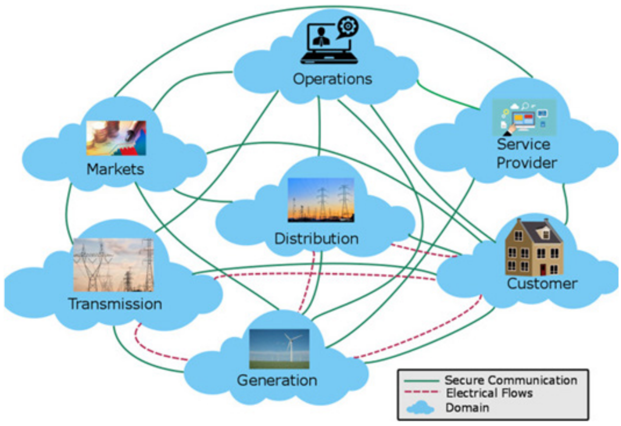


Figure 1 Smart Grid conceptual model ©NIST

The Pacific's motivation for change

The volatile cost of imported diesel burdens national economies, while extreme weather events disrupt power for extended periods, affecting lives, businesses, and critical services.

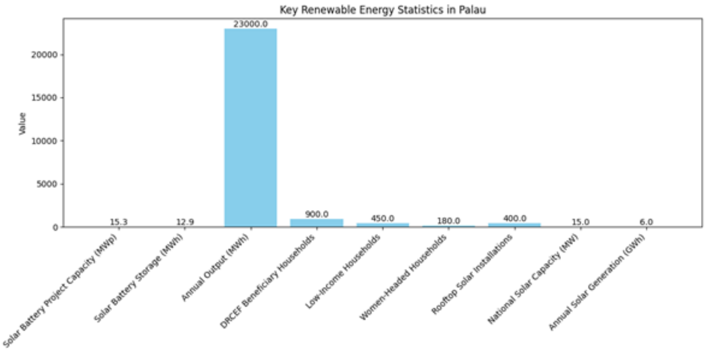
With the growing integration of renewable energy across Palau—particularly at the customer level—initiatives such as the National Development Bank of Palau (NDBP) grants have played a pivotal role in supporting residential and, more recently, commercial installations. These efforts are complemented by a range of community-based projects that are embracing clean energy as a sustainable alternative to traditional electricity generation.

The Palau Solar Battery Project is set to become the largest solar hybrid installation in the Western Pacific. This facility combines 15.3MWac of solar photovoltaic capacity with 12.9 MWh of battery energy storage, covering around 25% of Palau's electricity demand, subject to the grid being adapted to successfully manage that power.

The Disaster Resilient Clean Energy Financing (DRCEF) project, supported by the Asian Development Bank and the Japan Fund for the Joint Crediting Mechanism, provides subsidised loans through NDBP to promote low-carbon technologies such as solar PV systems and battery storage, with a particular focus on micro, small, and women-led enterprises.

The following chart visualises the key energy statistics in Palau, which highlight:

- The capacity and output of the Palau Solar Battery Project
- The number of households supported by the DRCEF programme
- The spread of rooftop solar installations
- The national solar capacity and generation



This growing capacity in both solar generation and battery storage provides the essential foundation for Palau's next energy evolution: building a smart grid that can intelligently manage this renewable energy, balance supply and demand in real-time, and ensure a resilient, efficient, and reliable power system for all households.

The first step: Digitalization

Integrating distributed renewable resources into a weak, overloaded grid is a huge technical challenge. Intermittent solar power can cause voltage and frequency fluctuations, leading to poor power quality and even blackouts. This is why the journey to a smart grid must begin with digitalization.

Creating software models of the physical grid and installing power quality meters helps collect real-world data on voltage, current, and harmonics. This allows engineers to run simulations, identify potential problems, and design mitigation strategies before renewables are installed. This foundational work enables integration of key technologies like grid-forming inverters that stabilize power flow, grid-scale batteries that store energy, and modern protection systems.

Digital communication systems enable seamless data exchange for real-time monitoring and control, while advanced metering infrastructure supports demand-side management by empowering consumers and optimizing load distribution. Operational advantages include load balancing and demand response, which dynamically adjust to fluctuating conditions, and predictive maintenance, which anticipates equipment failures to reduce outages.

At the grassroots level, communities are witnessing tangible benefits. In Aimeliik State, households with off-grid solar systems report reduced electricity costs and improved energy resilience during outages and extreme weather. Solar installations in remote schools on islands like Hatohobei, Pulo Anna, and Sonsorol ensure consistent electricity, enhancing education and community engagement.

Palau's roadmap to achieve 100% renewable energy by 2050 depends on this digital foundation. A smart grid would improve stability and efficiency, mitigate fluctuations, reduce outages, and enable dynamic energy exchanges. Consumers could export surplus electricity back to the grid with real-time tariffs that incentivize renewable investment and foster a resilient, decentralized energy ecosystem.

The broader benefits: Beyond reliability

A modernised grid translates directly into enhanced economic and social well-being. Reduced diesel imports free up national budgets for healthcare, education, and infrastructure. Stable, reliable power attracts business investment and fosters economic growth.

For consumers, it means lower electricity bills and protection from global fuel price shocks. Smart grids are essential enabling technology for achieving national decarbonization targets like Palau's goal of 100% renewable energy by 2050, ensuring the Pacific contributes to global climate solutions while protecting its own environments.

A resilient future

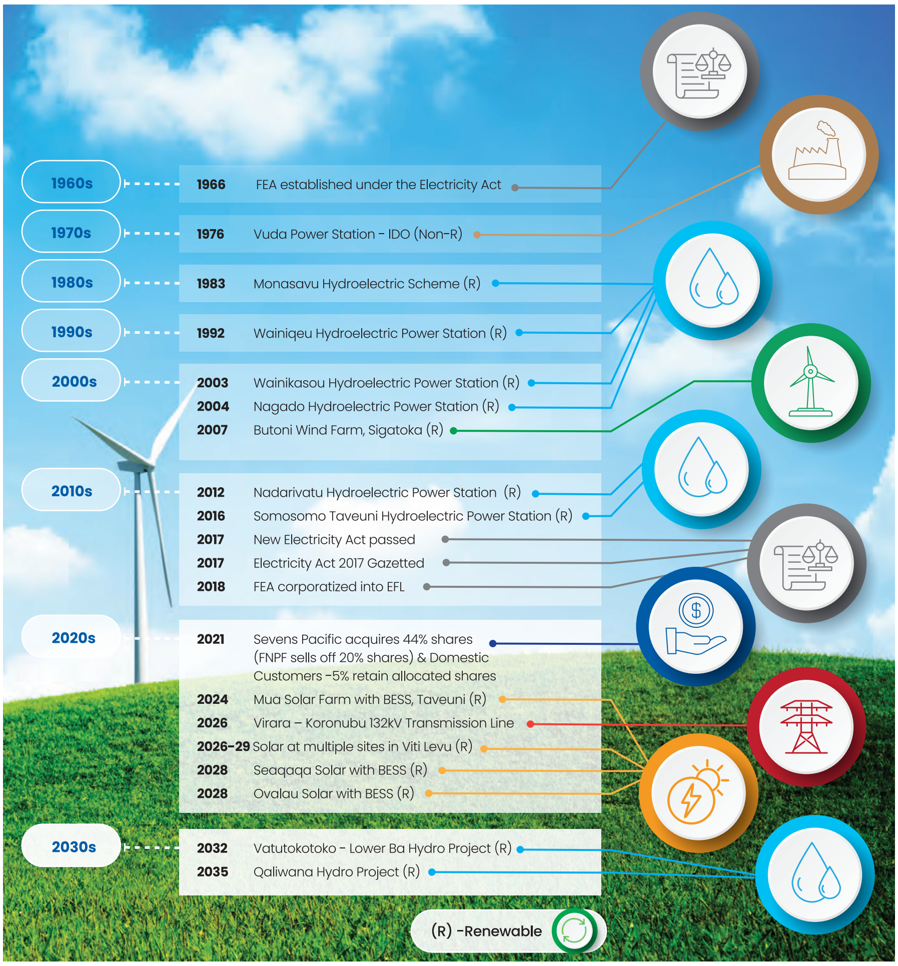
For the Pacific Islands, smart grid technology is the critical backbone for building a resilient, self-sufficient, and prosperous future. The transition requires strong local partnerships, a skilled local workforce, and bespoke solutions for each island state.

By embracing this evolution, Pacific nations can optimize renewable advantages, turning geographic challenges into strategic advantages and lighting the way toward a sustainable energy future for generations to come. The time to build the resilient grid of the future is now.

To find out more about how Pacific Island Renewables can help you reach your renewable energy goals, visit: www.pacificislandrenewables.com or speak to our local team in Koror, Palau: +680 587 2270

EFL's Roadmap Transition to Renewable Energy

Energy Fiji Limited



FIJI IS EMBARKING ON A BOLD JOURNEY TO TRANSFORM HOW WE POWER OUR LIVES

It is a major pillar of Fiji's National Development Plan and Vision. By the end of **2029**, Energy Fiji Limited (EFL) aim to have **60%** of our electricity from renewable sources, and by **2035** we plan to reach **90%**.

Together, we can take pride in powering Fiji with renewable energy- ensuring a sustainable, resilient, and prosperous future for all.

There's still a long way to go but we can all take pride of how far we've come on the road to a renewable future.

THE NEXT DECADE FROM 2025 TO 2035

Supporting a More Sustainable Energy Future

FIJI'S POPULATION AND ECONOMY ARE GROWING, AND SO IS OUR NEED FOR ELECTRICITY.

Relying on imported diesel is costly, polluting, and vulnerable to global disruptions. **That's why Energy Fiji Limited (EFL) is investing in renewable energy and modernising the grid.** It's the smarter path forward.

This approach will:

- help keep electricity affordable over the long term
- protect the environment and reduce pollution
- boost energy security by reducing the amount of fuel we need to import
- ensure power stays on during global fuel supply disruptions
- create local jobs and promote cleaner air and healthier communities

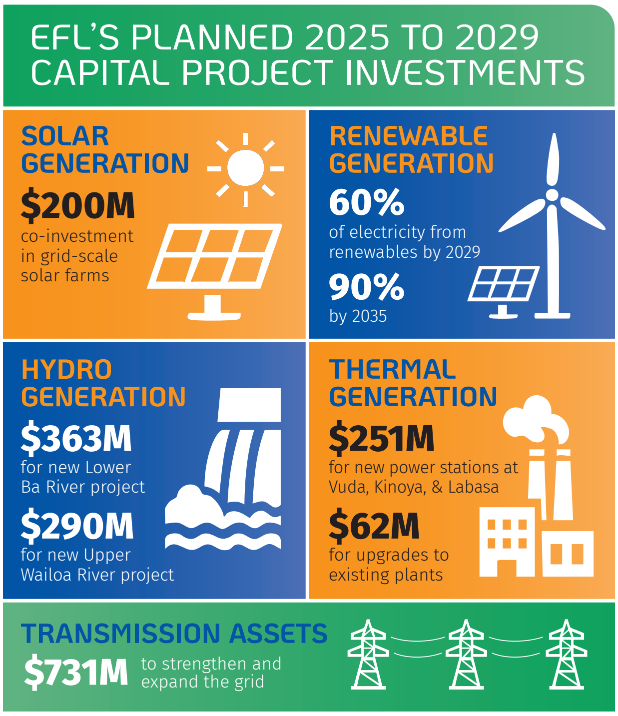
WHY RENEWABLE ENERGY MATTERS

EFL is working towards a future where electricity in Fiji is nearly 100% renewable and generated right here, from our own sun, wind, and water.

We aim to achieve:

- **60% renewable energy by 2029**
- **90% renewable energy by 2035.**

Making these changes now will help us avoid higher costs and greater challenges later, especially as the effects of climate change increase and global fuel prices remain unpredictable.



A SHARED JOURNEY TOWARDS A BRIGHTER FIJI

Our investment plan is about more than just building power plants—it's about building a better future.

Our vision is clear: 90% of Fiji's electricity will come from renewable sources by 2035.

To meet our renewable energy goals, we're also working with partners such as the Asian Development Bank and exploring public–private partnerships to accelerate investment in clean energy.

Together with Government support, private sector partnerships, and the resilience of the Fijian people, we are creating an energy system that will be reliable, clean, and affordable for everyone.

This is our shared journey towards a greener, more secure, and more prosperous Fiji.

HOW WE WILL GET THERE: SOLAR, HYDRO, WIND, BATTERIES, AND GRID UPGRADES

Our investment plan will help enable:

SOLAR POWER

- Fiji has year-round sunshine—perfect for solar energy.
- We're building large solar farms and encouraging rooftop solar for homes and businesses.
- The Taveuni project has been completed and commissioned.
- Projects in Western Viti Levu are in progress.

HYDROPOWER

- Our rivers have powered Fiji for decades.
- We will upgrade existing hydro stations and explore new sites.

WIND POWER

- Wind complements solar, especially at night.
- We are researching wind technologies.

BATTERY ENERGY STORAGE SYSTEMS (BESS)

- Batteries store excess solar and/or wind energy and release it when needed.
- They help keep power flowing steadily, day and night.

TRANSMISSION GRID UPGRADES

- We are investing over $700 million to build a stronger, smarter grid.
- This will reduce outages, allow power to reach more communities, and ensure we can use new renewable energy sources.

THERMAL (FUEL) GENERATION

- This project serves as a vital bridge to ensure reliable power supply as we transition to cleaner, renewable energy for a better future.
- We will be investing in new thermal stations at Vuda, Kinoya, and Labasa to replace temporary generators and meet growing demand.
- We need to upgrade existing thermal plants to make sure they're reliable.

POWERING THE FUTURE: RENEWABLE ENERGY EXPANSION

Thanks to new solar and hydro projects, we are well on the way to reaching our renewable energy goals:

- **46% of Fiji's energy is expected to be renewable by 2025.**
- **60% is expected by 2029 as new solar farms are commissioned.**
- **Hydropower will further boost this after 2030.**

This is a huge leap towards a cleaner, greener Fiji—reducing our carbon footprint and protecting our environment. This means less imported diesel, more solar and hydropower, and greater energy security for every Fijian home and business.

VIRARA TO KORONUBU
132kV Transmission Network Development

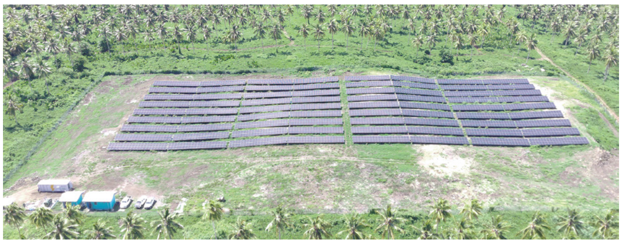
Powering Progress in western Viti Levu

EFL's $96M Virara–Koronubu 132kV Transmission Network Development Project is expanding capacity and securing power supply for the Western Division. It strengthens the grid to meet growing demand in Fiji's western corridor and supports inclusive regional development for years to come including capacity creation for new renewable energy projects.

MUA SOLAR PROJECT WITH BATTERY ENERGY STORAGE SYSTEM

Taveuni Goes 100% Renewable with Solar & Battery Innovation

Through the $5.93M Mua Solar Project, EFL has delivered a cleaner, quieter, and more reliable energy future for Taveuni. With support from KOICA, this project reduces diesel reliance and supports agriculture, tourism, and livelihoods—making Taveuni a national model for resilient island energy systems.



KINOYA POWER STATION & SUBSTATION PROJECT (CENTRAL, VITI LEVU)

Keeping the lights on as we transition to a renewable future

To support national energy security during Fiji's transition to 90% renewable electricity by 2035, EFL is investing $95 million in the Kinoya Power Station and Substation. This vital bridging project will add 20MW of generation capacity and modern grid infrastructure to ensure reliable power supply in the Central Division—keeping homes, businesses, and essential services energised throughout the journey to a cleaner future.

FIJI IS ON A BOLD JOURNEY TO TRANSFORM HOW WE POWER OUR LIVES

Many of these projects are already complete, some in progress, but there is still much more to do to reach our goal of sourcing 90% of our electricity from renewable sources by 2035.

Future projects will require significant investment, and EFL is committed to keeping the community informed along the way-because **Fiji's renewable energy future belongs to everyone.**

MONASAVU HYDRO-ELECTRIC SCHEME OVERVIEW AND HALF-LIFE REFURBISHMENT

Primary Renewable Energy Source

Commissioned in 1983, the Monasavu Hydro-Electric Scheme has served as Fiji's primary source of renewable energy generation for over four decades. It continues to be a cornerstone of the nation's energy mix and a key enabler of Fiji's renewable energy and climate resilience goals.

Half-Life Refurbishment Project

Initiated in 2011, the Monasavu Half-Life Refurbishment is a longterm investment aimed at sustaining the reliability, security, and performance of Fiji's largest hydropower facility. Scheduled to continue through to 2030, it represents one of the most significant asset renewal initiatives in Fiji's energy sector.

Benefits of the Half-Life Refurbishment

- Extends the life and performance of Fiji's largest renewable energy scheme
- Enhances reliability and security of electricity supply from renewable sources
- Supports national targets for clean energy and climate resilience.

Investment Summary

Total expenditure to date:	FJ $185 million
Estimated cost to complete:	FJ $100 million

This phased investment is essential to preserve and enhance one of Fiji's most valuable national assets.

Hydropower Process & Transmission

Water is sourced from Monasavu Lake, which stretches approximately 11 kilometres across a 470-hectare catchment area and stores up to 133 million cubic metres of water.

- From the lake, water is conveyed through a 5.47 km underground tunnel to the Wailoa Power Station.
- The flow drives four 20MW Pelton turbines, generating electricity at 11kV.
- The electricity generated at 11kV is then stepped up to 132kV and transmitted via the 132kV transmission network to major demand centres at Cunningham Road (Suva) and Vuda (Lautoka), helping ensure a stable and reliable power supply to Fiji's largest population and economic zones.

Stator positioning works

Contractors carrying out works on a steel lattice tower in the interior of Viti Levu.

Fully assembled transformers at the Vuda Zone Substation in Lautoka

Key Components of Generation Assets	
Monasavu Lake:	133 million cubic metres of storage
Tunnel:	5.47 km long underground tunnel
Wailoa Power Station:	4 × 20MW Pelton turbine generators
Controls:	Modernised control, protection, and switchgear systems
Generation Component Upgrades	• As part of the Monasavu Half-Life Refurbishment, significant upgrades have been undertaken at the Wailoa Power Station to modernise and extend the life of its core generation assets: • Nozzles, Runners, and Governor HPUs (G1–G4) • Fully upgraded across all four generating units between 2019 and 2023 • Excitation Systems, 11kV Switchgear, 415V MCC Panels, Control & Protection Panels, Cables, and HMI • Comprehensive modernisation completed by October 2023 • Generator Rehabilitation (Mechanical & Electrical) • G1: Completed in 2019 • G2, G3, G4: Completed by October 2023 • G4 Stator Rewinding • Completed in November 2024 • G3 Stator Coil and Bearing Replacement • Scheduled for completion in October 2025
Future Works (2026 Onwards)	• Wailoa Overhead Crane Upgrade • Tunnel Intake Gates and Control System Upgrade

Network Components Transmission & Substation Assets – 2025 Update		
Replacement of 132kV Transformers	• 4 x 11kV/132kV transformers replaced at Wailoa Substation • 2 x 132kV/33kV transformers replaced at Cunningham & Vuda Substations	Completed Completed
Replacement of 132kV Circuit Breakers	• Circuit Breaker (5H40) for Transformer T5 at Wailoa • 6 x Line/Transformer Circuit Breakers at Wailoa, Cunningham & Vuda	WIP Completed
Replacement of 132kV Current Transformers (CTs)	• Line and Transformer CTs at Wailoa, Cunningham & Vuda • Bus Coupler CT at Wailoa	Completed WIP
Replacement of 132kV Disconnectors /Earth Switches	• 36 units at Wailoa, Cunningham & Vuda Substations • 8 units on reserve bus at Wailoa Substation	Completed WIP
Control & Monitoring Upgrades	• 132kV Mimic Panel upgrades at Cunningham & Vuda • 132kV HMI and Mimic Panel upgrade at Wailoa Switchyard	Completed WIP
Tower Rust Refurbishment Program	• Ongoing	WIP

Key Components of the 132kV Transmission Network	
Transmission Line	The 132kV line, equipped with Optical Ground Wire (OPGW), extends approximately 147km across Viti Levu, forming a critical backbone of Fiji's national electricity grid.
Steel Lattice Towers:	The line is supported by 383 steel lattice towers, many of which are located in rugged, remote terrain, demonstrating the engineering challenges and resilience of the network.
Zone Substations:	Power is distributed efficiently across the island via two major Zone Substations – Cunningham in Suva (Central Division) and Vuda in Lautoka (Western Division).

FIJI'S ENERGY ROADMAP OUTLINES A LONG-TERM, STRATEGIC TRANSITION TOWARDS RENEWABLE ENERGY, WITH A STRONG FOCUS ON SUSTAINABILITY, RELIABILITY, AND NATIONAL ENERGY SECURITY

Since 1976, the country has steadily built its energy infrastructure, starting with thermal power stations and progressing into large-scale hydro, wind, and now solar energy.

A major milestone was the Monasavu Hydro Scheme in the 1980s, followed by key wind and hydro projects in the 2000s to 2017.

Currently, the roadmap is guiding Fiji through a major transition:

BY 2029	BY 2035
Fiji aims to achieve 60% renewable energy, largely through solar power combined with battery storage (BESS), new transmission lines, and upgrades like the Monasavu Half-Life Refurbishment.	**The goal is to reach 90% renewable energy,** backed by major projects like the Qaliwana Hydro Project and expansion of the national grid infrastructure.

The investment is significant—with hundreds of millions being committed to hydro, solar, and transmission upgrades—but it's essential to meeting future electricity demand while reducing reliance on imported fossil fuels.

RENEWABLE ENERGY TRANSITION PLANNING

- **Creation of renewable energy zones** (4x solar clusters, Western region and 1x hydro cluster in center of island)
- **Transmission network will be developed to connect generation sources** from these resource-rich zones/clusters to load centers

EFL'S PLANNED 2025 TO 2029 CAPITAL PROJECT INVESTMENTS

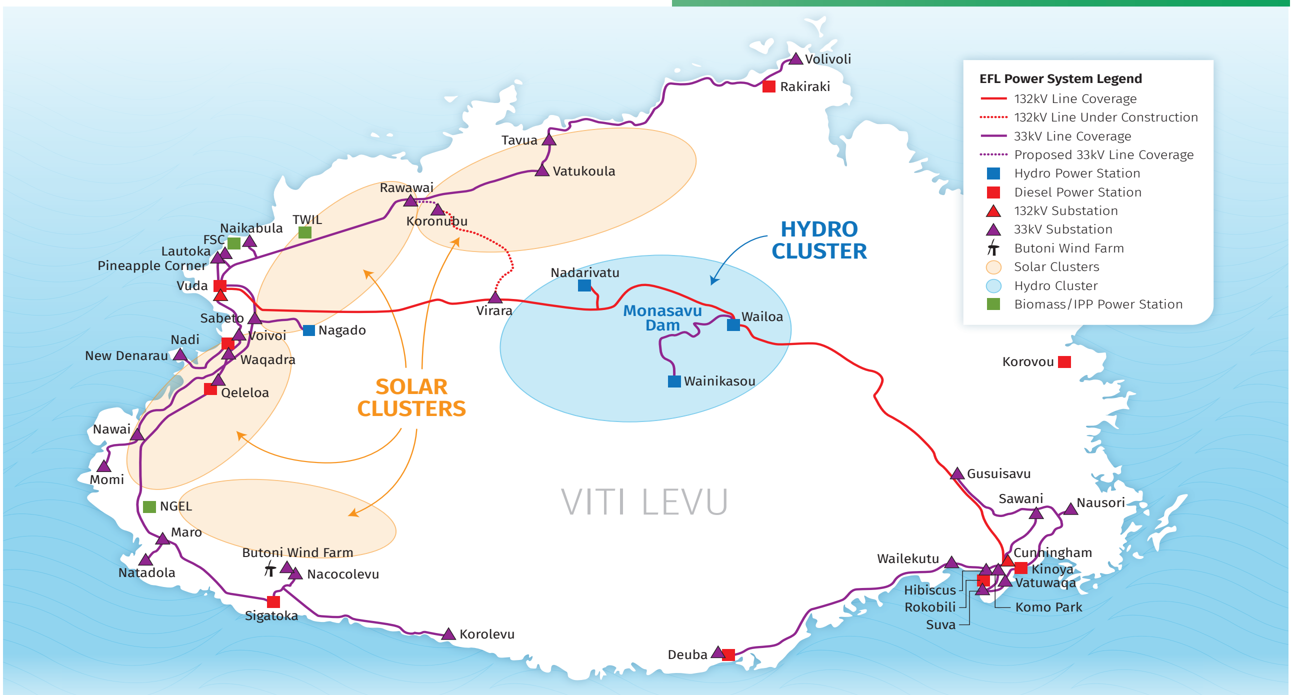
SOLAR GENERATION
$200M co-investment in grid-scale solar farms

CONTROL CENTRE UPGRADE
$39M improve operability of the grid with new generation mix

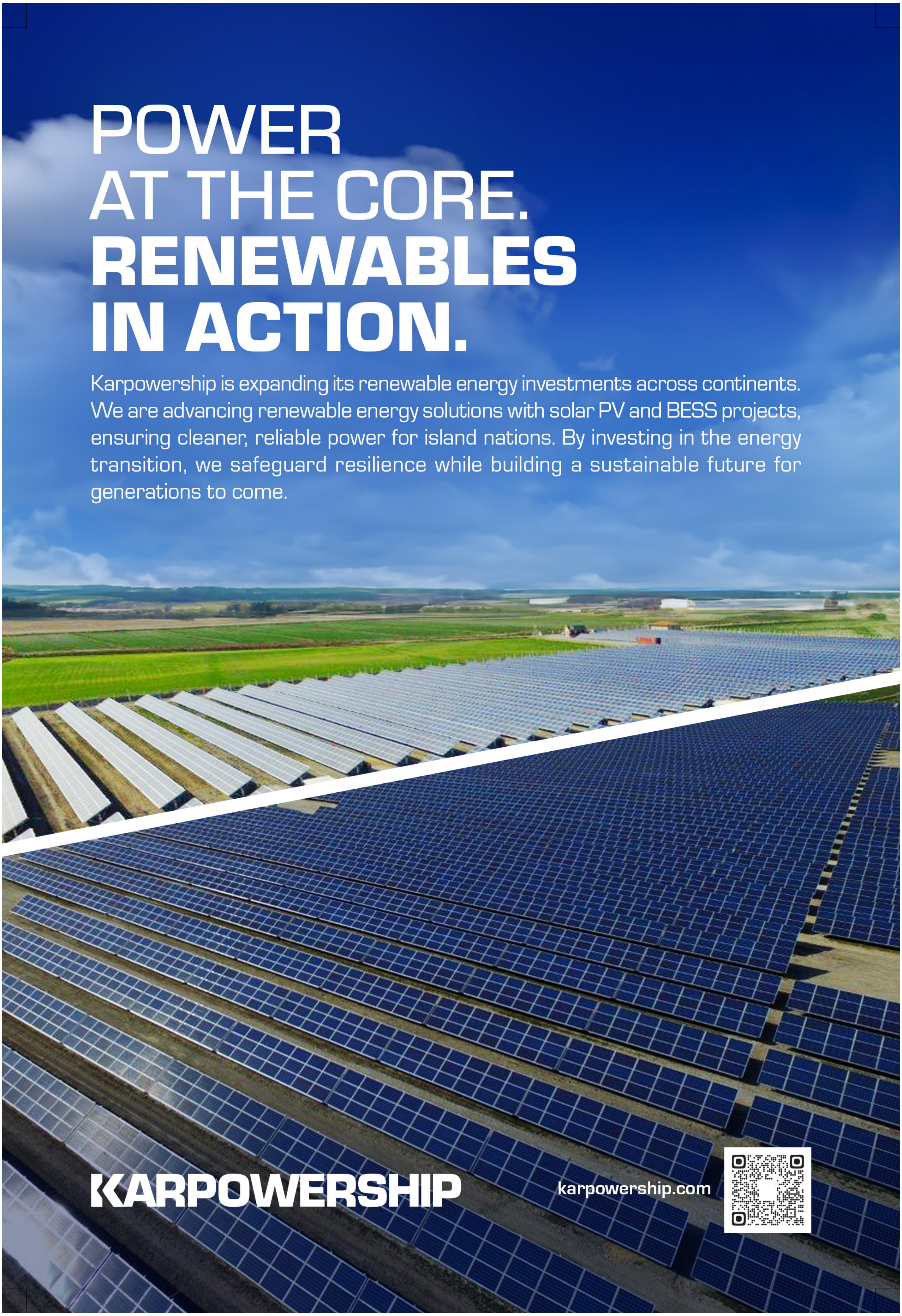
HYDRO GENERATION
$363M for new Lower Ba River project
$290M for new Upper Wailoa River project

THERMAL GENERATION
$251M for new power stations at Vuda, Kinoya, & Labasa
$62M for upgrades to existing plants

TRANSMISSION ASSETS
$731M to strengthen and expand the grid



EFL's renewable energy roadmap is about ensuring clean, reliable, and affordable power for Fiji's future, so that energy equity and sustainability becomes a shared national benefit.


POWER
AT THE CORE.
RENEWABLES
IN ACTION.
Karpowership is expanding its renewable energy investments across continents. We are advancing renewable energy solutions with solar PV and BESS projects, ensuring cleaner, reliable power for island nations. By investing in the energy transition, we safeguard resilience while building a sustainable future for generations to come.
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karpowership.com

Employ Women, Empower the Pacific: A Talanoa for Transformation

Mue Bentley Fisher, Senior Communications Specialist,
World Bank, Pacific Women in Power

The Pacific Power Association (PPA) and the World Bank's Pacific Women in Power (PWIP) program hosted a panel discussion titled **"Employ Women, Empower the Pacific"** in a powerful convergence of policy, advocacy, and community voices. The event was held on 24 June 2025 at Novotel Suva, Fiji, bringing together regional and local experts to address the lack of women represented in technical roles in the Pacific energy sector, and explore practical strategies to take the industry forward.

The Economic Imperative

Women make up less than 19% of the workforce across Pacific power utilities and hold only 5% of technical roles—positions vital to the region's energy transition. The World Bank's Pacific Economic Update (June 2025) shows that these gaps are not only a sector challenge but an economic one: closing gender employment gaps across the Pacific could raise GDP per capita by 22% on average, and by up to 30% in Fiji.

"The energy sector illustrates both the challenge and the opportunity," said Helle Buchhave, Senior Social Development Specialist and Task Team Leader for the Pacific Women in Power (PWIP) program. "Action is needed at both the national level—through family-friendly policies and stronger legal protections—and within utilities themselves, by investing in STEM pathways, safe workplaces, and more inclusive practices."

The Update underscores that coordinated action across public policy and workplace practice is essential to strengthen the energy workforce, improve sector performance, and unlock long-term economic growth across the Pacific.

Panelists Speak: Voices of Change

Moderated by Mr. Ingo Wiederhofer, World Bank Practice Manager of Social Development in East Asia and Pacific, the panel featured dynamic speakers who brought lived experience, research, and grassroots insight to the table.

"If we want resilient infrastructure, we need resilient institutions—and that means inclusive ones. Based on the data, it becomes clearer that mapping a deliberate path to include more women in the Pacific energy sector is central to performance, innovation, and long-term sustainability," Mr. Wiederhofer said.

Dr. Daniel Wood – University of the South Pacific

Dr. Wood emphasized the importance of early education and retention in STEM fields: "We're not just losing women at the university level—we're losing them in high school. They're choosing not to take physics and math, and that's where the pipeline breaks."

Ms. Julianne Verma – Women in Construction and Trade Fiji

Ms. Verma shared candid insights from her work in trades and renewable energy, including how working facilitates often being biased to male employees. For example, she said: "When you're the only woman on-site, there's no special convenience or bathroom. That makes a big difference."

She called for practical support, not special treatment: "We don't want privileges. Just add the additional things that a male worker normally enjoys. That's equity."

Ms. Tara Chetty – Pacific Community (SPC)

Ms. Chetty focused on the cultural barriers that limit women's participation: "These are the same norms which allow things like violence against women and gender-based violence to exist to such a large extent in our communities. Addressing those gender norms will also help address some of the barriers that lie in the path of girls."

She also emphasized the need for systemic change: "We need to move beyond tokenism and start embedding gender equity into the DNA of our institutions."

Ms. Leihani Anjain - Chief Financial Officer of Marshalls Energy Company, Inc.

With over 18 years of professional experience -including 13 in senior executive finance roles - Ms. Anjain has spent the last 14 years driving operational excellence and strategic growth at Marshalls Energy. Her journey is a testament to resilience, vision, and the power of women's leadership in a field where boundaries are still being redefined.

"We are at similar crossroad as our colleagues across the Pacific at Marshalls Energy, and having the baseline data and economic insights to drive change is extremely valuable," Ms. Aigain said. "We particularly want to work with our local schools to encourage more girls into STEM, and to welcome women into the energy sector as a viable career path for all."

Opening and Closing Reflections

Ms. Reena Suliana of PPA opened and closed the event with a clear message:

"We are here to reflect honestly on where we stand... and more importantly, to talk together about the practical steps we can take forward. Let's take today as fuel—not a final word, but a spark to keep this movement going.

"Initiatives like the Pacific Women in Power program are already helping us reimagine what a future workforce can look like: diverse, with more women in technical, higher paid jobs, and organisations better for it."

From Dialogue to Action

The Talanoa-style format encouraged open exchange and practical solutions:

- Expand STEM scholarships and apprenticeships for girls.
- Improve workplace safety and sanitation for both men and women.
- Introduce paid parental leave and affordable childcare.
- Challenge stereotypes through public campaigns.
- Invest in retention—not just recruitment.

The PWIP Program and Regional Momentum

Launched in 2023, the PWIP initiative is now a central pillar of regional energy reform. It supports utilities promote women's employment, through capacity building and introducing relevant policy options for long term increase in a strong divers labor force. The Efate Outcome Statement, endorsed by Pacific energy ministers in 2023, reinforces this commitment.

Looking Ahead

The Talanoa made one thing clear: the Pacific energy sector cannot afford to overlook half its talent pool. As utilities modernize and the region accelerates toward clean energy goals, integrating women into every level of the workforce is no longer optional—it's essential. The insights shared during the Talanoa offered solutions for change, and the momentum generated is already shaping new conversations, policies, and partnerships.

What happens next will depend on how seriously stakeholders commit to turning dialogue into action.

Weaving Light into Lives of Fiji through Rural Electrification

SEIAPI Newsletter

On Koro Island, a rural coastal community in Lomaiviti, Eastern Fiji - the weaving and sale of traditional mats is more than a livelihood. With support from the Australian Government's Pacific Climate Infrastructure Financing Partnership, the United Nations Development Programme (UNDP) Fiji Rural Electrification Fund (FREF) recently launched a field mission to eight selected villages in Lomaiviti Province. The goal is to gather local knowledge and collect socio-economic and environmental data that will inform evidence-based decisions on finalizing sites for Phase 2 of the FREF project that aims to install solar mini-grids to unlock the development potential of rural Fijian communities. In Nasau village, the reality of energy scarcity affects the daily lives of people. Most households rely on a shared village generator, powered by monthly contributions from each family. "We make good money weaving mats, as there is a high demand both locally and internationally for mats from Koro," said Nanise Yaya Viribale, President of the Nasau Women's Group. "But the village generator only runs for three hours each night, which gives us very limited time to prepare voivoi (pandanus leaves) and weave together."

For full story, visit: https://www.undp.org/pacific/stories/weaving-lightlives-fiji-through-rural-electrification

EV Charging Station Launched in Samoa

SEIAPI Newsletter

An Electric Vehicle (EV) Charging Station and 20 plugin hybrid vans were launched in Samoa earlier this month, marking a step forward in the nation's push for sustainable and low-emission transport.

The charging station, located in Tuanaimato, is part of the Climate Action Pathways for Island Transport (CAP-IT) project, a regional initiative funded by the Government of Japan and implemented in partnership with the UNDP. The project supports Samoa's national climate commitments and long-term transition to lowcarbon transport.

The new facility includes five DC fast chargers, each with a 60-kilowatt capacity and dual charging points, enabling up to 10 EVs to be charged simultaneously. It also houses two 22-kilowatt AC chargers, designed to meet the needs of the newly deployed plug-in hybrid vans.

Since late 2024, Samoa has received 76 EVs for government use under the CAP-IT initiative. These include sedans, SUVs, pickup trucks, utility vehicles, and the newly introduced plug-in hybrid vans.

For more information, please visit: https://www.samoaobserver.ws/category/samoa/11534

Solar Repair Training Empowering Remote Vanuatu Communities

SEIAPI Newsletter

Fixim Sola, a new solar repair training course launched last month in Vanuatu's Tafea Province, is giving local communities the tools, skills and confidence to manage solar waste, improve energy access and create new job opportunities.

Launched in June 2025, 48 participants from five islands, including 18 women and four people with disabilities, took part in two weeks of hands-on learning led by the University of New South Wales in partnership with the Vanuatu Disability Promotion Advocacy Association, Vanuatu Institute of Technology, University of the South Pacific and the Vanuatu Department of Energy.

For more information, visit: https://www.aiffp.gov.au/news/solar-repair-training-empowering-remote-vanuatu-communities-tackle-waste-and-create-jobs

Practical Transformer Diagnostics:

Daniel Hurley, General Manager,
AVO New Zealand

The Minimum Toolkit for Reliable Condition Assessment

Start Simple, Start Smart

Power transformers are among the most valuable single assets on a distribution or transmission network. While complex diagnostic suites exist—SFRA, dielectric frequency response, online dissolved gas analysis, partial discharge, and more—many asset owners and service providers still lack a reliable, practical foundation for day-to-day condition assessment. The reality is that you don't need to start at the deep end. A solid "minimum toolkit" can deliver rapid insight, catch early-stage issues, and justify further investment—without blowing your capital budget.

This article makes the case for a practical, cost-effective baseline comprised of three proven instruments:

- Megger MIT525 5 kV Insulation Resistance Tester – a light portable device for robust insulation integrity checks.
- Megger TTRU1 Transformer Turns Ratio Tester – for validating the integrity of windings, turn-to-turn insulation and tap changers.
- Guide H6 high-quality handheld Thermal Imaging Camera – for quickly finding thermal anomalies that indicate loading issues, loose connections, and developing faults.

Together, these tools enable power utilities, contractors, and industrial plant teams to cover the essential diagnostic bases before moving into advanced, specialised equipment. Let's unpack what each instrument does, how they work together, and how they create a defensible maintenance strategy that can later scale as your needs evolve.

Why a "Minimum Kit" Matters

1. Cost-Efficiency and Faster ROI

Comprehensive diagnostic test sets are brilliant—but they're also expensive and often require technical expertise. A portable toolkit composed of a megohmmeter, ratiometer, and thermal camera allows you to perform routine checks, confirm initial suspicions, and triage problems—all at a fraction of the cost of high-end systems. The payback often comes from preventing just one unexpected outage, forced replacement, or major rewind.

2. Simplicity and Rapid Deployment

The learning curve on these instruments is short. Field technicians can be up and running quickly: measuring insulation resistance, verifying transformer ratios, and scanning with infrared imaging often requires only brief training. This immediacy is invaluable when your focus is on keeping assets in service.

3. Credible Data for Decision-Making

While these tools are "basic" compared to advanced diagnostics, the data you get is far from trivial:

- Insulation resistance trends can reveal moisture ingress, insulation degradation, or contamination.
- Turns ratio measurements quickly confirm winding integrity or tap changer issues.
- Thermal imaging shows you loading imbalances, loose terminations, overheating bushings, or cooling problems—issues that are easy to fix if caught early.

In short: you gain real, actionable information without needing to mobilise a full diagnostic team every time.

The MIT525: Insulation Resistance Testing Done Right

Insulation resistance (IR) testing is a cornerstone of transformer condition assessment because dielectric breakdown is one of the most common—and costly—failure modes. The Megger MIT525 delivers a 5 kV output (plus lower ranges) that allows you to test power transformers in accordance with IEC/IEEE guidelines while offering advanced features like Polarisation Index (PI) and Dielectric Absorption Ratio (DAR) calculations.

Key Reasons to Include a 5 kV IR Tester in the Kit

- Baseline Insulation Health: A single IR reading gives a snapshot of insulation condition. When trended over time, it becomes an early warning signal.
- PI and DAR Analysis: These ratios help you evaluate insulation dryness and cleanliness. A low PI suggests moisture or contamination.
- Repeatability and Comparability: Standardised test voltages and times make it easy to compare results across units and over years.
- Safety and Compliance: Units like the MIT525 include safety interlocks, live circuit detection, and automatic discharge functions—protecting both the tech and the asset.
- Use of guard to eliminate parasitic current flow that may interfere with measurements as well as to better select the different capacitive regions of the transformer.

Good Testing Practice

Stabilise the transformer temperature before testing if possible, or at least record temperature and correct results accordingly.

Perform a 1-minute IR reading and a 10-minute reading for PI (10 min / 1 min). Document both.

Record humidity and ambient conditions. High Moisture levels in the environment may affect results. The use of guard is recommended.

Trend, don't just test. A single number is informative; a history is powerful. Build a results database—it will pay dividends.

The TTRU1: Confidence in Winding Integrity

A transformer's turns ratio is fundamental to its operation. Deviations from nameplate values, phase-angle shifts, or asymmetry between phases suggest winding damage, shorted turns, or tap changer problems. The Megger TTRU1 packs a lot of direct transformer testing functionality into a compact, fieldready unit.

Why Turns Ratio Testing Is Essential

- Rapid Detection of Winding Faults: Ratio errors outside allowed tolerances (typically ±0.5% or as per manufacturer specs and international standards) are red flags.
- Tap Changer Verification: On-load or off-load tap changers can be sources of trouble. The TTRU1 lets you measure the corresponding ration at each tap position, ensuring it's within tolerance and consistent with nameplate information.
- Phase Angle and Excitation Current: Additional parameters (depending on the test mode) help reveal core issues or unusual magnetising behaviour.
- Commissioning and Post-Maintenance Checks: After transport, repair, or refurbishment, ratio testing confirms the unit's ready to energise.
- Shut-down and not sure if it possible to re-energize your transformer, ratio testing is a simple and easy test to identify winding or insulation damage by isolating the transformer but not disconnecting all cable.

Best-Practice Tips for Ratio Testing

De-energise and isolate the transformer thoroughly. Follow lock-out/tag-out procedures.

Use proper connection techniques and verify correct vector groups, particularly on complex transformers.

Record tap positions meticulously. Consistent naming and numbering prevent confusion in later trends.

Make sure transformer has been demagnetized.

Trend across time—subtle changes may indicate developing faults.

The TTRU1's portability and accuracy make it a go-to for utilities and service contractors who need quick, reliable readings without hauling a large test bench.

Guide H6 Thermal Imaging Camera: Seeing Heat, Seeing Risk

A handheld thermal camera is one of the most intuitive diagnostic tools available. Even non-specialists can appreciate the significance of a hotspot. For transformers, thermal imaging reveals mechanical, electrical, and environmental problems in seconds, without taking the asset out of service.

Common Transformer Issues Revealed by Thermal Imaging

- Loose or corroded connections on bushings and terminals show as hotspots under load.
- Cooling system inefficiencies (blocked radiators, failed fans/pumps) reveal elevated overall tank temperatures.

- Uneven load distribution may be visible as asymmetry across phases or connections.
- External influences like solar gain, wind shielding, or proximity to heat sources can be identified and mitigated.

Optimising Thermal Surveys

Load the transformer: Hotspots appear when current flows. Survey during typical or peak load where possible.

Adjust emissivity settings on the camera appropriately (painted steel vs. shiny metal will affect accuracy).

Compare similar components (e.g., all three phase bushings) to spot anomalies quickly.

Document images with timestamps and asset IDs. Build a visual history.

Thermal imaging also complements electrical tests: if you suspect a winding or tap issue from ratio testing, a thermal scan may show whether it's causing elevated temperatures under load.

How These Three Tools Work Together in a Practical Workflow

A logical workflow for routine condition assessment might look like this:

1. Thermal Scan in Service
2. Walkdown with a thermal camera while the transformer is energised and under normal load.
3. Note any abnormal hotspots, asymmetry, or cooling system issues.
4. Use this to prioritise further testing or maintenance.
5. Offline Electrical Tests
6. After isolating and grounding the transformer, perform insulation resistance testing (MIT525) to gauge dielectric condition.
7. Follow with turns ratio testing (TTRU1) to confirm windings and tap changer function.
8. If unusual findings arise, plan targeted follow-up tests (e.g., winding resistance, SFRA, or oil analysis).
9. Data Consolidation and Trending
10. Store IR values, PI ratios, ratio results, tap readings, and thermal images in a central database.
11. Trend results year-on-year or after major events (faults, maintenance, storms) to identify accelerating degradation.
12. Decision Point
13. Use deviations, downward trends, or unexpected hotspots to justify advanced diagnostics or remedial work.
14. Because you've collected foundational data, you can engage specialist testers or invest in higher-end equipment with clarity on need and scope.

Real-World Scenarios Where the Minimum Kit Pays Off

Scenario 1: Early Moisture Ingress

A substation transformer shows a slowly declining PI value over three routine tests. Insulation resistance is still above minimum thresholds, but the trend suggests moisture or contamination. Alerted early, maintenance teams schedule a controlled dry-out before a catastrophic dielectric failure occurs. The cost of drying is minor compared to emergency replacement.

Scenario 2: Hidden Tap Changer Fault

A 33/11 kV transformer's turn ratio is within tolerance on most taps, but one position reads just outside spec. Operators investigate the tap changer mechanism, discovering pitted contacts that would have led to unreliable voltage regulation. Early repair prevents downstream voltage complaints and potential equipment damage.

Scenario 3: Overheating Bushing Connector

Infrared inspection reveals a white-hot connector on phase B during a thermal scan. A simple torqueing or re-termination job avoids months of stress on that connection, preventing a flashover. No advanced instrumentation required—just a camera and an experienced eyeball.

In each case, the minimum kit instruments surfaced actionable information without costly deployments.

Building a Pathway to Advanced Diagnostics

The minimum kit doesn't replace advanced testing—it prepares you to use it more effectively. Once you have the basics in place and a database of IR, TTR, and thermal results, you can easily integrate more advance testing like:

- Winding Resistance and Demagnetisation Testing: Identify high-resistance joints, contact issues, or trapped residual magnetism.

- SFRA (Sweep Frequency Response Analysis): Detect core movement, inter-winding faults, and mechanical deformation after faults or transport.
- Dielectric Frequency Response / Tan Delta Testing: Better characterise insulation condition at different frequencies and temperatures.
- Online DGA Monitoring: For critical transformers, continuous gas-in-oil monitoring catches faults in real-time.
- Partial Discharge Testing: Locate and quantify PD activity that might not yet be visible thermally or via insulation resistance.

Importantly, adding these tools later becomes more strategic: you'll know which transformers justify deeper study, where to focus budget, and how to interpret advanced results against a known baseline.

Making the Business Case: From Minimum Kit to Programmatic Testing

Quantify the Risk Reduction

Use historical failure data or industry benchmarks to show how early detection prevents outages. Even one avoided transformer replacement or unplanned outage can pay for the entire base kit many times over.

Highlight Training and Safety Benefits

Short learning curves mean techs can embrace these tools quickly. Emphasise the built-in safety features (voltage detection, discharge circuitry, and robust test leads) that make modern instruments safer than ad-hoc methods.

Create a Documented Test Regime

Formalise a testing program for example:

1. Annual or biannual IR and TTR checks
2. Quarterly thermal scans during peak load seasons
3. Triggered tests after faults, storms, or major switching events

Documentation not only helps operations—it provides evidence of due diligence for auditors, insurers, and stakeholders.

Practical Tips for Getting Started

- Standardise Test Procedures: Write concise test method statements—how to connect, what to record, acceptable limits, and escalation steps.
- Invest in Good Leads and Accessories: Poor connections lead to noisy data. Choose the correct clamps, Kelvin clips, and insulation shields.
- Label Everything: Proper asset IDs, tap positions, and test points remove ambiguity. It's easier to trend and compare when data is consistently labelled.
- Use Digital Reporting Tools: Many testers integrate with software for automatic result capture. Consider cloud databases to streamline analysis.
- Train for Interpretation: Numbers alone aren't enough. Make sure the team understands what a low PI or slight ratio shift actually means and when to escalate. Conclusion: A Solid Foundation for Smarter Asset Management

Conclusion: A Solid Foundation for Smarter Asset Management

Starting with a Megger MIT525, a TTRU1, and a Guide H6 thermal camera doesn't just "get you by"—it gives you a robust, defendable testing regimen that will catch early problems, justify maintenance decisions, and pave the way for more advanced diagnostics down the track. This minimum transformer testing toolkit aligns with utility realities: budgets, limited time, and a constant need for dependable data.

By establishing strong fundamentals, you're not just buying instruments—you're building a culture of proactive maintenance. And when you're ready to go deeper, your team will already have the confidence, processes, and baseline data to ensure every advanced test you add delivers real value.

If you're considering your first step into structured transformer testing—or looking to tighten up your current practices—these three tools make an excellent starting point. AVO New Zealand can assist with all of the above and have application specialists who can train onsite in the Pacific Islands. Let us discuss how to integrate a base transformer testing kit into your program and what the next phase of your testing roadmap might look like.

Welcome!

TO THE NEW ALLIED MEMBERS

There have been seven (7) new Companies who have joined the PPA as Allied Members since our last PPA Magazine.

SICUROUSA: SicuroUSA is based in Ohio, United States of America. Their primary activity is grid reliability services, preventing outages and enhancing reliability through our predictive intelligence.

SOLAR PACIFIC PRISTINE POWER INC.: Solar Pacific Pristine Power Inc. is based in Koror, Republic of Palau. Their primary activity is solar power generation.

UNIONPETROCHEMICAL (HK) CO., LTD: Union Petrochemical (HK) Co., Ltd is based in Queensway City, Hong Kong. Their primary activity is marine fuels supplier.

YACHIYO ENGINEERUNG CO., LTD: Yachiyo Engineering Co., Ltd is based in Tokyo, Japan. Their primary activity is consulting engineering services.

PRAMAC GENERAC AUSTRLIA PTY LTD: Pramac Generac Australia Pty Ltd is based in New South Wales, Australia. Their primary activity is power generation manufacturing, and their secondary activity is energy storage system manufacturing.

HADRON ENERGY: Hadron Energy is based in California, United States of America. Their primary activity is Micro Modular nuclear reactor supplier.

MARINSA INTERNATIONAL INC.: Marinsa International Inc. is based in Florida, United States of America. Their primary activity is supplying generator sets, parts supply and service.