# PPA

## A PACIFIC POWER ASSOCIATION PUBLICATION

VOLUME 27 ISSUE 1 - March 2019


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# CONTENTS







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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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**Cover Page Photograph – "Executive Director of the Pacific Power Association with representatives from the World Bank, Ricardo Energy & Environment and power utilities from participating Pacific Power Association Members at the VRE Stakeholders"**

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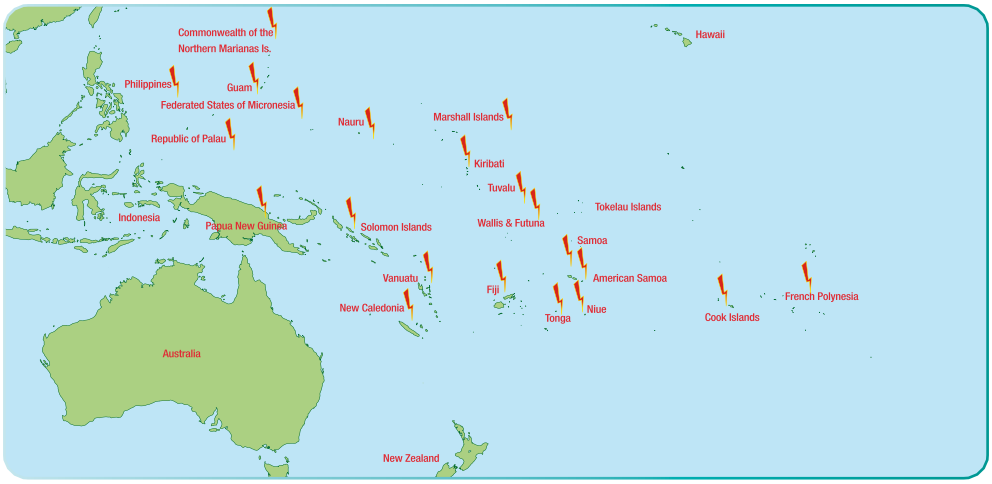


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# Editor's Notes

**Andrew D. Daka**
Executive Director

Bula and Greetings from Suva.

This year 2019 begun when we left last year for a number of our members with much to be done in the renewable energy space. There were proposals to be evaluated, tenders to be awarded, contracts signed and projects to be completed; all in an effort to transition to higher contributions from renewable energy generation and ultimately addressing climate change.

One of the areas where the Association has seen an increase in activity within the utility members is the engagement of private sector investment as Independent Power Producers (IPP) through Power Purchase Agreements (PPA). Recent examples of these are Guam Power Authority's 60MW IPP with Hanwa Energy of Korea, Palau Public Utilities Corporation evaluating a 35MW solar project and Tonga Power Ltd soon to award a 6MW contract for solar generation.

With utilities engaging with private sector, there exist a need for utilities to have expertise to negotiate IPPs and this is an immediate need for the capacity building in that area as identified in the Training Needs Assessment carried out under the World Bank funded Sustainable Energy Industry Development Project (SEIDP).

The Association, in responding to the need will be facilitating the first of a series of workshops to address that need, scheduled for early April 2019 to be held in Nadi, Fiji Islands. However, as well as the training workshops, it is also very important for utilities who have had some experience in negotiating PPAs to share their experiences with the other member utilities.

In this issue you can read about heat recovery as a source of renewable energy. Now this is a fuel source that is available to all utilities that have diesel generation and any process that generates heat which is normally lost into the atmosphere.

You will also read about Komaihaltec's non-tilted typhoon resistant 300kW wind turbine which would suit our cyclone-prone regions.

The preparations for the 28th Annual Conference and Exhibition are well underway and the host utility, TAU, and the PPA Secretariat are finalizing the program. One thing that is certain is that the program will have something for everyone. I therefore urge all the members to register for the conference as well as submit papers for presentation early to avoid disappointment.

In closing, let me welcome Datelstream Limited, PowerSmart Limited, Gentrack Limited, IGSNZ Limited and HNAC Technology Co. Ltd who have just joined as new Allied Members.

Vinaka vaka levu.

# Waste Heat to Power: The Baseload Renewable You Already Have

Robert Emrich
Director of Sales & Market Development - Electra Therm

Continuous duty gensets provide baseload power generation in diverse applications around the globe. However, high fuel costs and engine maintenance are pain points felt by operators as they deliver this critical service. A low maintenance path to significant fuel savings and lower emissions is what the U.S. Department of Defense (DoD) had in mind when they approached ElectraTherm to integrate the POWER+ GENERATOR with a Cummins KTA-50 1.1 megawatt generator. The DoD wanted to investigate the performance impact and economics for their diesel engine fleet. Between the DoD project and the 70+ POWER+ GENERATORs running in the field, ElectraTherm has demonstrated more than 10% increase in fuel efficiency along with simple installation, mobility and low maintenance. The POWER+ GENERATOR can replace the engine's radiator entirely and deliver a payback of two years or less for diesel or heavy fuel oil-fired gensets. In effect, the engine's waste heat becomes a source of cost savings by displacing the radiator's capital cost and parasitic load, i.e. more power with a quick payback.

In the past, there were no proven commercial products for converting engine heat to power so operators had little choice but to accept the heat loss to the atmosphere. Today ElectraTherm has deployed more than 70 units worldwide with over 1.2 million hours of cumulative fleet experience. ElectraTherm is the leader in small-scale, distributed power generation from waste heat; we utilize Organic Rankine Cycle (ORC) and proprietary technologies to generate power from low temperature heat ranging from 77-122°C. ElectraTherm's Waste Heat to Power (WHP) technology converts various sources of heat into power, including internal combustion engines, combined heat and power (CHP), micro geothermal, biomass, and process heat. ElectraTherm's primary market is waste heat from stationary internal combustion engines. With the typical engine running at about 33% efficiency, there is considerable waste heat between the jacket water and the exhaust. Typical engine sites include: prime power production in remote areas, island and developing nations, biogas gensets including landfill and wastewater treatment plants, natural gas compression stations and renewable biofuels.

**Many Benefits of Heat-to-Power for Prime Power in Remote Areas**

There are multiple benefits to integrating an ORC heat to power generator with an engine genset and we can confidently say that we have created the world's most efficient engine cooling device. The first benefit is clear: the additional electrical output from the conversion of the waste heat to electricity with no additional fuel consumption or emissions. Second and less obvious is the reduction or elimination of the parasitic load from the engine cooling fans. The POWER+ GENERATOR acts as the radiator and, therefore, the engine-driven radiator fans can actually be disconnected, allowing more work to be performed by the engine to generate additional electricity. A third benefit can be achieved in hot climates or seasonally high ambient conditions, due to the fact that the ORC has a greater cooling capacity than the engine requires. So for very high ambients when the engine radiator limits the output of the engine the increased cooling capacity provided by the ORC's radiator allows for increased performance. The POWER+ electricity output combined with reduced parasitics account for 10%+ fuel efficiency gain depending on engine size and configuration. The additional benefit from decreasing the engine's de-rate period or the amount of de-rate will, of course, vary with ambient conditions.

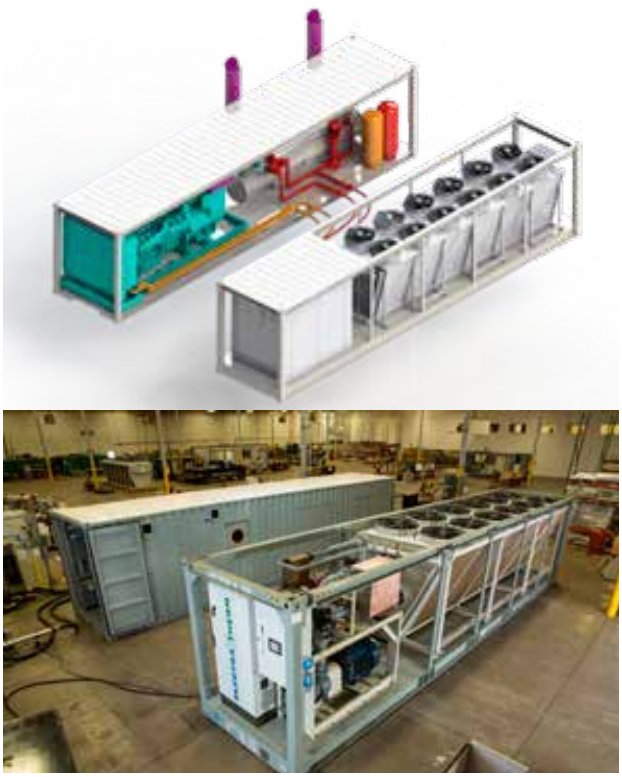
**The Department of Defense Projects**

Our first project with the DoD was to simulate various engine models and ORC integration schemes, and fully test those configurations on ElectraTherm's test cell. A matrix was developed consisting of five engine models and two engine configurations over different ambient conditions for waste heat capture: jacket water only and jacket water boosted with exhaust energy for higher ORC efficiencies and output. U.S. Navy personnel visited ElectraTherm several times during the first project for training and inspection of our test cell and facilities. At the conclusion of this project a very favorable report was issued by the Navy.

The next step was to develop a higher output, fully integrated ORC specific to a Cummins KTA-50 1.1 megawatt engine for DoD deployment. The ORC and all balance of plant was packaged in ISO shipping containers for ease of deployment and mobility throughout the world. Funding for this second project came from DoD's Environmental Security Technology Certification Program (ESTCP) through Southern Research Institute (SRI) who is independently monitoring the performance and fuel efficiency gains.

Figure 1 shows the configuration, comprised of two 40' ISO shipping containers. The Cummins genset, engine controls, switch gear and exhaust gas heat exchanger were housed in a Combined Heat and Power (CHP) module packaged under ElectraTherm's direction by Cummins Rocky Mountain from Denver, Colorado. The ORC module contained the POWER+ GENERATOR and associated controls, liquid loop radiator (combined radiator for the engine and ORC) and the corresponding balance of plant (piping, pumps and expansion tank, etc). The system was tested with the Mobile Utilities Support Equipment (MUSE) group at the Port Hueneme, CA Navy facility for fuel efficiency testing by SRI.

**Figure 1.** DoD funded ORC integration and replacement project



This project forced our engineering team to look hard at the question "Do we need both the engine radiator and ORC radiator?" All ORCs need condensing and all engines need cooling. Could it be done with one radiator, eliminating approximately $75,000 in capital cost for an engine this size? The answer is a resounding "YES". Advanced engine cooling with a payback was born, accomplished with an intermediate heat exchanger to optimize the return temperature to the engine and a bypass to ensure the engine cooling remained operating if the ORC is not running. The impact to the overall installed cost for an ORC can now be reduced by 20-30%.

ElectraTherm currently manufactures a 35 kW unit that fits well with ~500 kW gensets (our 4200 model), a 65 kW unit which fits well with ~800 kW engines (our 4400 model), and our project with the DoD is the first 110 kW unit (our 6500 model), well suited for 1-2 MW engines.

**Figure 2.** ElectraTherm installed ten POWER+ GENERATOR 4400s at a district heating plant in Slovakia.

ElectraTherm's experience to date with genset integration has been very successful. Our applications include single engines and multiple engines utilizing jacket water heat alone as well as jacket water combined with exhaust heat. Engine models that have been integrated with the Power+ Generator include Jenbacher, Deutz and MWM engines in Europe as well as CAT and Waukashau engines in North America.

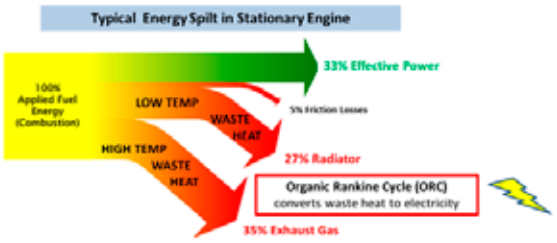
**How it Works**

ElectraTherm's POWER+ GENERATOR operates using a closed loop ORC, where hot water is the fuel. Hot water from the engine enters a heat exchanger

to excite (pressurize) the non-flammable, non-toxic working fluid, driving the twin-screw expander and generator to create electricity. ElectraTherm's patented twin-screw expander is unique in its configuration, lubrication and specifications, but the core technology is based on reliable, proven compressor technology that has been around for more than 20 years.

The twin screw expander has a rotational speed of 1800 - 4900 RPM, considerably less than turbo expanders. Unlike high speed turbo expanders, screw expanders are robust units that tolerate "wet" dual phase flow. This allows the POWER+ GENERATOR to utilize more cost effective and compact heat exchangers that tolerate perturbations in both temperature and flow with turn down ratios of 6:1 available on demand. This is particularly advantageous in low temperature waste heat streams such as engine jacket water. Through a patented lubrication scheme, the POWER+ GENERATOR design is simplified and eliminates lubrication reservoirs, oil coolers, pumps, land filters, creating a simple, robust, and efficient system with fewer parasitic loads and maintenance requirements. Figure 3 shows why engine gensets are a great match for POWER+ GENERATORs from ElectraTherm since a significant portion of the waste heat is at low temperatures and engine throttle positions can vary widely depending on the electrical load demand.

**Figure 3.**




Distributed WHP systems for stationary engines are not yet well known or mainstream, but the technology is field proven, and the economics are now attractive. ElectraTherm's various packaged solutions are making it easier to economically capture waste heat and make emission-free and fuel-free power from sources that already exist. In planning your next genset application, or if you have an existing radiator replacement coming up – consider implementing waste heat to power, the renewable you already have.

# TRANSFORMER TESTING DOESN'T NEED TO BE EXPENSIVE OR COMPLICATED

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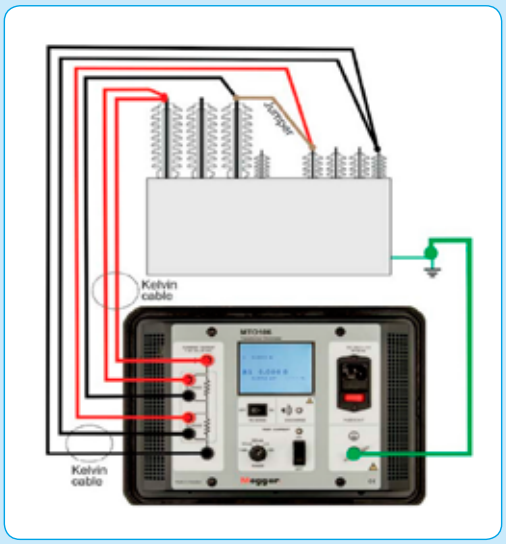


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# Non-tilted Type Typhoon Resistant Model of 300kW Wind Turbine

Leiko Toyoda
Planning Manager - Komaihaltec Inc.

Abstract
In the face of climate change, the pacific nations are confronting the risk of ever increasing scale of typhoons and cyclones. At the same time, such nations are leading the world in the transition to the renewable energy, with ambitious yet realizable renewable energy targets. The renewable energy technology that accommodate the needs and the conditions of the island nations is inevitable for them to achieve their goals. Komaihaltec Inc., mid-size wind turbine manufacture, has newly developed a typhoon resistant model of its 300kW wind turbine. It will resist the gust up to 91.26 m/s or 204MPH by actively keeping the rotor in downwind position to reduce the wind load. The operators of the wind turbines do not have to tilt down the tower before a typhoon, thus it will produce as much energy as possible before the typhoon comes close, and will resume the normal operation immediately after its passage.

## 1. Introduction

Komaihaltec Inc., which has founded in 1883, has been one of the major fabricators of steel bridges and building structures in Japan for long time. In 2006, it developed and installed the prototype of 300kW wind energy generating system. The wind turbine was developed on the basis of wind-resistant research experience and expertise that had been built up in the company through the designing of steel bridges.

While the 300kW wind turbine "KWT300" was designed to accommodate the climate and geographical condition of Asian countries, such as the risk of typhoons and earthquakes, as well as higher turbulence caused by complex terrains.

As we observe the increasing scale of typhoons and cyclones, we have newly developed the typhoon resistant model that could resist the wind speed as high as 91.26m/s without being tilted down.

## 2. Features of Komaihaltec 300kW wind turbine

The below chart summarizes the features of Komaihaltec 300kW wind energy generating system "KWT300".

**Chart 1. Feature of KWT 300 (normal model)**

| | |
|---|---|
| Model | KWT300(normal model) |
| Rated Capacity | 300kW |
| Cut-in wind speed | 3.0m/s |
| Rated wind speed | 11.5m/s (instant)<br>15m/s(10min average) |
| Cut-out wind speed | 25m/s |
| Hub height | 41.5m |
| Rotor diameter | 33m |
| Weight | Tower blocks: >10tons<br>Nacelle: 18 tons |
| IEC class<br>(refer Chart 2) | |
| | IIA+<br>Vave = 8.5m/s<br>Vref = 50m/s<br>Iref = 0.18 |
| Control system | Output control<br>Soft cut-in and cut-out |
| Design life | 20 years |

KWT 300 is designed to be compact and robust. Its blades and tower blocks can be transportable with 10 tons trucks and the nacelles with 15 ton low-bed trailers. It requires a 60ton crane with special erections system while a 160ton crane is used for normal erection method.

**Chart 2. IEC classification of KWT300**

| IEC WTGS Class | | I | II | III | S (KWT300) |
|---|---|---|---|---|---|
| Vref(m/s) | | 50 | 42.5 | 37.5 | 50 |
| Vave(m/s) | | 10 | 8.5 | 7.5 | 8.5 |
| Iref Turbulance Intensity | A | 0.16 | 0.16 | 0.16 | 0.18 |
| | B | 0.14 | 0.14 | 0.14 | |
| | C | 0.12 | 0.12 | 0.12 | |

**Image 1. KWT300 in an island of the Philippines**

### 3. Setting the Conditions for typhoon resistant model

IEC (International Electrotechnical Commission) has been discussing the new IEC Wind turbine generating system class for the regions with exposure to tropical cyclones. Although it has yet to been finalized, the newly defined class will have the increased reference wind speed (Vref) of 57m/s, compared to the current highest Vref of 50m/s for class I category. When converting Vref to instant speed, survival wind speed, 50m/s shall be 70m/s and 57m/s shall be 79.8m/s.

Chart 3 Illustrates some of the massive cyclones which caused significant damage to the people's living. The maximum instant wind speed for these cyclones exceeds 80m/s. While we are seeing more and more actual events attributed to climate change, such scale of cyclones will be no longer abnormal.

We have analyzed a typhoon situation in one of the most southern islands of Okinawa, Japan. The derived the design value of Vref = 58.5m/s and the survival speed of 91.26m/s.

**Chart 3. Example of large cyclones in recent years**

| | | (10 min average) | | | | |
|---|---|---|---|---|---|---|
| Cyclone Name | year | wind speed (mph) | wind speed (m/s) | Pressure | Affected area | Recorded max wind speed |
| Winston | 2015–16 | 145 | 64.8 | 915 hPa | Fiji | 84.5m/s |
| Yolanda /Haiyan | 2013 | 145 | 64.8 | 895hPa | Philippines | 195mph 87.17m/s |
| Maemi | 2003 | | 55 | 910hPa | Miyakojima, Japan | 86.6m/s |

### 4. KWT300 Typhoon resistant model

There are several ways to increase the toughness of wind turbines against the wind load caused by typhoons and cyclones. The simplest way is to increase the toughness of each parts such as blades, towers, shafts, flanges, bolts joints etc. so that the wind turbine can withstand the wind load. This, however, increase the weight and the cost of the wind turbines. Considering the locations typhoon resistant model is required, typically islands, the increase in weight could make the erection of wind turbines unfeasible by requiring larger cranes, which is unlikely to be readily available in islands settings.

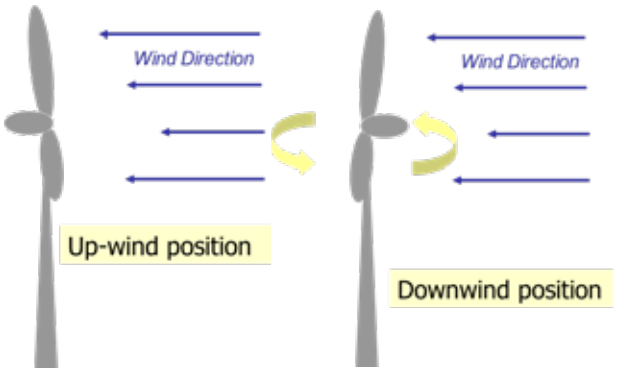
The alternative is to reduce the wind load. Some wind turbines adapt the system to lower down the rotors when a cyclone approaches so that they could avoid the gust up in the sky. The gust level on the ground should be lower than that up in the sky.

Komaihaltec has chosen another way to reduce the wind load, that is to keep the wind turbines rotors in down-wind position. (Image 2) This is a patent registered technology.

KWT300 is designed to be an up-wind type wind turbine. It withstands the wind from any direction with the wind speed up to 70m/s. The precondition of this design is that the wind turbine will receive the wind load from any direction as it may lose the control of its rotor position during the grid loss.

On the other hand, the same wind turbine can withstand the wind up to around 80m/s when the rotor is being kept downwind position. To achieve this, the power source for the rotor position control (yaw control) must be secured all the time. Thus, our typhoon resistant model is equipped with emergency generators to keep the yaw control even during the grid loss.

**Image 2. Image of rotor position change**



In addition to the downwind yaw control system, major components have increased the strength to achieve the survival wind speed of 91.26m/s.

**5. Advantage of non-tilt-down type**

It is the most significant advantage for non-tilt-down type that it makes the most of the strong wind during the typhoons. Usually the gust over 80m/s is only observed in one instant of a typhoon passage. Most of the time while typhoon is approaching and passing, the wind speed is below the cut-out speed of 25m/s. Thus, for non-tilt-down type wind turbine, such as KWT300, the typhoon approaching period is actually a great opportunity for power generation.

When a strong typhoon is approaching, KWT300 operator shall put the wind turbine "storm-control mode". The wind turbine will keep the normal operation until the wind speed reaches the cut-out wind speed. When it reaches the cut-out wind speed, then the wind turbine automatically stops generation and start rotating the rotor to downwind position. After the passage of the extreme wind, the wind turbine automatically detects the wind speed and resume the normal operation. The downtime due to the typhoon passage will be minimal.

On the other hand, tilt-down type wind turbines must be lowered when the wind speed is below 10m/s, therefore cannot utilize the wind resource during the typhoon approaching and passing. The down time during the typhoon could be several days.

**Chart 4. Typhoon model specification**

| | Standard Model | Typhoon Model |
|---|---|---|
| Cut-in Wind Speed | 3.0m/s | |
| Cut-out Wind Speed | 25.0m/s | |

| | | |
|---|---|---|
| Maximum Wind Speed Vref (ten minutes average) | 50m/s (111.8mph) | 58.5m/s (130.9mph) |
| Survival Wind Speed, Ve50 (3 seconds average) | 70m/s (156.6mph) | 91.26m/s (204.1mph) |
| Control during Typhoon | Keep rotor up-wind position | Keep rotor down-wind position |
| | | Active yaw control |
| In case of loss of grid power for auxiliary supply | No yaw control Designed to withstand the wind load from any direction | Supply power for yaw control with emergency power supply to keep the rotor position |
| Survival wind of wind censors | 70m/s | 100m/s |
| Nacelle cover survival wind | 70m/s | 91.26m/s |

**6. Demonstration**

In February, 2019, Komaihaltec completed the installation of KWT300 normal type with typhoon control system in an island of the Philippines. Although those, without increased strength of parts, are not the full-scale typhoon resistant model, we intend to demonstrate the yaw-control system with these machines.

Komaihaltec hopes to contribute to the island nations to achieve their renewable energy goals.

# Stakeholders' Consultation Workshop on Variable Renewable Energy for Pacific Island Power Utilities

Pacific Power Association

The Pacific Power Association, in consultation with the World Bank, has identified the need for Variable Renewable Energy integration assessment and SCADA-Energy Management Storage system design to support the development of the growing renewable energy sector in the region.

In light of this, a team of consultants led by Ricardo Energy & Environment were engaged in early 2018 to work with selected power utilities from around the Pacific to undertake assessments of the existing power systems and to develop best solutions to allow for the deployment of more variable renewable energy sources such as solar photovoltaic and wind power. The first phase of this technical assistance involved in-country data collection and consultations between the consultants and the power utilities.

This week in Nadi, a stakeholders' consultation workshop is underway to discuss and validate the findings of studies that have been prepared by the consultants. The workshop will also allow the consultants to conduct technical dialogue with utilities on key regulatory and policy reform recommendations. In attendance at this workshop are representatives from the PPA secretariat, the World Bank, the consultants as well as the power utilities in Chuuk, Kosrae, Marshall Islands, Pohnpei, Samoa, Tuvalu, Tonga and Yap who are all recipients of this Technical Assistance.

*Caption: Executive Director of the Pacific Power Association with representatives from the World Bank, Ricardo Energy & Environment and power utilities from participating Pacific Power Association Members at the VRE Stakeholders Consultation workshop.*

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# The Project for Introduction of Hybrid Power Generation System in Pacific Island Countries – Regional Technical Cooperation Project by JICA

Tadayuki Ogawa
JICA expert in Fiji - JICA

Japan International Cooperation Agency (JICA) has been engaged in the captioned project in Fiji, FSM, RMI, Kiribati and Tuvalu since March, 2017. The objective of the Project is to promote "Hybrid Power Generation System (HPGS)", aiming to achieve proper operation and maintenance of Diesel Engine Generators (DEG) and RE power generation systems. Smart integration of RE requires healthy operation and maintenance conditions of DEG, which is the reason why we designed this Project as "Hybrid", instead of simply integrating RE into the existing grid.

Under the transition of utility business model, human resource development is one of the big challenges for all utilities in PICs. The project has been offering continuous learning opportunities for selected core counterparts who are expected to share their skills and knowledge with their co-workers. A series of hands-on and classroom trainings have been provided in each country by the experts from Japan, together with the assistance to establish regional training functions at EFL Lautoka Training Center in Fiji. Also, the first counterpart training was held in February 2018 to learn the design concept of HPGS in remote islands of Okinawa, research institutes and manufactures in Japan. In September 2018, the second training offered the opportunity to participate in the on-going overhaul work of DEGs in remote island of Okinawa.

In total 22 number of candidate trainers are registered under the Project in Fiji, 19 from EFL and 3 from DOE staffs. As a result of the past trainings for trainers in Fiji, following training courses will be offered under the 1st regional training in Fiji in 2019, inviting core counterparts from FSM, RMI, Kiribati and Tuvalu.

1) Operation & Maintenance for Diesel Engine Generators
2) Grid Integration of Renewable Energy Generation Systems
3) Operation & Maintenance of Renewable Energy generation Systems (Solar PV)

The participants will have an opportunity to exchange their views and opinions with other counterparts to improve their skills and knowledge. Trainers in Fiji will be technically supported by Japanese Experts to deliver classroom lectures and hands-on trainings in accordance with curriculum. The result of the training will be evaluated to improve the training curriculum, textbooks & materials for the next training.

*Hands-on PV Training in Majuro*

*Installation of Trainng PV system (3.5kW) in Fiji*

# PPA Ladies in Nepal, WePower Women's Professional Network February 20 – 21

Pacific Power Association


*Some of the pictures taken with new friends and colleagues from the WePower Network: Ms. Ramla Quereshi-CEO and Founder, Women Engineers Pakistan, Mrs. Dawa Bhuti – Deputy Executive Engineer, Druk Green Power Company, Bhutan, Ms. Sandra Shuster – Vice President, Business Development Water, Power & Dams, STANTEC, Ms. Fowzia Hassan – Senior Energy Specialist, South Asia Region, The World Bank, Dr. Ramalatha Marimuthu (Chair Institute of Electrical and Electronic Engineers (IEEE), India Women in Engineering (WiP), Professor Kumaraguru College of Technology Anna University, Dr. Bozenna Pasik-Dunkan (IEEE, WiP Global Chair, Mathematics Professor at University of Kansas), Dr. Celia Shahnaz (Chair, IEEE, Power and Energy Society, WiP – Bangladesh, Professor at Bangladesh University of Engineering and Technology), and PPA Power Champions Edna and Tei.*

The World Bank along with other development partners hosted the first regional conference in Kathmandu, Nepal from February 20 - 21st. The overall goal of the WePOWER Women's Professional Network is to support higher participation of women in the energy sector. Some of the WePOWER Baseline data conducted for all 8 South Asian countries* show that the share of women employees in the surveyed institution ranges from 3% to 15%, and the share of women engineers and technicians is even lower – less than 1% to 6%. WePOWER is partnering with Strategic and Institutional partners to create a self-sustaining professional network. The partners will endorse the objectives of the network that align with the WePOWER's five pillars: (i) Science, Technology, Engineering and Mathematics (STEM) education, (ii) Recruitment; (iii) Development; (iv) Retention; and (v) Policy and Analysis.

Pacific Power Association (PPA) Gender Champions through the generous support of World Bank, through financed SEIDP, was invited to share about our Gender Equality work as a region, as well as what is happening at the local level. PPA Gender Champions - Miss Edna Noga, Staff Engineer from the American Samoa Power Authority and Miss Teiiti Nia, Assistant Engineer from Te Aponga Uira of Cook Islands participated in this inaugural regional conference.

Over 250 participants from various regional and international stakeholders shared strategies and lessons learned from their respective oranganisations to enhance gender equality in the power sector. Students from the local high schools were invited to participate in the STEM is for Girls! – Interactive Game-based Learning session and was fun and educational for all. Gender diversity and inclusion is crucial to the workforce challenge in the power sector, and as shared by several speakers/presenters, "gender equality is smart economics…gender equality is smart business".

For the latest updates on WePOWER, please join the WePOWER Linkedin Group:

Women in Power Sector Network in South Asia
*https://www.linkedin.com/groups/12139181/*

*Countries included in baseline assessment: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka

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# Renewable Energy / Energy Efficiency Guidelines: Summary of In-Country Training Workshop

Geoff Stapleton
Managing Director - GSES

## 1. Summary

Between 6th August and 7th December 19, 4-day workshops were conducted in 12 countries. 490 people registered for these workshops and 429 different people attended at least 1 day of one of the workshops. The breakdown per country is shown in table 1.

***Table 1: Analysis of Attendees per Country***

| Workshop Location | Number Registered | Number Attended at least one day | Breakdown | |
|---|---|---|---|---|
| | | | Male | Female |
| Palau | 36 | 31 | 31 | 0 |
| Yap (FSM) | 25 | 23 | 23 | 0 |
| Chuuk (FSM) | 29 | 25 | 23 | 2 |
| Pohnpei (FSM) | 22 | 19 | 19 | 0 |
| Kosrae (FSM) | 28 | 28 | 28 | 0 |
| Fiji | 42 | 38 | 38 | 0 |
| Marshall Islands | 22 | 16 | 16 | 0 |
| Kiribati | 36 | 28 | 26 | 2 |
| Tuvalu | 7 | 7 | 7 | 0 |
| Vanuatu | 29 | 25 | 21 | 4 |
| Nauru | 26 | 26 | 23 | 3 |
| Port Moresby (PNG ) | 56 | 51 | 50 | 1 |
| Lae (PNG) | 33 | 30 | 28 | 2 |
| Samoa | 24 | 22 | 18 | 4 |
| Solomon Islands | 39 | 30 | 29 | 1 |
| Tonga | 36 | 30 | 27 | 3 |
| **Total** | **490** | **429** | **407** | **22** |

The objective of the workshops was to raise awareness of the existing 6 guidelines and the fact that through SEIDP another 11 will be developed.

It is a requirement of the Pacific Power Association (PPA) and Sustainable Energy Industries Association of Pacific Islands (SEIAPI) technician's certification program that certified technicians use these guidelines when designing and installing systems. The workshops then provided an opportunity for certified installers to be informed on the technical content of the guidelines.

Through the raising of the awareness it is hoped that relevant government departments and multi-lateral and bi-lateral donors will adopt the guidelines when implementing solar related projects.
The workshops were very successful in bringing people from private industry, utility, government and in some times trainers together to discuss technical issues. This interaction was beneficial to those who attended.

Though the workshops provided some technical information they were not an in-depth training course. Those attending the workshops emphasised that there is an ongoing need for training course to be conducted within the region and in particular within each country.

The workshops were conducted by Dr. Herbert Wade and Mr. Geoff Stapleton (GSES Project Manager).

Dr Herbert Wade conducted the following 4 day workshops:

- Palau (6th -9th August);
- Yap (13th to 16th August)
- Chuuk (20th to 23rd August);
- Pohnpei (27th to 30th August);
- Kosrae (3rd to 6th September);
- Marshall Islands (10th -13th September) and
- Nauru (22nd 25th October)

Mr Geoff Stapleton conducted the following 4-day workshops

- Fiji (Suva- 3rd to 6th September);
- Kiribati (Tarawa-11th -14th September);
- Tuvalu (19th -21st and 24th September);
- Vanuatu (8th to 11th October);
- Power Moresby (PNG) (30th October to 2nd November);
- Lae (PNG)( 5th to 8th November);
- Samoa (12th to 15th November);
- Solomon Islands (20th to 23rd November) and
- Tonga (4th to 7th December)

Though not part of this project, however as a direct result of this project, Mr Stapleton conducted 4 days of workshops in the Cook Islands between 7th and 10th August. These were funded by the local utility company, Te Aponga Uira (TAU).

## 2. Workshop Topics and Agendas

### 2.1 Workshop Topics

One-day workshop presentations were prepared on each of the following six guidelines:

- Operation and Maintenance of PV Systems (Grid connect)

- Utility Scale Energy Storage
- Design of Grid Connected PV Systems
- Installation of Grid Connected PV Systems
- Design of Off Grid PV Systems- including session on design of Hybrid Systems
- Installation of Off Grid PV Systems- including a session on Hybrid Systems

Each country was asked to select which four workshops they wanted covered. If required one guideline could be repeated over 2 days for a particular country if that is required by the PPA/SEIAPI members. As an example, if a PPA member wants to have Operation and Maintenance of PV Systems (Grid connect) conducted twice so they can send half their technical staff one day and the rest on the second day that could be considered.

However, while conducting the workshops some modifications were undertaken. For instance, Mr. Stapleton found that he could cover the design of off-grid systems including a discussion on grid systems in one day. As well as one day on installation of off-grid systems along with discussion on grid connect installation. So he basically started offering those two along with the O& M and Energy Storage.

Samoa requested that design/install grid connected PV systems be one day and Design/Install off-grid systems be another day and this was also catered for in delivering their workshops.

Table 2 provides a breakdown of how many attended each of the different workshop topics in each country.

### 2.3 Quizzes

Two quizzes per topic were prepared and these were to be conducted when and if there was time. Mr Stapleton found when conducting the sessions covering both off-grid and grid there was no time for the quizzes on those 2 days but then some would be held on the days covering O & M and Energy Storage.

***Table 2: Analysis of Attendance at the Various Workshop Topics***

| | O & M PV Systems | Energy Storage | Design Grid Connect PV Systems | Install Grid Connect PV Systems | Design Off Grid PV Systems | Install Off Grid PV Systems | Design Off Grid PV Systems & Discussion of Design of Grid connected PV Systems | Install Off Grid PV Systems & Discussion of installation of Grid Connect PV systems | Design and install Off Grid PV Systems | Design and Install Grid Connect PV systems |
|---|---|---|---|---|---|---|---|---|---|---|
| Palau | 24 | 25 | 22 | 25 | | | | | | |
| Yap (FSM) | 21 | | 23 | | 20 | 18 | | | | |
| Chuuk (FSM) | 20 | 24 | | 21 | 20 | | | | | |
| Pohnpei (FSM) | 14 | 16 | | | 15 | 13 | | | | |
| Kosrae (FSM) | 20 | 17 | | 19 | | 17 | | | | |
| Fiji | 33 | 27 | | | 22 | 27 | | | | |
| Marshall Islands | 14 | 15 | | 12 | | 12 | | | | |
| Kiribati | 22 | 20 | | | | | 25 | 21 | | |
| Tuvalu | 6 | 5 | | | | | 6 | 6 | | |
| Vanuatu | 12 | 10 | | | | | 18 | 21 | | |
| Nauru | 18 | 20 | 23 | 21 | | | | | | |
| Port Moresby (PNG) | 46 | 38 | | | | | 47 | 45 | | |
| Lae (PNG) | 26 | 18 | | | | | 23 | 28 | | |
| Samoa | 16 | 17 | | | | | | | 14 | 18 |
| Solomon Islands | 19 | 24 | | | | | 25 | 25 | | |
| Tonga | 22 | 18 | | | | | 23 | 23 | | |
| **Totals** | **333** | **294** | **68** | **98** | **77** | **87** | **167** | **169** | **14** | **18** |

**3. Workshop Planning and Methodology**

The following summarises the activities undertaken in organising each of the workshops:

- The project implementation officer, Mr Wairarapa J. Young from PPA, e-mailed the CEOs (or equivalent) of the in-country utilities reminding them of the workshops being conducted under the SEIDP and introducing GSES. An example of this e-mail is provided in Annex 7.
- The GSES project manager, Mr Geoff Stapleton, then sent a follow up e-mail that asked for suggestions on venues and also included the workshop survey form for the utility to complete. This survey helped select the guidelines that would be covered in each day of the four day workshops. An example of Mr Stapleton's e-mail is provided in Annex 8 while the survey is provided in Annex 9.
- The survey forms were also distributed to in-country members of SEIAPI.
- In some countries, the venue was a room available at the utility and in other countries a list of hotels was provided and GSES would obtain quotes and select the venue.
- Once the venue was selected and the relevant guidelines for the topic were finalised, the registration forms were distributed to the utility, SEIAPI members and any other stakeholders including government departments, training institutes and donors located in that specific country. Sometimes follow up e-mails were sent. An example of the registration form is provided in Annex 10.
- A database of registrations for each country was developed and these are provided in Annexes 13 through to Annex 28.
- The Wednesday or Thursday prior to the workshop an e-mail was sent to the workshop registrants reminding them of the workshops and providing them details of the daily agenda. For privacy reasons the individual e-mail addresses were listed in the BCC section of the e-mail. An example of this e-mail is provided in Annex 11.
- This was followed up by individual e-mails containing each of the guidelines that were being presented at the workshops.
- PowerPoint presentations were prepared for each of the six guidelines. These were often modified to better fit the topics and participants during the early workshops.
- An introductory PowerPoint was also developed. This provided: background to the project; background to SEIAPI and also the PPA/SEIAPI certification/accreditation program and the purpose of the guidelines and the objective of the workshops.
- Two sets of short quizzes were developed for each of the guidelines with the intention that one would be conducted in the morning and in the afternoon. However, whether or not these were conducted was left at the discretion of the presenter.
- The survey that was used for the PPA organised training courses conducted in June/July was adapted to be used for these workshops. The survey is provided in Annex 12.
- The surveys were scanned and then sent to the PPA.
- A summary table from each country was developed and is included in the relevant sections below.

**4. Survey**

Due to an oversight by GSES, surveys were not available for distribution for the Palau workshops. GSES then contacted PPA and obtained a copy of the surveys that had been developed for the recent training courses conducted in Samoa and Pohnpei. These were slightly adapted and used in Yap. However, Dr. Wade undertook further modifications and this is the survey document included in Annex 6 and used for all subsequent workshops.

The survey forms were scanned and sent to PPA.

**4.1 Summary of Survey Written Answers**

The written survey answers provided the following key points:

- Some thought it was a training course and therefore expected more practical hands on demonstrations.
- Some mentioned that there needed to be more interactive sessions given that it was a workshop whereby they could get into groups and an exchange of ideas could take place.
- Many mentioned that it needs to be delivered for a longer duration, and repeated more often.
- Generally good feedback was provided on the instructors.

It was these comments that emphasised the need for more in-depth training being conducted within many of the countries.

# Welcome!

## New Allied Members

Five (5) new companies have joined PPA as Allied Members since our last PPA Magazine. The new members are:

**DATELSTREAM LIMITED:** Datelstream Limited is based in Auckland, New Zealand. Their primary activity is software supply and support (pre & post-paid billing and customer care).

**POWERSMART LIMITED:** PowerSmart Limited is based in Tauranga, New Zealand. Their primary activity is solar energy generation and storage systems integrator. Their secondary activity is design, supply, build-renewable energy generation, storage and grid integration.

**GENTRACK LIMITED:** Gentrack Limited is based in Auckland, New Zealand. Their primary activity is information systems/software. Their secondary activity is utility management.

**IGSNZ LIMITIED:** IGSNZ Limited is based in Tauranga, New Zealand. Their primary activity is generator and hybrid control systems. Their secondary activity is generator installations and commissioning.

**HNAC TECHNOLOGY CO., LTD:** HNAC Technology Co., Ltd is based in Changsha, China. Their primary activities are control & monitoring systems, information Systems/Software, design services, installation services, mechanical auxiliary systems, power generation, protective devices, project management, SCADA, switchgear, training and Turnkey/Design build. Their secondary activities are communications, computer systems, electrical repairs, energy efficiency, maintenance systems, metering & instrumentation, renewable energy systems, mechanical repairs, procurement/ Evaluation services, storage tanks, transformers, voltage control and testing services.


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