A PACIFIC POWER ASSOCIATION PUBLICATION

VOLUME 33 ISSUE 2 - JUNE 2025

Pacific Power Association Strategic Plan Workshop, Nadi, 2025

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PPA

June 2025, Volume 33 Issue 2

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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.

PACIFIC POWER magazine is published four times a year.

Advertising
Reena Suliana
Pacific Power Association, Suva, Fiji Islands

Layout & Design
Printhouse Pacific Pte Limited

This magazine is read by an audience of opinion leaders in governments, development partners, the public service, the academic community, the media in the Pacific and members of the Pacific Power Association. Subscription to Pacific Power magazine is available at US $60 a year from the association.

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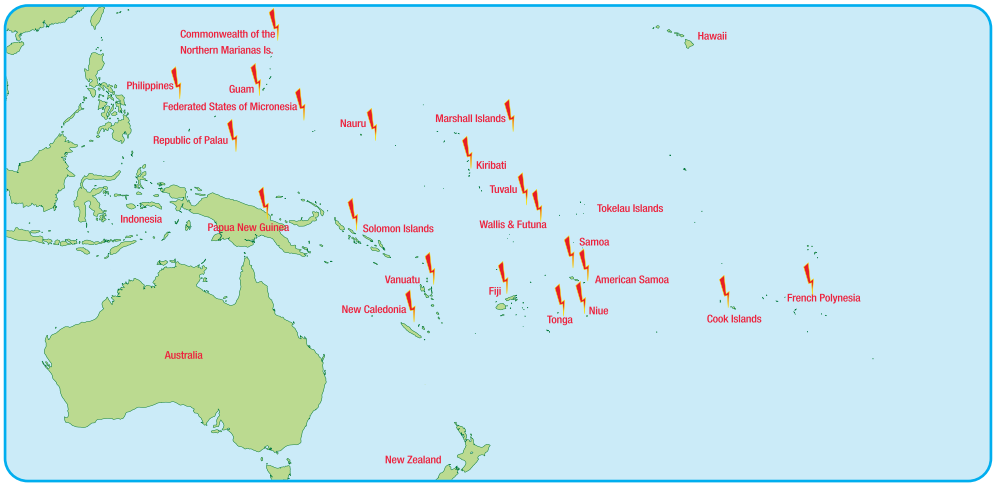

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Editor's Note

Gordon Chang
Executive Director

The Pacific islands are at the forefront of the global shift towards sustainable energy. As nations struggle with the dual challenges of climate change and energy security, remarkable strides have been made, demonstrating resilience and innovation. This momentum is vital as the region charts a course toward a resilient, clean, and reliable energy future.

In recent years, some pacific nations have achieved significant goals. For instance, the Marshall Islands has made notable progress with the Majuro Solar Project, which has significantly increased renewable generation capacity and reduced reliance on imported fossil fuels. Similarly, Tuvalu has introduced small-scale solar installations, providing cleaner energy access to remote communities—a critical step in enhancing resilience and reducing operational costs.

Regional collaborations like the Pacific Power Association's initiatives have supported knowledge exchange, capacity building, and joint investments that accelerate renewable deployment. Additionally, development partners such as USAID have supported innovative projects like the Majuro Dock Resilient Power Strategy, integrating renewable energy with resilient infrastructure designs. Despite these successes, certain obstacles remain such as intermittency and grid stability, financial constraints, policy and regulatory gaps, and technical skills and capacity. Addressing these challenges requires integrated solutions and robust policy support in terms of grid modernization and energy storage, innovative financing, policy and regulatory frameworks and capacity building.

The Pacific's path to a sustainable energy future is attainable through sustained commitment, regional cooperation, and innovative policymaking. By embracing technology, strengthening regulatory frameworks, and fostering regional partnerships, the Pacific can set a global example of resilience and sustainability. Together, we can energize the islands with clean, reliable power—fuelling economic growth, environmental stewardship, and resilience for generations to come.

The PPA Secretariat would like to welcome the new Allied members, Petro Oceania Energy Pte Limited and HNAC Technology Co. Ltd since the last quarter. The Secretariat acknowledges continuous support of those members that provided their articles and advertisements for this issue.

The Secretariat also announces that its 32nd Annual Conference and Trade Exhibition will be held from the 22-25 September 2025 in the beautiful island nation of Palau. This landmark event will bring together industry experts and stakeholders across the pacific and beyond to share knowledge, explore emerging trends and strengthen regional collaboration in the energy sector. As one of the most anticipated gatherings in the Pacific Power Association calendar, the conference this year promises to deliver engaging discussions, dynamic exhibitions and valuable networking opportunities. Further details including registrations, program and sponsorships are provided on the official PPA conference website page.

The PPA team and I look forward to seeing you all there!

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Toward Stable Renewables: Managing Costs and Intermittency in Island Power Systems

Ildo Agnetti
HDF Energy Australia

Inspired by HDF Energy's work on energy storage and system services

Across the Pacific, the shift to renewable energy is driven not only by environmental urgency but by pressing concerns around energy security, affordability, and resilience. Island nations, rich in solar and wind potential, are at the forefront of this transformation. Yet, their small, often isolated grids make them particularly vulnerable to the variability of renewable energy sources.

Unlike large continental systems, island grids lack the scale and redundancy to absorb fluctuations. As solar and wind penetration rises, so does the need for robust energy storage and ancillary services—such as frequency regulation, grid balancing, and black start capability—to maintain stability and reliability.

Beyond LCOE: Uncovering the Real Costs of Renewables

While the Levelized Cost of Energy (LCOE) for solar and wind has dropped substantially in recent years, these figures rarely account for the full spectrum of system costs—like grid upgrades, balancing needs, and the economic value of dispatchable power. Local conditions further shape project viability. For example, regions exposed to extreme weather or facing high financing costs may see capital expenditures rise by 20% or more.

Increasing renewable shares without matching infrastructure can also lead to significant inefficiencies: grid congestion, curtailment, and higher operating costs. Studies show that moving from 60% to 90% renewable energy penetration without adequate planning for storage and system balancing can increase electricity prices by nearly 40%.

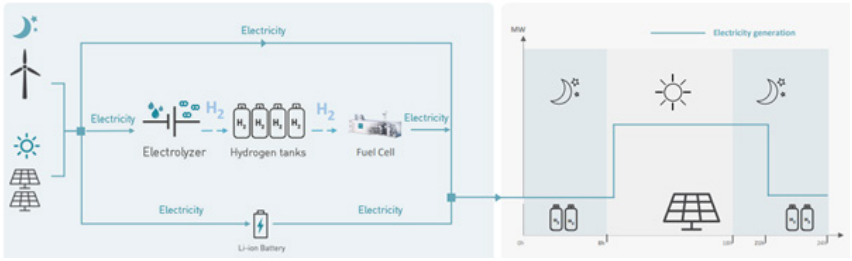
Addressing these challenges requires innovative solutions and models that go beyond simple generation—they must incorporate long-term storage, flexibility, and grid stability.

The Role of Integrated Storage Solutions: Renewstable®, a Game-Changer for Island Power

One such approach is hybrid renewable systems that combine solar (or wind) generation with long-duration storage technologies such as hydrogen. These solutions aim to smooth out the intermittency of renewables by providing energy when natural sources are unavailable—at night, during cloudy periods, or in times of peak demand.

HDF Energy's Renewstable® model is a leading example attracting interest across the region.

It offers a proven, fully dispatchable renewable energy solution. By combining solar and/or wind power with green hydrogen production and long-term storage, it delivers reliable electricity around the clock—regardless of weather conditions. During the day, excess solar power generates hydrogen via electrolysis. At night or during cloudy days, this hydrogen feeds fuel cells that produce electricity, ensuring continuous and stable supply.



This architecture supports a wide range of services:

- Power flexibility: Load following, peak management, and on-demand dispatch.
- Ancillary services: Frequency and voltage regulation, network support.
- System restoration: Black start capability, island mode operation, and reserve capacity.

The Renewstable® model is not hypothetical—it's happening now. The CEOG project in French Guiana, currently under construction, exemplifies this model. Combining a 55 MWp solar plant, a 16 MW electrolyser (capable of producing up to

600 tonnes of green hydrogen per year), massive hydrogen storage and two of HDF's 1.5 MW fuel cells, it will supply 10,000 Guyanese households in Western French Guiana with reliable, renewable power 24/7. It's projected to cut CO_2 emissions by 39,000 tons annually and operate under a 25-year PPA, demonstrating sustainability, technical feasibility and financial bankability. Projects like this may serve as a valuable reference for Pacific countries exploring their own energy transition paths.

Local Impact and System-Wide Value

Beyond resilience, such systems help reduce dependency on imported fossil fuels—a major expense for many island economies. They also offer broader socio-economic value, creating jobs, supporting local businesses, and directing investment back into communities.

From a grid-wise perspective, dispatchable renewable solutions can reduce reliance on diesel backup, extend the life of existing infrastructure, and help flatten and stabilize the cost curve over time—even as the share of renewable generation increases.

Toward a Resilient Energy Future

As Pacific nations refine their energy strategies, attention is shifting from generation cost alone to system-wide sustainability. Governments, utilities, and regulators increasingly recognize the importance of solutions that ensure reliability while enabling high shares of renewables.

Technologies like Renewstable® show how renewables, when combined with storage and grid services, can deliver stable and affordable power. They represent a viable pathway for island nations to achieve their energy goals without compromising resilience or economic feasibility.

To succeed, energy planning must be holistic—addressing not just generation but also the infrastructure, flexibility, and support services that make renewables work. In a region where fuel imports dominate budgets and aging diesel plants strain the grid, Pacific countries have a chance to lead by example, crafting energy systems that are not only clean and resilient, but also tailored to the unique needs of its people and environment.

Contact HDF Energy for more information

Ildo Agnetti, Business & Project Developer HDF Energy Australia – ildo.agnetti@hdf-energy.com

Powering Pacific Islands: Advanced Energy Management System for Sustainable Energy Transition

Agnieszka Rychlicka, Business Development Manager BU Software & Microgrids, Energy Pool

As the Pacific Islands face growing energy, climate, and infrastructure challenges, Energy Pool—a global leader in advanced energy management—is helping to redefine the future of energy for islanded microgrids. With more than 15 years of experience, the company offers real-world, intelligent microgrid control systems designed specifically for the complexities of islanded environments. The goal: improve grid reliability, increase renewable energy integration, and optimize system performance.

The Pacific Microgrid Dilemma

Islanded microgrids are vital for providing energy access in remote and isolated regions. Yet, they come with unique constraints: harsh environmental conditions, unpredictable weather, costly logistics, and a heavy dependence on diesel generators. These challenges translate into high operational costs, frequent maintenance needs, and substantial carbon emissions—posing both technical and ecological threats to the communities they serve.

To address these obstacles, Energy Pool has developed a robust, data-driven approach that leverages advanced Energy Management Systems (EMS) and Power Management Systems (PMS) to ensure immediate grid stability while enabling long-term optimization.

From Diesel Dependency to Digital Intelligence

Initially, the priority for utilities like Enercal in New Caledonia was to reduce operational costs. Diesel generation was the dominant energy source, with the Isle of Pines alone consuming over a million liters of diesel annually—equivalent to nearly 9,000 kg of CO_2 emissions per day. A first step toward decarbonization was taken with the integration of a small solar PV system, which met just 5% of the island's electricity needs. However, renewable production was frequently curtailed, and diesel gensets continued to run continuously to maintain stability.

A New Energy Landscape in New Caledonia

With significant renewable energy targets in place, Enercal invested in scaling up PV and battery storage:

- Solar capacity increased from 250 kW to 1.5 MW
- A 1 MW / 4 MWh battery storage system was installed

However, integrating these new assets presented a complex challenge: how to coordinate and optimize a multi-asset system, with multiple brands and technologies. It needed an advanced solution capable of optimizing the use of renewables and not only reacting in real-time. Optimal battery management requires sophisticated forecasting of both energy production and demand, as well as strategic decision-making when to charge and discharge the batteries.

Therefore, to unlock greater renewable energy use, Enercal partnered with Energy Pool to implement a more advanced solution — transforming the islands' microgrids with smart, predictive energy management.

Figure

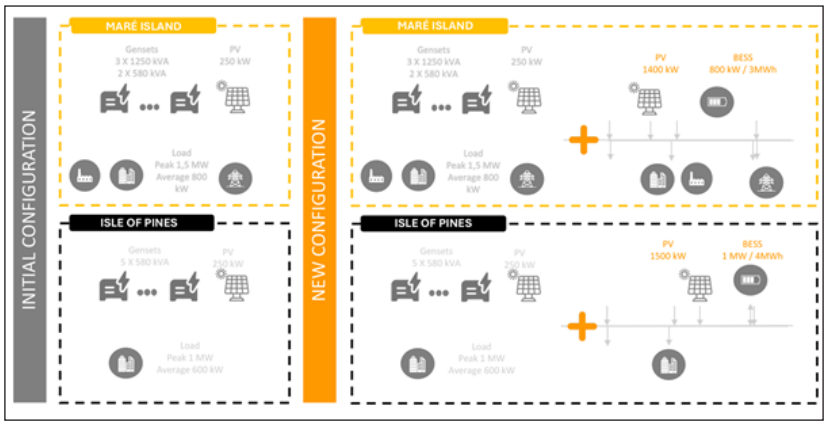


Figure 1 : Initial vs. New configuration of the energy production for the Isle of Pines and Maré Island

Unlocking the Power of Optimization

Energy Pool's two-level system architecture combines:

- PMS (Power Management System): Manages real-time control, voltage and frequency regulation, and emergency dispatch.
- EMS (Energy Management System): A cloud-based platform that forecasts generation and demand, optimizes dispatch every 15 minutes, and sends actionable setpoints to the PMS.

This integrated solution enabled seamless coordination of diesel, solar, and battery systems—even allowing the battery to operate in grid-forming mode alongside gensets, a first in many Pacific island contexts.

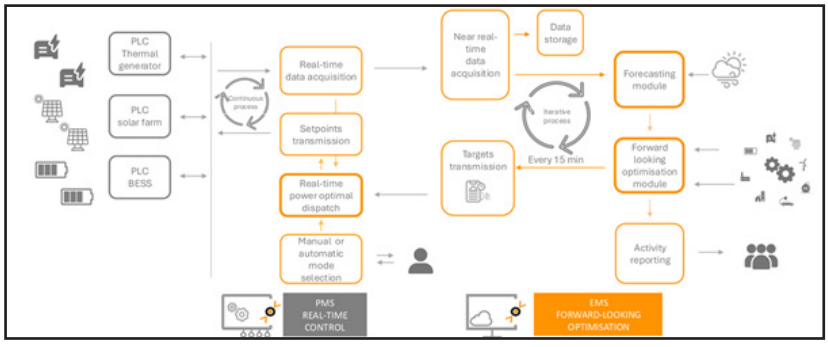


Figure 2 : Energy Pool's Solution : functional details

Measurable Impact

With Energy Pool's solution in place, the transformation has rapidly shown a significant impact

- Up to 70% renewable energy penetration during the day
- Significant reduction in diesel use and CO_2 emissions
- Estimated annual fuel cost savings of $530,000—over $5 million over 10 years

On most days, only one diesel generator now operates at night, compared to two trunning simultaneously in the past. Renewable energy is used to its full potential, and the battery storage system is charged and discharged strategically based on forecasting and smart and real-time optimization.

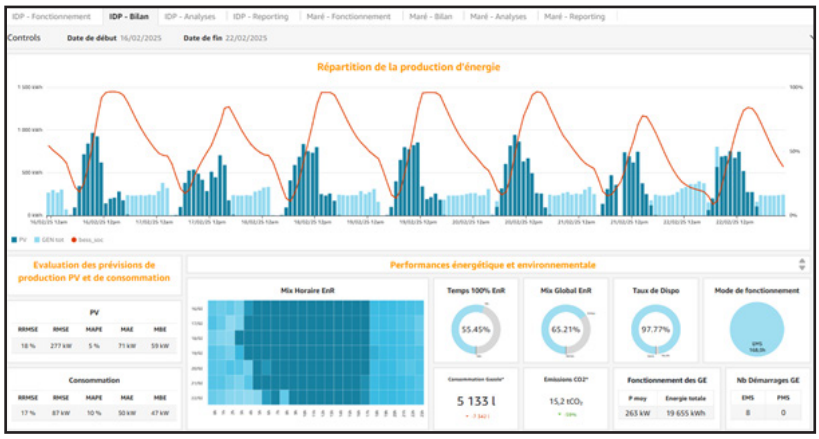


Figure 3 : Dashboard showing KPIs for one week operations on the Isle of Pines

A Regional Model: Scaling Success in Tonga

Energy Pool has successfully scaled its solution for Tonga Power Limited, which serves over 80,000 residents on the island of Tongatapu. This project, larger in scope and complexity, manages a hybrid energy mix including solar, wind, battery storage, and diesel.

Initial results include:

- Reduced number of active diesel generators.

- Improved grid stability and frequency control.
- Smoother energy dispatch and increased operational efficiency.

With over 40 MW of managed capacity, Tonga's microgrid demonstrates how Energy Pool's EMS/PMS architecture can adapt to both small islanded systems and larger, more integrated networks.

Conclusion

The energy transition for islanded microgrids is not just an engineering challenge—it's a critical step toward climate resilience, energy sovereignty, and sustainable development. Through its pioneering work in the Pacific, Energy Pool has shown that this transition is not only possible—it's already happening.

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USAID Majuro Dock Resilient Power Strategy

Damon Schmidt, Sr. Energy Regulatory/Policy Analyst
Hawaii Natural Energy Institute

OBJECTIVE AND SIGNIFICANCE: HNEI's Grid System Technologies Advanced Research Team (Grid***START***) was contracted by the U.S. Agency for International Development (USAID) through its prime contractor, DAI Global, LLC in collaboration with Pacific International, Inc. (PII) to design a reliable, resilient, cost-effective and scalable power solution to support increases in the transshipment of skipjack tuna through a locally owned dock facility (Dock) on Majuro Atoll in the Republic of the Marshall Islands (RMI). Tuna transshipments through the Dock are essential not only to the global fishing industry, but also RMI's national economy.

Figure 1. HNEI and PII's Kramer family in Majuro, RMI.

BACKGROUND: Energy usage at the PII Dock is primarily a function of tuna-filled refrigerated container cooling loads, which are forecast to dramatically increase in step with tuna transshipment operations over the next decade. However, the electric service on the island has been historically unreliable and its customers experience frequent power outages. In order to protect substantial perishable inventories, PII requires that it be able to serve 100% of its load via self-generation or other operational mechanisms when utility electric service is not available. HNEI Grid***START*** was engaged to analyze the techno-economic feasibility and benefits and develop a strategy for phased upgrades to the current Dock energy system to enable it to operate both as a microgrid connected to the utility electric system and as a stand-alone facility. The analysis included evaluations of various combinations of existing and potential thermal and alternative energy generation resources and energy storage capabilities.

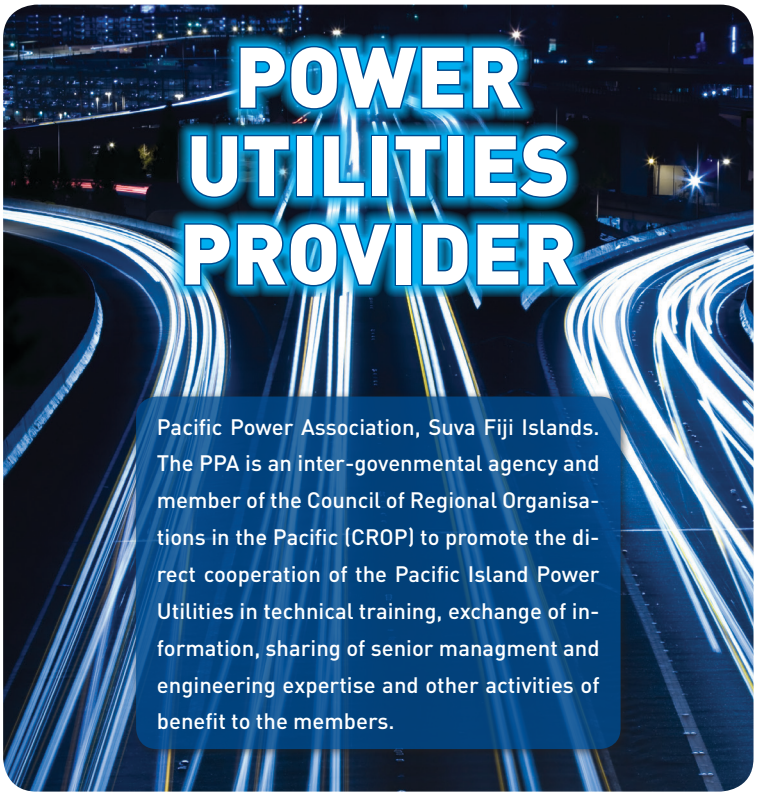
As a foundational component of its analysis, HNEI Grid***START*** projected hourly loads for the Dock at various stages of its expansion, including the addition of a planned 2,000 metric ton cold storage facility. Potential solutions to fill the gaps in PII's power and energy needs were evaluated utilizing the proprietary *XENDEE Microgrid Decision Support Platform*, a microgrid optimization planning tool that evaluates the resiliency and cost-effectiveness of microgrid energy systems. The microgrid simulations performed in connection with this project considered fixed costs, energy bill savings and other variables (e.g., resiliency) to derive optimized microgrid designs, including optimized quantities of PV generation potentially including a battery energy storage system (BESS).

PROJECT RESULTS: At a high level, the results indicate that there is an opportunity for PII to significantly reduce its operating costs and mitigate its business risks by maximizing self-generation, including solar PV panels on the roofs of its facilities, in lieu of relying upon the purchase of utility-produced electrical energy. Additional measures such as the installation of a cold storage facility and/or more frequent transshipments of tuna off of the Dock could reduce operating costs even further. Such cost reductions could improve RMI's competitiveness in relation to the foreign vessels that currently transfer their tuna inventories offshore in the Majuro lagoon (with little or no benefit to the local economy).

Figure 2. Purse seiner fishing vessel moored at PII Dock.

The results of Grid**START**'s analyses also appear to have caught the attention of international financing entities, which could potentially fund energy investments at the Dock capable of achieving solar PV penetrations as high as 40% over the 25-year life of the project.

Funding Source: USAID
Contact: Leon Roose, lroose@hawaii.edu
Last Updated: June 2024



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Energy Regulatory and Technical Support for Yap State, Micronesia

Damon Schmidt, Sr. Energy Regulatory/Policy Analyst
Hawaii Natural Energy Institute

OBJECTIVE AND SIGNIFICANCE: In partnership with the Pacific Power Association (PPA) and through funding under an Asia Pacific Regional Energy System Assessment (APRESA) grant from the U.S. Office of Naval Research, HNEI's Grid System Technologies Advanced Research Team (Grid***START***) is providing technical and regulatory/policy support to the Yap State Public Service Corporation (YSPSC) in the Federated States of Micronesia (FSM).

Figure 1: PPA's 30th Annual Conference in Saipan.

BACKGROUND: PPA is an inter-governmental agency whose objective is to improve the quality of power in the Pacific region through a cooperative effort among the utilities, private sector and regional aid donors. HNEI has been working with PPA since 2023, when HNEI Grid***START*** participated as an invited presenter at PPA's 30th annual conference in Saipan. Over the past two years, Grid***START*** has worked with PPA to shape a partnership to deliver much needed capacity building to PPA's member utilities.

YSPSC is a state-owned utility that provides water, electricity and sewer services to Yap's main island (Yap Proper), as well as the state's outer islands. The peak demand on Yap Proper is approximately 1.9 MW and is served by approximately 11 megawatts (MW) of installed capacity. Approximately 10% of Yap's installed capacity comes from alternative energy sources such as solar photovoltaic (PV) and wind. This includes both utility-scale projects funded by entities such as the Asian Development Bank and smaller systems installed by customers who benefit from net energy metering (NEM) tariffs. Significant increases in penetration of variable/intermittent energy resources, battery energy storage systems (BESS) and electric vehicles (EVs) are expected on Yap in the near future, including projects procured on a bundled basis by the larger FSM government, and owned/operated by YSPSC. Significant new load demand from U.S. Department of Defense facilities under construction is anticipated.

Figure 2: VRE installations on Yap Proper.

PROJECT RESULTS: The first training provided by HNEI GridSTART under its partnership with PPA was conducted at YSPSC's offices in October 2024. The training consisted of two full days of slide presentations and discussions on stated topics of interest for YSPSC including:

- Hawaii's energy transition;
- Managing high PV and wind penetrations;
- Updated grid interconnection standards;
- BESS and EVs;
- Power system resilience; and
- Competitive procurements for new generation projects.

HNEI Grid***START*** also provided its internally developed *Generation Mix Resource Modeling Tool* to YSPSC personnel and trained them on its use. The team visited the island's power generation and distribution facilities and engaged in further discussion with YSPSC's management to identify potential avenues for future follow-on support. In 2025, HNEI Grid***START*** plans to conduct additional trainings for other Pacific region utilities under its partnership with PPA.

Figure 3: Rai Stone Money in Yap.

Funding Source: Office of Naval Research
Contact: Leon Roose, lroose@hawaii.edu
Last Updated: November 2024

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PNG Women in Power's Delegation to WEN-Africa, Zambia

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

"An amazing experience that offered us actionable insights and access to a global knowledge network"

"It was encouraging to hear the progress from African nations on addressing gender gaps within their organizations. It gave me confidence and great insights to do the same at PNG Power," Lucy Veao Senior Human Resource Officer, Recruitment of PNG Power Limited (PPL)

The Women in Energy Network – Africa (WEN-Africa) held its 2nd Annual Conference in Lusaka, Zambia, on April 3rd and 4th, 2025. The conference, themed "Empowering Women to Energize Africa's Future," focused on advancing gender equality in the energy sector.

The event showcased WEN-Africa's commitment to transforming Africa's energy landscape by empowering women across the energy value chain, and featured representatives from various energy organizations across Africa and beyond, including Papua New Guinea.

Benedicta Savage, Acting General Manager, National System Operations, and Lucy Veao, Senior Human Resource Officer, Recruitment of PNG Power Limited (PPL) attended the conference, eager to learn from international counterparts and share their own experiences in PNG's energy sector.

PPL, a Pacific Women in Power Trailblazer, represented the program to peers at WEN-Africa. The World Bank's Pacific Women in Power Program supports utilities and energy ministries in increasing women's employment in the Pacific energy sector.

Benedicta and Lucy share insights from WEN-Africa 2nd Annual Conference

Benedicta's journey to Zambia was the longest trip she had ever taken, lasting almost two days.

"Upon arrival, I felt apprehensive as I had never been to that part of the world," Benedicta said. "We had a good night's rest, and at the conference the next morning the presence of friends from the World Bank, event organizers and even translators throughout the event helped ease my concerns."

The conference stood out as a significant regional gathering, according to Benedicta, with extensive international representation that underscored its importance and scope.

Reflecting on her first impressions, Benedicta noted that the issues faced by attendees were quite similar to those faced in PNG, and she was impressed by WEN-Africa's strong targets to move the numbers in the area of women's jobs.

"The diverse sessions—from policy implementation to entrepreneurship—offered actionable insights and inspiring success stories," Benedicta said.

"Personal interactions with professionals across Africa reinforced the value of collaboration and exchange."

"My key takeaways from the conference included the realization of the importance of platforms like the World Bank's Pacific Women in Power Program, to push gender inclusion targets in our region," Benedicta remarked. "I hope that these efforts will continue and that partnerships can be set up in PNG to support women, and that PPL continue to measure our progress year on year against the Pacific Women in Power baseline."

She emphasized the need for ongoing support within the workplace to make meaningful changes, acknowledging that they are just starting the journey at PPL.

"For example, I am the only female engineer in my team, and if we set targets to boost our efforts, it can increase women in STEM roles at PPL, but we need deliberate actions for change, and tracking."

Benedicta added that one of the best parts of the conference was the opportunity to share stories about the Pacific during a panel discussion with an audience that was unfamiliar with the Pacific region.

"It was great forming connections and learning from their networks," she said. "The toughest part of the

experience was the travel, but the insights gained were invaluable."

Lucy felt similar apprehension on travelling to an unfamiliar part of the world but soon felt at ease.

"When I met the WEN-Africa representatives, the World Bank team, including Ms. Fowzia, Ms. Yukari, Ms. Marie Paul, and Ms. Meskerem, they were amazing and a joy to work with. The environment felt somewhat similar to PNG, making me feel very comfortable."

With gender work progressing in Papua New Guinea, alongside the PNG National Public Services Policy 2013 and the recently approved revised PPL Gender Equality and Social Inclusion (GESI) & Gender-Based Violence (GBV) Policy, Lucy envisioned PPL evolving into a State-Owned Entity that champions GESI principles and values.

"It was encouraging to hear the progress from African nations on addressing gender gaps within their organizations. It gave me confidence and great insights to do the same at PNG Power," Lucy said.

"I hope that efforts, such as these international learning opportunities supported by the World Bank's Pacific Women in Power Program, will continue, to tap into the value of collaboration and knowledge exchange."

Lucy had the opportunity to present at the conference about PPL's own gender-inclusion efforts and challenges, marking her first such experience at an international-level event. Lucy highlighted PPL's commitment to gender equality and women's employment within their organization, and work with the World Bank's Pacific Women in Power program to drive changes towards a more enabling work environment for women.

Lucy met several people whose presentations aligned with her interests, including Engineer Saleh Suleiman from Zanzibar, Engineer Dr. Chilala Kakoma from Zambia, Ms. Cecillia Kalungu-Yvyu from Kenya Power and Lighting Company, and Mr. Antony T. Mutambirwa from ZASA Holdings, Zimbabwe. These interactions provided valuable insights and potential for future collaboration.

"The experience not only aligned with the PPL and PWIP goals for increasing women's employment but also emphasized that while challenges are shared, so too are the pathways to impactful solutions."

Progressing practical outcomes from WEN-Africa 2nd Annual Conference

CAPTION: L to R: Ms. Fowzia Hassan, Team Leader & Senior Energy Operations Officer, World Bank, Benedicta Savage, Assistant Manager National Systems Operations, PPL, Lucy Veao, HR Senior Recruitment Officer, PPL, Madam Eng. Amani Al-Azzam, RENEW MENA Steering Committee Member, Ministry of Energy and Mineral Resources, Jordan, Dr. Reham Elmorally, Head of Public Policy, Entlaq Holdings, Egypt.

Looking ahead, Benedicta and Lucy believe that scholarships for women and gathering support from local stakeholders, such as schools and universities, as well as from development partners, to increase the number of female engineers graduating in PNG would be beneficial.

"We also see opportunities to increase interest in the energy sector from an early school age," they said.

Benedicta and Lucy also proposed the establishment of an internal network within PPL to help women in STEM roles progress their career aspirations.

"Now is when our work really begins, and we look forward to support from our colleagues and management at PPL, and ongoing engagement with initiatives such as the World Bank Pacific Women in Power Program, to make these goals a reality."

Various photos of Benedicta and Lucy at the Meeting

Meet Benedicta Savate, Acting General Manager, National System Operations, PPL

Benedicta Savage is an Electrical Engineer specializing in power system operations, grid stability, and technical regulatory compliance. As the Acting General Manager of National System Operations at Papua New Guinea (PNG) Power Ltd, she oversees grid operations, system reliability, system integrity, and operational efficiency. She has provided technical support for major power projects, including the 54MW Edevu Hydro Power Plant, the 132kV Transmission Line, and the 15-year Power Development Plan

Meet Lucy Veao, Senior Human Resource Officer, Recruitment, PPL

Lucy is the Senior Recruitment Officer and Gender Equality and Social Inclusion (GESI) Support Officer at PNG Power Ltd (PPL). She is the focal point for PPL to the World Bank Pacific Women in Power. Lucy is attending the Pacific Women in Power Trailblazer Gender-Inclusion Training, sponsored by the World Bank, to address unconscious bias and promote gender equality at PPL. In 2015/2016, she helped recruit over 200 apprentices, trainees, and graduates, including females in technical roles. Lucy has extensive experience with development partners on gender-related activities, including implementing Gender Equality and Social Inclusion (GESI) and Gender-Based Violence (GBV) policy at PNG Power Limited

THE FUTURE IS OURS

In small island nations, where land is limited and valuable, our floating power plants offer a smart, scalable, and sustainable energy solution.

With no land occupation and resilience in all weather conditions, we deliver reliable, efficient, and affordable electricity — directly to your shores.

Preserve your land. Secure your energy future.

- Plug-and-play power generation
- Built to exceed environmental standards
- Operates in all weather conditions
- No land infrastructure required
- Purpose-built for island countries

KARPOWERSHIP

karpowership.com

SEIAPI Conducts Standards Webinars

SEIAPI Secretariat

As a build up upon the generic standards webinar held in June 2024 on Solar standards, SEIAPI has commenced hosting a webinar series for its members and associates covering Australia & New Zealand standards relevant to solar installations.

Group photo of EFL inspectors and SEIAPI representatives (July 2024)

The first webinar series (AS/NZS 5033 Webinar Series 1) was conducted online on 6th February with around 50 participants joining online via ZOOM whilst the 2nd webinar series (AS/NZS 5033 Webinar Series 2) was conducted online on 12th March with around 40 people joining (one hour sessions). The first and 2nd webinar series covered how to correctly interpret and apply AS/NZS 5033 to solar installations. The webinar series was conducted by Mr Geoff Stapleton. Geoff has begun covering the relevant sections of the standard with continuation of the remainder in the next webinar series.

Geoff specialized in solar (PV) energy in the final year of his electrical engineering degree in 1981and then went on to obtain his electrician's license. He joined BP Solar Australia in 1987. In 1989 he started his own company on the south coast of NSW where he designed, installed and maintained off grid power systems. In 1998 he was one of the co-founders of Global Sustainable Energy Solutions Pty Ltd (GSES) and currently the Director of International Training. Geoff has played an active role on committees within the various Australian solar/sustainable energy industry associations since 1991; a Member of Standards Australia Working Groups since the mid 1990's and for 10 years was a member and later Chair of the Renewable and Sustainable Technical Advisory committee that oversaw the ongoing management of renewable energy training units in Australia. Geoff has been an accredited designer and installer since 1994.

The standards to be covered in the series include:

- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays
- AS/NZS 5139 Electrical installations - Safety of battery systems for use with power conversion equipment
- AS/NZS 4777 Grid connection of energy systems via inverters - Installation requirements

These will then be followed by webinars covering the relevant sections of the USA National Electrical Code.

The standard AS/NZS 4509 Stand Alone Power Systems, is currently being rewritten, hence that will be covered in a future webinar when released.

The webinar series provided opportunity to representatives from the solar companies, Utilities based in the Pacific (including Energy Fiji Limited, Solomon Power, PNG Power Ltd etc) and individuals to join and grasp better understanding of the safety and installation requirements specified by the standards.

SEIAPI plans to continue with the standard webinars in the coming months for the benefit of the solar industry and hopes that these webinars would have a positive impact on solar installation practices.

From Sea to Clinic: Vanuatu's First REnew Pacific Project Already Delivering Impact

Katrina Swanston, Communications Specialist
REnew Pacific
Palladium

One of Vanuatu's first REnew Pacific projects, led by Respond Global, has already begun installing the first of 20 new solar power systems in off-grid health facilities across the country, less than a month since launching.

The Respond Global team landed their HELPR 1 vessel on Loh Island in Vanuatu's remote Torba province to install the first new solar system at Loh's Health Centre, which serves 2,000+ people, enabling the local health service to have reliable power for the first time.

This means:

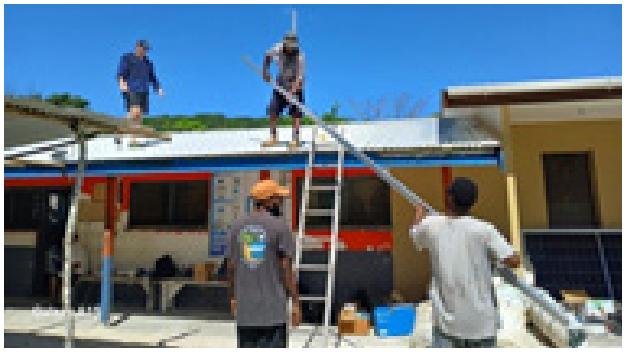
- Night-time emergency care
- Safe vaccine and medicine storage
- Power for medical and office equipment.

This is the first milestone for the one-year project that will reach 40 remote health facilities to install or refurbish solar systems, supporting 80,000 people across Vanuatu. In partnership with the National Green Energy Fund - NGEF Vanuatu, the REnew Pacific project will also be supporting local schools, removing e-waste and building long-term skills through partnerships with the Vanuatu Institute of Technology.

🔗 Learn more about the project here: https://renewpacific.com.au/from-sea-to-clinic-helpr-1-powering-vanuatus-remote-health-centres/

REnew Pacific is the Australian Government's $75 million investment in off-grid renewable energy for rural and remote communities across the Pacific and Timor-Leste. It's part of the Pacific Climate Infrastructure Financing Partnership, a $350million initiative for climate infrastructure in the region delivered by the Australian Infrastructure Financing Facility for the Pacific.

🔗 Find out more about REnew Pacific here: https://renewpacific.com.au/



Solar power transforms learning for primary school students on Fiji's remote Rabi Island

On the remote Rabi Island in Fiji, Buakonikai Primary School is undergoing a transformation that is reshaping the future of its 115 students.

For the first time in its history, the school is now powered by clean, reliable solar energy and connected to the internet, opening up new learning opportunities for its students.

It's made possible through an Off-Grid Renewable Energy Partnership between Its Time Foundation and the Australian Government, through AIFFP's Pacific Climate Infrastructure Financing Partnership (PCIFP).

Six months on from its launch, the new solar system is already delivering considerable impact:

- **Clean, reliable electricity** to keep the lights on and computers running, improving classroom conditions and student engagement.
- **Sustainable and cost-effective power**, saving the school over AUD 6,000 annually in fuel costs - money that can now be reinvested in education.
- **Internet connectivity**, giving students access to a world of knowledge beyond their island.

The impact doesn't stop at Buakonikai. This school now serves as a blueprint for other off-grid communities in the Pacific, showing how clean energy can improve education outcomes, reduce emissions and enable

greater community resilience.

Watch a short film about the partnership: https://youtu.be/ZWotMAYhe_A

Learn more about the partnership here: https://thebpp.com.au/partnership/piloting-a-sustainable-solar-energy-model-for-fijis-remote-school-communities/

REnew Pacific is a new, long-term AUD $75 million investment by AIFFP to deliver off-grid and community-scale renewable energy projects, like this one, in rural and remote parts of the region.

Find out more about REnew Pacific here: https://renewpacific.com.au/

New off-grid solar system powering up hospital services in Vanuatu's remote Torba province

Last week, one of Vanuatu's first REnew Pacific projects, led by Respond Global, achieved its second major milestone in record speed, installing a new 15kW off-grid solar system at Quatvaes Hospital, Torba.

Quatvaes Hospital is Torba's main provincial hospital, serving over 11,000 people in one of the most remote off-grid areas of Vanuatu. It previously operated without reliable power, which meant the local community couldn't always access safe, consistent healthcare when they needed it most.

Now, they are able to access:

- Healthcare services, including emergency care, powered 24/7 by clean, reliable energy
- Life-saving equipment like oxygen concentrators and critical diagnostic tools like a new X-ray machine
- Telemedicine via satellite internet.

This is the second installation in under a month for this REnew Pacific project, one of the first in Vanuatu, which will reach 40 remote health facilities over the next year, supporting over 80,000 people. In partnership with the National Green Energy Fund - NGEF Vanuatu, the REnew Pacific project will also be supporting local schools, removing e-waste and building long-term skills through partnerships with the Vanuatu Institute of Technology.

Learn more about the project here: https://renewpacific.com.au/from-sea-to-clinic-helpr-1-powering-vanuatus-remote-health-centres/

REnew Pacific is the Australian Government's $75 million investment in off-grid renewable energy for rural and remote communities across the Pacific and Timor-Leste. It's part of the Pacific Climate Infrastructure Financing Partnership, a $350million initiative for climate infrastructure in the region delivered by the Australian Infrastructure Financing Facility for the Pacific.

Find out more about REnew Pacific here: https://renewpacific.com.au/

NiuPower

Together We Can

NiuPower is an independent power producer headquartered in Papua New Guinea.

We mobilise capital to deliver, operate and maintain energy generation or storage technologies as hybrid solutions or as part of a grid or microgrid. We adopt a practical, flexible and modularised approach to meeting the specific needs of a customer.

One of our core capabilities is the ability to partner with Government at all levels, indigenous owners of land and State-Owned Enterprises to deliver business outcomes.

NiuPower currently owns a 60MW gas fired power station near Port Moresby operated by its O&M and OEM partner, Wartsila.

Given there is gas in excess of our requirements, we are seeking to set up domestic and regional markets for LNG throughout our neighbours in Micronesia, Polynesia and Melanesia.

Michael Uiari
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Strategic Planning Workshop for CEOs: 14 – 16 May, Nadi

Pacific Power Association

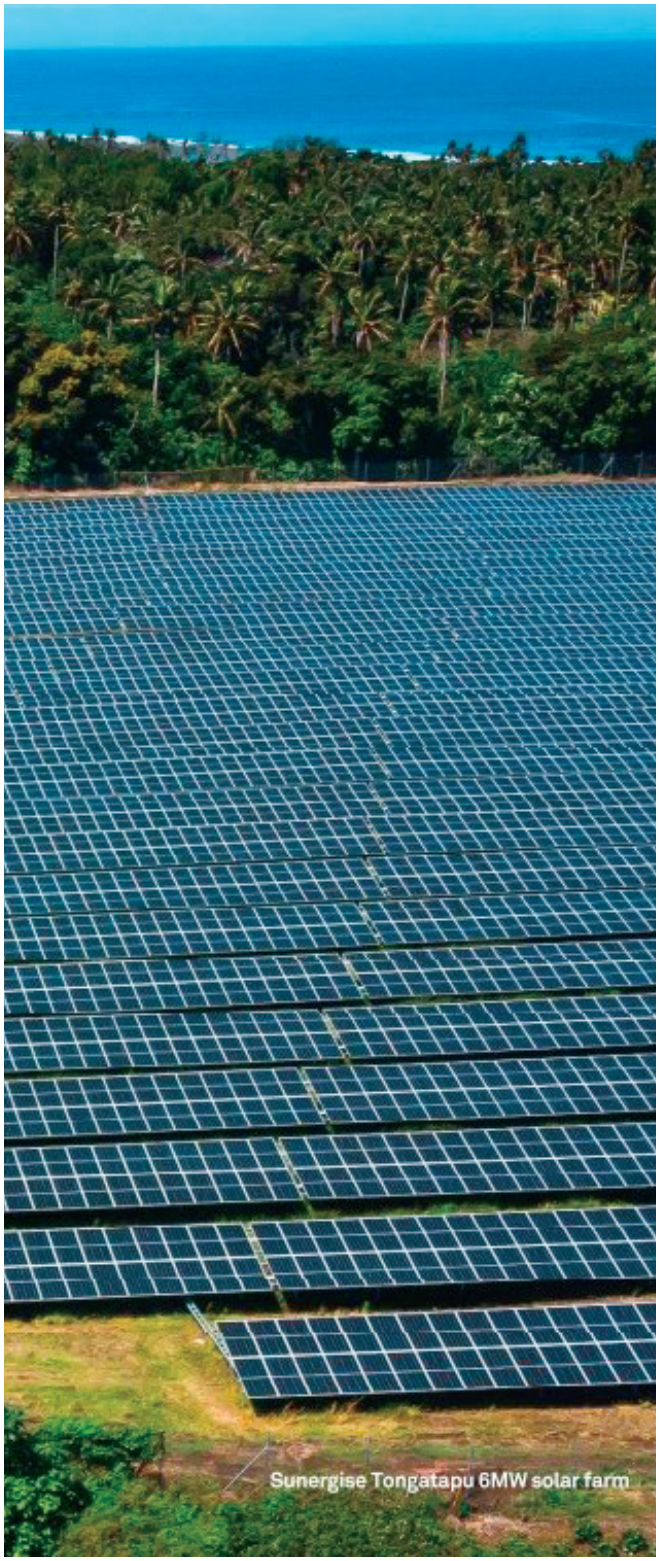
From 14 – 16 May, five PPA member chief executives, and one senior staff representing the CEO, met in Nadi to consider priority areas of action for PPA from 2025 through 2029, as part of a strategic plan development supported by the World Bank.

Mr Wallon Young (ED, ASPA and PPA board chair), Ms Leslie Katoa (CEO, TAU), Mr Casey Freddy (GM, KUA), Mr Mafalu Lotolua (GM, TEC), Mr Victor Nabeyan (GM, YSPSC) and Mr Semesi Tawaki (representing the CEO, EFL) met at the Novotel hotel and constituted a steering committee to represent the board in overseeing the plan's development. Several CEOs were unable to attend due to airline issues or work pressures. Mr Krishnan Nair represented the World Bank and Ms Jane Romero attended on the first day on behalf of the Pacific Regional Infrastructure Facility (PRIF).

The steering committee considered an assessment of PPA's financial capacity and an analysis of the weaknesses and strengths of PPA's previous plans covering 2011-2016 and 2018-2023. Responses to questionnaires sent to all member CEOs, the development community and others were presented. Finally, a series of 21 short briefing notes was also available on potential issues facing PPA and member utilities, with possible actions to address the issues.

The committee decided on seven draft broad strategic goals: 1) Promote and Support Renewable Energy Transition, 2): Support for the Development of Climate Change Resilience within Member Utilities, 3) Using Petroleum Fuel More Efficiently and Reducing Utility Consumption, 4) Support for Building the Technical, Administrative and Regulatory Capacity of the Utilities, 5) Provision of Services to Member Utilities by the PPA Secretariat; 6) Support To Utilities for Financial Sustainability, and 7) Support to Member Utilities for Human Resource Management. For each of these there are a number of objectives, and actions to reach the objectives. These will be considered by the board and further developed over the next month.

The workshop was facilitated by Mr Peter Johnston and Mr Zaeen Khan, both of whom have extensive energy sector experience. They are currently preparing a draft strategic plan to be considered by the steering committee, and then by all utility CEOs for their consideration and input. There will also be an on-line briefing to walk through the document and invite further feedback. The strategic plan will then be ready for formal signatures and adoption at the PPA Annual Conference in Palau in September.


Sunergise Tongatapu 6MW solar farm

How Batteries Go Bad: Understanding Battery Failure Modes

Andrew Sagl, Product Category Manager
Megger USA

Batteries have become essential components of our infrastructure; they provide uninterrupted power to data centres and facilitate the integration of renewable energy into our power grids. Now that we rely on batteries more than ever, understanding battery failures is not merely an academic exercise; it's essential knowledge for anyone responsible for battery systems.

The financial implications of battery failures are significant. When a battery system fails, organisations face not only the direct replacement costs but also the indirect costs related to system downtime, potential damage to connected equipment and, in some cases, the loss of critical services. A single hour of downtime in a data centre can cost as much as $1 million.

With all this in mind, let's explore the main ways batteries can fail.

Lead-acid Battery Failure Modes

Lead-acid batteries are one of the most common types of stationary battery. While they're reliable and well understood, they can fail in several ways.

Positive grid corrosion

Positive grid corrosion is a chemical process where the lead alloy that forms the battery's positive grid gradually converts to lead oxide. This process is accelerated by high temperatures, overcharging and excessive cycling. While some degree of grid corrosion is normal and actually designed into batteries, excessive corrosion can significantly shorten battery life, leading to:

- Physical expansion of plates
- Increased internal resistance
- Reduced power capability
- Eventual battery failure

Sulphation

During normal battery discharge, the active materials in a lead-acid battery (lead and lead dioxide) react with sulphuric acid to form lead sulphate. This is a natural and necessary process. However, there's a crucial difference between the soft, normal lead sulphate formed during regular discharge and the problematic crystalline sulphate that can develop under certain conditions. Sulphation is largely preventable and normally reversible, but it can become permanent if batteries remain in a discharged state, when charging is insufficient or when regular maintenance is neglected. It results in:

- Reduced capacity
- Increased internal resistance
- Physical damage to the plates

Internal shorts

Internal shorts often develop gradually and can be difficult to detect until significant damage has occurred. Unlike external shorts, which are usually obvious, internal shorts work silently within the battery, potentially creating dangerous conditions.

Internal shorts in lead-acid batteries generally fall into two categories: hard shorts and soft shorts. Hard shorts are typically caused by paste lumps resulting from manufacturing defects. Soft shorts are the result of excessively deep discharges where the specific gravity becomes so low that lead begins to dissolve into the electrolyte. This lead gets trapped in the separators, causing the short circuits. Both hard and soft shorts cause:

- Immediate capacity loss
- Excessive heat generation
- Potential thermal runaway
- Fire risks in severe cases
- Release of hazardous gases

Dry-out (VRLA specific)

While valve regulated lead acid (VRLA) batteries were developed to be maintenance free, they face a unique challenge: dry-out. Unlike their flooded counterparts, once a VRLA battery loses its electrolyte, there's no way to replenish it. This makes dry-out one of their most insidious failure modes.

VRLA batteries can lose electrolyte through excessive

heat, overcharging, poor ventilation or improper charging voltage. Loss of electrolyte leads to:

- Increased internal impedance
- Reduced capacity
- Higher operating temperature
- Decreased efficiency
- Loss of plate-to-electrolyte contact
- Accelerated ageing
- Potential thermal runaway
- Shortened backup time
- Unreliable performance
- Increased operating costs
- Premature failure

Thermal runaway (VRLA specific)

Thermal runaway is a dramatic and dangerous failure mode that can happen with any battery chemistry. In lead acid batteries it is more common in VRLA than VLA types. Unlike other failure modes that develop gradually, thermal runaway can escalate rapidly, potentially leading to catastrophic failure within hours. Thermal runaway is a self-reinforcing process where heat and current feed off each other in a dangerous spiral where the battery heats up and passes more current, which generates more heat, so the battery passes even more current, and the cycle continues until failure occurs.

Early detection, based on these criteria, is crucial for preventing catastrophic failures:

- High temperature
- Lower resistance
- Increased current
- Gas generation exceeding recombination rate
- Pressure build up, forcing venting
- Electrolyte loss

Lithium-ion Battery Failure Modes

Lithium-ion batteries have revolutionised energy storage, but they come with their own unique set of failure modes.

SEI layer build-up

The solid electrolyte interface (SEI) layer is essential for the operation of a lithium-ion battery but, during the life of the battery, it increases in thickness over time at a rate that is influenced by multiple factors. The growth of the SEI layer has direct implications for battery impedance:

- Progressive impedance increase
- Higher voltage drop under load
- Reduced maximum current capability
- Increased heating during operation

Lithium plating

Lithium plating is one of the most serious failure modes in lithium-ion batteries, potentially leading to catastrophic failures. Unlike gradual degradation mechanisms, lithium plating can create immediate safety hazards and careful management is required to prevent it. When the battery is functioning normally, lithium ions intercalate (insert themselves) into the anode's graphite structure during charging. However, under certain conditions, ions accumulate on the anode surface and metallic lithium deposits form. Eventually, dendrites grow, and the structure becomes unstable.

Lithium plating creates serious safety concerns:

- Internal short circuits
- Thermal runaway potential
- Cell rupture possibility
- Capacity degradation
- Increased internal resistance
- Accelerated ageing
- Cell imbalance
- Potential fire hazard

Non-uniform ageing

Many battery ageing processes are usually considered to be uniform across the cell, but reality is often more complex. Non-uniform ageing occurs when different parts of the cell age at different rates, creating localised weaknesses that can significantly impact performance and safety. It can result in:

- Reduced overall capacity
- Increased internal resistance
- Uneven current distribution
- Variable voltage response

BMS failures

The battery management system (BMS) is the critical intelligence that keeps lithium-ion batteries operating safely and efficiently. When the BMS fails, it can compromise both battery performance and safety, so understanding these failures is crucial. BMS failures can manifest in various ways, such as hardware, software or calibration problems.

BMS failures can have serious safety implications:

- Overcharge risk

- Over-discharge potential
- Temperature control failure
- Current limit failures
- Lack of critical warnings
- Delayed shutdown response
- Failed emergency disconnection
- Inadequate thermal management
- Cell imbalance
- Thermal runaway
- Excessive stress on cells
- Accelerated ageing

Battery string issues

In addition to individual battery failures, battery strings are susceptible to another important failure mode: degradation of inter-cell connections if they are not properly maintained. This degradation is due to multiple factors including corrosion, vibration and repeated temperature changes. As the connections degrade, their resistance increases. This may not be noticed when the string is passing only a small float current, but when it is called upon to deliver higher current, the increased resistance of the connections can lead to excessive heating, which, in some cases, creates a fire hazard.

Inter-cell connections are often the weakest link in a battery string, and their failure can have serious consequences:

- High resistance
- Increased heat
- Reduced capacity
- Voltage imbalances

Testing and Prevention: The best defence against battery failure

Understanding failure modes is crucial but preventing failure through proper testing and maintenance is even more important. Proper maintenance and regular testing with the right equipment aren't just good practice; they are essential for:

- Ensuring system reliability
- Protecting investments
- Maintaining safety
- Meeting obligations
- Optimising performance

We'll cover testing and maintenance approaches in more detail in a future post.

Conclusion

As we've seen, batteries can fail in numerous ways, from the gradual degradation of positive grids in lead-acid batteries to the potentially dangerous lithium plating in lithium- ion systems. Understanding these failure modes isn't just an academic concern – it's about protecting critical infrastructure, ensuring business continuity and maintaining safety.

Some failure modes, like sulphation or SEI layer build-up, work slowly and steadily, gradually undermining your battery's performance. Others, like thermal runaway or internal shorts, can strike quickly and dramatically. But all share one crucial characteristic: they give warning signs before causing catastrophic failure.

This is why regular testing and maintenance are so important. The cost of implementing proper testing and maintenance programs is minimal compared to the potential consequences of battery failure – consequences that can range from expensive replacements and system downtime to serious safety incidents.

Welcome!

TO THE NEW ALLIED MEMBERS

There have been two new Companies who have joined the PPA as Allied Members since our last PPA Magazine.

PETRO OCEANIA ENERGY PTE LIMITED: Petro Oceania Energy Pte Limited is based in Suva, Fiji. Their primary activity is supply of Petroleum Products.

HNAC TECHNOLOGY CO., LTD: HNAC Technology Co., Limited is based in Hunan Province, China. Their primary activity is hydropower, solar power, energy storage and water treatment.


Accelerating sustainability in marine and energy
We develop, produce and service turbochargers and digital solutions: these make engines more powerful and efficient, while also reducing emissions. Our advanced products are used in a wide-range of sectors including marine, energy and rail. These industries make our world turn and we power them, reliably and sustainably, while also helping them decarbonize.
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Accelleron