

Oceania

The Project for Introduction of Hybrid Power Generation System in the Pacific Island Countries

Final Report (Attachment)

September 2023

Japan International Cooperation Agency (JICA)

Okinawa Enetech Co., Inc.
Okinawa Electric Power Co., Inc.

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Annex D-3 : Yap State Related Documents

Project Final Report

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5 Training Needs Assessment (TNA)

5.1 Training Needs Assessment Report

Training Needs Assessment Report
for the Introduction of
Hybrid Power Generation System
in the Federated States of Micronesia
(YAP State)

January, 2018

JICA Expert

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1. Organization of counterparts

(1) Department of Resources and Development (FSM federal government)

The Energy Division of the Department of Resources and Development (DRD) is in a position to formulate energy policies at the federal level, promote energy conservation, promote the use of renewable energy, including coordinating work when receiving financial support from donors. The personnel structure of the Energy Division is only Assistant Secretary, Mr. Hubert Yamada and his subordinate.

In the past, advisors from the EU, WB, and JICA senior volunteers were dispatched.

Basically, each state government's public corporation operates the electric utility of the target area under the policies and regulations of the state government, and DRD is not in the position to oversee the state government company.

(2) Yap State Public Service Corporation (YSPSC)

In Yap State, YSPSC provides public services in the energy sector. YSPSC has a general manager, an assistant general manager, and one manager each for power generation, power distribution, and outer island operations, and the total number of staff is about 100 people.

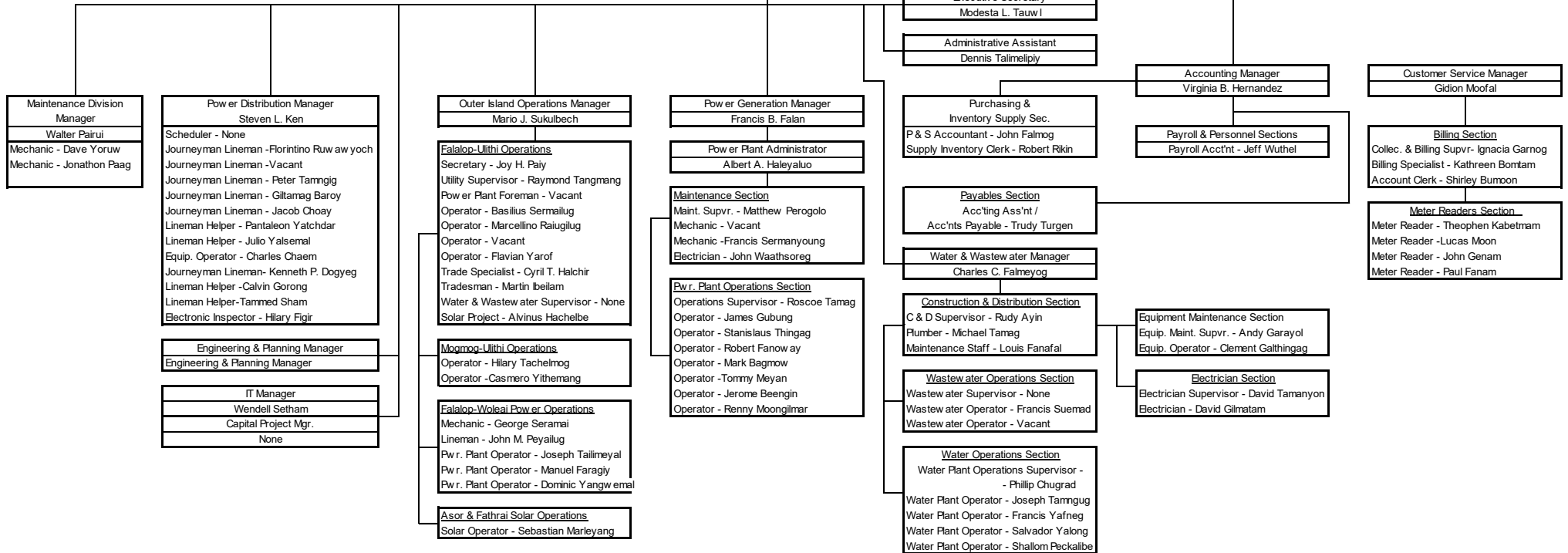
**Yap State Public Service Corporation
Organizational Chart**

Board of Directors
Chairman - John Hasmal
Vice-Chairman - Francis Faney
Secretary - Al Ganang
Member - Ignathio Waithog / Member - Lonnie
Member - Mike Hasurmai / Member - Paul

General Manager
Faustino R. Yangmog

Assistant General Manager
Victor Nabeyan

Comptroller
Virginia B. Hernandez



2. Operation & maintenance conditions of Diesel Engine Generators (DGs)

Yap State Public Service Corporation (YSPSC) is a State-Owned Enterprise that oversees both generation and distribution of electricity in Yap state, and also is the sole provider of water and sewer systems in Yap.

YSPSC Power Plant is located in the capital Colonia, and it was upgraded by installing Units 1-3 with the assistance of the Asian Development Bank (ADB) and World Bank (WB) in May 2017. Of the existing DG units, 2 DEUTZ units (Units 7 and 8) have been in operation for 22 years, so there are plans to make electrical renovations and use them as backup generators.

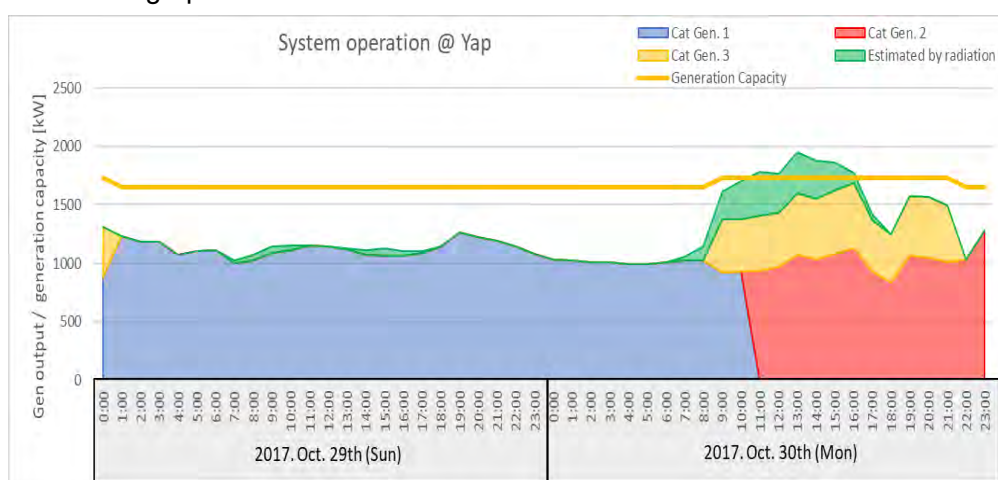
The total installed capacity is 10.5 MW, but only 9.0 MW is available to generate and supply power to Yap's grid with a load of 2.0 MW.

The table below shows the DG unit composition.

Table1 DG units in YSPSC Power Station

Unit No.	Manufacturer	Model	Rated Output	De-rated output	Revolutions	Year of manufacture	Actual state
			(kW)	(kW)	(rpm)		
1	Caterpillar	3516C	1,650	1,600	1,800	2017	Operating
2	Caterpillar	3516C	1,650	1,600	1,800	2017	Operating
5	Caterpillar	10005	830	800	1,800	2017	Operating
6	Deutz	BV8M640	3,200	2,500	600	1966	Being refurbished
7	Deutz	BV8M640	3,200	2,500	600	1966	Being refurbished
Total			10,530	9,000			

The current peak load for Yap's grid is around 2.0 MW. The grid load on weekends and weekdays is as shown in the graph below.



On weekends when the grid load is low, power is supplied by only one unit, whereas on weekdays, two units are required.

The power plant operation is 24 hours monitored constantly by 8 operators divided into 3 shifts. Only Units 1 to 3 are controlled automatically in isochronous load sharing by ComAp electronic controller. The Vergnet Wizard Hybrid monitoring control system is currently being implemented. Units 1 to 3, and Units 7 and 8, after replacement of the governors, sensors, etc., will be connected.

In addition, by comprehensively controlling RE including the recently installed Vergnet WT (3×275 kW) and the existing PV at the power plant (200 kW) with the new Vergnet monitoring equipment, they aim to efficiently integrate RE (maximum integration of RE).

It is assumed that economic load dispatching control operation (EDC) cannot be recommended as 2 DG units are normally in operation since the rated output of the DGs is much larger than the system load of 2 MW, isochronous load sharing is implemented, and the operation of the power plant is automatic. It is assumed that since the power plant operation is automatic, instructing the operators to perform it manually would be difficult.

New electronic flow meters will be installed on Units 7 and 8 for fuel consumption measurement. During the JICA team's stay in Yap (Oct 30th to Nov 4th), it was confirmed using measuring instruments brought from Japan, that the system frequency during PV generation hours was within the YSPSC target control value of 60.0 Hz to 62.0 Hz.

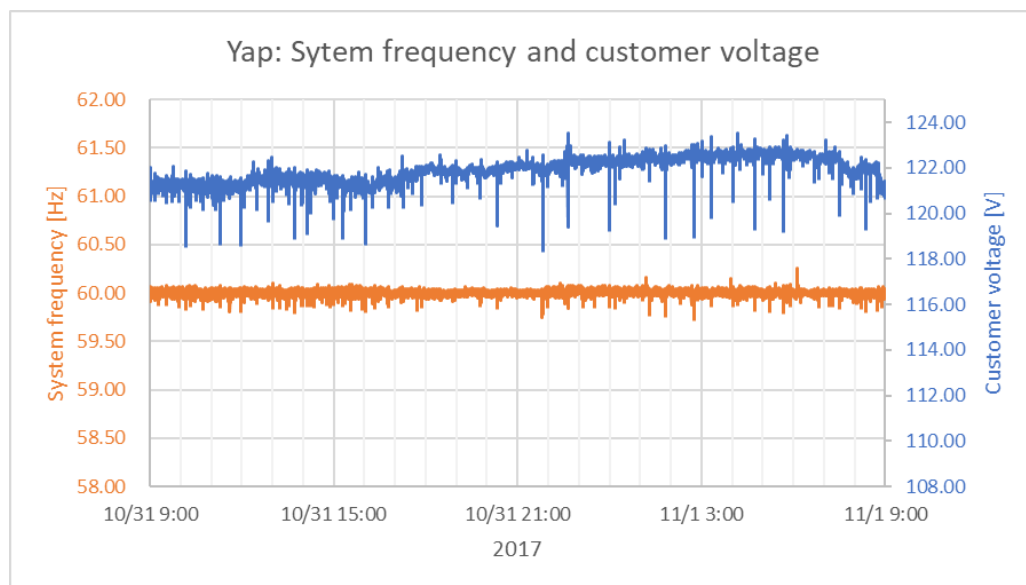


Fig. 3 System frequency fluctuation range

YSPSC has 6 mechanical maintenance staff and 1 electrical staff. Of the mechanical staff, 2 of are experienced in overhaul works, and the remaining 4 are assistants. None have graduated from college or vocational school, but they have some basic knowledge of DG.

As there is a shortage of electrical maintenance staff, two electricians from YSPSC's Engineering Department have been dispatched to provide support for not only power plant maintenance and transmission and distribution, but also for PV facilities.

Daily inspections and cleaning are conducted according to the existing check sheet. The plant staff conducts inspection of the new engines at 500 hours and 1,500 hours according to the manufacturer's recommendation. Annual and 24,000 hours overhaul works will be performed by EPSA of Australia, the company which installed the DGs.

EPSA basically performs mechanical maintenance. They do not inspect the electrical equipment. Maintenance has never been performed on the generator (old engine) itself and the electrical boards of the old units

Spare parts are managed, but they only keep the bare minimum. The idea of preventive maintenance has not taken root, so maintenance is performed only when something fails.

3. Current situation and future development plan of RE power generation system

- Department of Resources and Development (DRD, FSM federal government)

One of the goals of FSM Energy Policy and Energy Action Plan (2010) is to increase RE up to 20% of total energy supply by 2020. To achieve this goal, DRD has been coordinating for 4 states to request donors to assist in expanding RE facilities.

In Yap Island, grid-connected PV facilities were installed at YSPSC (200 kW funded by the Japanese Government through PIF), and 5 sites on State-owned properties (308 kW in total, through ADB project, not completed). In addition, three wind turbines with a total capacity of 825 kW were installed in Yap Island through ADB's project. For the outer islands, Stand-alone PV systems, SHS, and SCS were installed through EU's project.

As the next steps, YSPSC is planning to apply to the Green Climate Fund (GCF) for cooperation. Adjustment contents from ADB are coordinated with the federal government to provide YAP State with the facilities below.

- Floating PV (1.2 MW, Chamorro Bay)
- 1.5 MW Battery Storage
- Wind turbine (500-600 kW × 2) (in addition to the existing 3)

The main contractor and sub-contractor of the World Bank's electric power project are Castalia and ITP, respectively. Under the support of the project, each state of FSM is developing an Energy Master Plan. Yap State's draft plans will be received by around January 2018. In addition, an RE project funded by the EU will start even though its contents have yet to be confirmed.

In addition to PV and wind power, a feasibility study for waste to energy is listed in the Yap State Energy Action Plan (2017) as one of the high priority activities in the future.

Table: RE projects in Yap State

Completed / On-going Projects

Project Title	Donor/Fund Program	Admin. Agency/ Contractor	Main Components for YAP	RE Capacity	
				On grid	Off grid
REP-5	EU/EDF-9	IT Power	Stand-alone PV systems for outer islands with total capacity 49.4 kWp		49
North REP	EU/EDF-10	SPC	SHS and SCS for outer islands.		204
			Stand-alone PV systems for outer islands.		279
Yap Renewable Energy Development Project	ADB/Loan	Vergnet	Three wind turbines (Vergnet/ total capacity: 625 KW)	625	
		EPSA	Two DGs (CAT/1,650 KW, 830 KW)		
			Grid-connected PV system in 5 sites	308	
FSM PEC Fund Project	Gov. of Japan / PEC Fund	PIF	Grid-connected PV at YSPSC	200	
FSM Energy Sector Development Project (on going)	WB/IDA	Castalia	Support developing "Investment Master Plan" (on going)		
Total				1,133	533

Planned Projects

Yap State Renewable Energy Development Project, Phase II	ADB grant, GCF		Floating PV systems	1200	
			Additional two wind turbines	550	
			Short term energy storage of 1.5MW for 5 minutes		
	EU/EDF11	SPC	T.B.C		

For the net metering program, they accept a total of up to 100 kW of private sector PV (10 kW/customer, 0.25 USD/kWh), and currently, about 70 kW have been deployed. The Hybrid Wizard, which Vergnet plans to deploy, cannot monitor nor control PV systems under this program, but since the capacity of the net metering program is less than or equal to 100 kW in total, YSPSC assumes that there will be no issues.

4. Operation & maintenance conditions of RE power generation system

YSPSC currently owns 5 PV facilities with a total capacity of 314 kWp, and the total installed capacity for private sector PV is around 62.45 kWp.

PV and WT facilities in YAP are shown in the table below.

No	PV Facility Name	Output (kW)	View	Comments
1	YSPSC Power Station	200		Installed with the assistance of PEC.
2	CEMD Solar PV (CM Office)	24		Civil Engineering and Maintenance Department Panels: 104 (240 W) Installed with the assistance of ADB.
3	DPS Solar PV (Police Station)	24	 	Department of Public Safety Panel: 100 (250 W) Installed with the assistance of ADB.
4	Sports Complex Solar PV	50	 	Sports Complex Panel: 200 (250 W) Plan to install the panels on the roof in preparation of the Micronesia Games of 2018.
5	Water Plant Solar PV	80	 	Water Plant building Panel: 52 (250 W) Installed with the assistance of ADB.
6	YAP EARLY CHILDHOOD EDUCATION CENTER	50	 	Installed with the assistance of ADB.
7	YAP WT	825	 	Installed in Nov 2017 275 kW × 3

YSPSC electricians regularly inspect PV installations and perform maintenance when necessary. According to the JICA expert team's inspection, the condition of these facilities was good. Training on a more detailed inspection from this point forward is necessary in order to keep these facilities in operation for a long time.

5. Current capacity and training needs assessment

(1) Operation & maintenance of DGs

In May 2017, 3 new high-speed generators were installed at the power plant, and in November, 3 new WTs were installed in Yap. As there are plans to improve the operation efficiency by introducing a hybrid system control device, training for operators in hybrid system operation is important to improve their skills.

Current operation of DGs is performed by isochronous load sharing control, so the burden on operators is low due to the small number of DGs operated automatically. In addition, after the implementation of the Vergnet Hybrid Controller, PV, WT, and DGs will be controlled automatically for more efficient grid operation. It is very important to train operators on the characteristics of hybrid system operation, including knowledge about its merits and demerits as well as its risks.

As for the mechanical maintenance staff, only 2 have experience in overhaul, and the rest work as assistants. This staff needs more training in DGs which is important to improving their skills and to allow for them to perform overhaul without the assistance of an external supervisor.

For electrical maintenance, it would be better if the new staff could assist in performing the work. Electrical maintenance training is strongly recommended.

(2) Grid integration of RE power generation system

YSPSC has plans to refurbish the old DEUTZ units installed in their power plant (Units 7, 8) and improve their operation efficiency by implementing Vergnet's electric control device in order to promote RE integration.

In order to reach the RE integration goal of the national strategy (30% in 2020), YSPSC is applying for aid to install a floating PV (1.2 MW, to be installed in Chamorro Bay), a 1.5 MW battery storage, and additional wind turbines (500-600 kW × 2 units). To confirm the validity of these facilities for the YAP power system, it is necessary to transfer and improve knowledge on hybrid power generation systems to YSPSC engineers (RE integration capacity and stabilization method).

(3) Operation & maintenance of RE power generation system

Operation and management of RE is performed by two people, and inspection is not performed using a check sheet (only visual inspection). Therefore, we felt that they need to record what was inspected on a check sheet, and where necessary, provide proper education on

maintenance. Since YSPSC has an action plan for promoting RE, it is conceivable that the need to educate their staff is high.

(4) Summary

In summary, YSPSC's power plant was upgraded, and new WTs were installed, so in terms of a hybrid power system, it is going well. However, in order to maintain this power system in optimal condition and in the future, to increase RE penetration to further reduce their dependence on diesel fuel, training of their engineers is necessary. This project is a good opportunity to learn how operation and maintenance is performed in Okinawa and to adapt this knowledge to the conditions in Yap.

End

5.2 Questionnaire

Project of Introduction of Hybrid Power generation system in PICs
Survey Questionnaire

No.	Questionnaire / Information Required
I	COUNTRY ENERGY POLICY RELATED INFORMATION
1	National Energy Strategy and Action Plan in latest version
2	National electrification plan (diesel, renewable energy, etc.)
3	National energy efficiency and conservation plan
4	National plan for climate change mitigation
5	Current regulatory framework on power sector
6	Organizational chart of the Ministry of Energy
7	List of donor's projects (title, year, duration, budget, contents, etc.)
8	Energy expansion plan.
9	Information of energy efficiency and conservation project (donor, objective, method, implemented year, project title, etc.)
10	
II	STANDARD, LAWS, and REGULATIONS
1	Standards, regulations, rules, guideline for power supply
2	Standards, regulations, rules, guideline for distribution
3	Standards, regulations for RE grid interconnection
4	Laws and restrictions in constructions of new power generation facilities.
5	(Environment, real state, forest, security, etc.)
6	IPP or PPP power plant situation (if any)
7	Current activity on demand side management.
8	Current activity on awareness raising for energy efficiency and conservation
9	Guideline for Environmental Impact Assessment (EIA).
10	
III	RENEWABLE ENERGY RELATED DATA
1	Meteorological data
	• Solar Irradiation (1 year / hour or minute data)
	• Wind Speed (m/s, 1year/ hour or minute data)
	• Ambient Temperature (1year/ hour)
	• Precipitation

2	Potential map and data (solar irradiation, wind, hydro, biomass, etc.)
3	Data of existing solar PV system (location, type, capacity, number of user, purpose, implement agency, installed year, etc.)
4	Solar power generation data (1year/ 1 hour)
5	Data of existing wind generation system (location, type, capacity, number of users, implement agency, installed year, etc.)
6	Wind power generation data (1year/ 1 hour)
7	Data of existing Hydro generation system (location, type, capacity, number of users, implement agency, installed year, etc.)
8	Hydro power generation data (1year/ 1 hour)
9	Data of existing biomass generation system (location, type, capacity, number of users, implement agency, installed year, etc.)
10	Biomass power generation data (1year/ 1 hour)
11	Regulation or Manuals on renewable system
12	List of ongoing and future RE project
13	List of resource engineers on renewable technologies.
14	List of local providers of RE products
15	O&M of and the supply chain of PV components (DC lights, battery, controller, inverter, etc.)
16	Environmental impact caused by existing PV and renewable technologies.
17	Cost of installation of PV facilities (US/ kW)
IV	DIESEL POWER STATION and DISTRIBUTION FACILITIES
1	Installed capacity, power output, configurations, etc.(Existing and Planning)
	•Manufacturer, specifications, actual service life.
	•Capacity (kw) of each
	•Limitations in max, and min output during operation
	•Generator active capacity (kVa), efficiency.
	•Monthly, yearly power generation(kwh) and total fuel consumption.
	•Fuel type and consumption curve or consumption amount at 25%, 50%, 75%, 100% of rated output of each engine
2	Peripheral equipment of each diesel generator
	•Heat balance flow sheet and calculations.(cooling system)
	•Specifications of each equipment.
3	Power plant fuel storage capacity
4	Drawings of Power plant layout.
5	Utilities flow chart (fuel oil, lubricant oil, cooling water, air, wastes oil, etc.)
6	Electrical wire diagram drawing of the power station.
7	Transmission and Distribution line diagram drawings (Feeders)
8	Manual of each diesel generators

9	Cost of installation of DEG facilities (US/ kW)
10	
V	POWER STATION OPERATION AND MAINTENANCE
1	Operation standard (Voltage, Frequency) , Fluctuation tolerance (±、%)
2	Records of power generation (kwh). (Past 5 years)
3	Peak load (kw).
4	Daily, monthly, and yearly load curve. (kW) (past 5 years)
5	Power generation (kW) data (1 year/ 1hour each)
6	Consumption of fuel (monthly, year)
7	Power consumption amount at the power plant.
8	Losses (power generation, transmission)
9	Failure, shutdown, technical problems, etc. (cause)
10	Type of control in diesel power generation (AFC, ALC, Load shedding, isochronous, other)
11	Regulations in air pollution (NOx, Sox, dust), sound level, vibration, etc.
12	Power plant operation management (flow chart, personnel numbers, position)
13	Cost of power generation (US/kWh)
14	Power tariff structure and procedure of the tariff setting
15	Cost of Fuel (US/ L)
16	Study of improved efficiency in power plants efficiency
17	Power plant Maintenance management (flow chart, personnel numbers, position)
18	Maintenance cycle of diesel generators
19	Works of each kind of maintenance
20	Spare parts procurements
21	Workshop for maintenance
22	Cost of maintenance and works duration.
23	Training system for operators and power plant staffs.
24	
25	

☐ **Existing units' data**

Diesel Generator No.		1	2	3	4	5	6	7	8
Engine	Manufacturer								
	Model No.								
	Serial No.								
	Rated output								
	Current max. output								
	Current min. output								

	Revolutions rpm								
	Fuel type								
	Governor control (Droop/Isochronous)								
	Cooling system								
	Installed year								
Generator	Manufacturer								
	Type								
	Model No.								
	Serial No.								
	Voltage								
Other	Fuel consumption [L]								
	Generation cost [USD/kWh]								
	Fuel cost [USD/L]								
	Failure record								
	Current status								

5.3 DG Training Curriculum

DG Training Curriculum for Yap

Subject	Contents	
1.Basic Knowledge of DEG power generation	1	• Understanding of Diesel Generators type, structure, operation principle and characteristic.
	2	• Diesel engine performance curve, efficiency during operation, heat balance diagram.
	3	• Understanding of mechanical devices on Diesel power generation. Purpose, type, characteristics of each device.
		1) Cylinder head, valves, rocker arm, pushing rod, springs
		2) Piston, rings, connecting rod, pin
		3) Cylinder liner
		4) Crankshaft, camshaft, main bearings, fly wheel
		5) Turbocharger
		6) Governor
		7) Intercooler (air, oil)
		8) Pumps, radiators and others
	4	• Understanding of electrical components on Diesel power generation. Purpose, type, characteristics etc. of each electrical panels, etc.
		1) Generator & Exciter
		2) Transformer
		3) Circuit breaker
		4) Control panel / alarms / CT, PT's
		5) Power center, AVR, AFC, Synchronous board
		6) Electrical drawings, single line diagram
		7) Device number / protection relays
		8) Others electrical components
	5	• Understanding of each utilities in diesel power plants
		1) Fuel System
		2) Lubricant oil system
		3) Cooling water
		4) Air system
		5) Exhaust gas
2.Operation of DEG's	1	• Operation and control method of diesel power generation facilities (governor free, automatic control devices, etc.)
	2	• Operating Procedure of Diesel Power Plant
		1) Operation precautions
		2) Patrol inspection
	3	• Supply and Demand Management
		1) Efficient operation
		2) System frequency adjustment

		3) Voltage management
		4) Power reserve
	4	• Diesel generator Economical load distribution operation (EDC technology (basic knowledge · application))
	5	• Power generation data sorting、analysis (Power generation amount, output、fuel consumption amount and rate, operation parameters of diesel engine operation)
	6	• Diesel generation operation data record sheet
	7	• Financial analysis of power plant operation
	8	• Trouble Shooting
3.Maintenance of DEG's	1	• Safety work training
	2	• Periodical inspection (Mechanical)
		Types of inspections, contents, check sheet
	3	• Periodical inspection (Electrical)
		Types of inspections, contents, check sheet
	4	• Overhaul of Diesel Generator and Auxiliary Equipment
		1) Purpose & process
		2) Washing & Inspection of parts (Dye penetrant test)
		3) Engine maintenance standards
		4) Assembly
		5) Centering adjustment
		6) Start-up and commissioning
	5	• Drawing up of maintenance manual
	6	• Verification, modification, addition of notes in the maintenance manual(electrical / mechanical)
	7	• Maintenance plan (spare parts verification, management, consumables, schedule, etc.)
	8	• Handling of mechanical measurement equipment (OJT)
		1) Calipers, micrometers, dial gauge
		2) Noise meter
		3) Vibrometer
		4) Torque wrench
		5) Pmax device & Others
	9	• Handling of electrical measurement equipment (OJT)
		1) Electroscopes
		2) Multi-meter
		3) Tester
		4) Digital Pressure Calibrator
		5) Instrumentation signal measurement / generator
		6) Ohm meter & Others

	10	• Maintenance works report writing, keeping and supervision
	11	• Disassembly & Inspection of each section of diesel generators, troubleshooting. (mechanical and electrical OJT)
	12	• Planning of maintenance works
	13	• Maintenance works report writing
	14	• Improvements in power plant facilities

5.4 Renewable Energy Training Curriculum

RE Training Curriculum for Yap

Subject		Contents	
RE O&M	1. Formulation/ Explanation / Update of manual	(1)	Operation & Maintenance of System
		(2)	patrol check and periodic inspection
		(3)	Daily check
		(4)	Periodic Inspection
		(5)	Development of the check sheet
		(6)	Updating of maintenance manual according to the system condition of each country .(Joint work)
			Verification of operational condition of the updated maintenance manual, comments.(Follow up from Project team)
			Periodic monitoring of the operational condition of the manual.(Joint work)
	2. Operation practice of the measuring equipment	(1)	String tracer
		(2)	Cell line checker
		(3)	Insulation resistance tester
		(4)	Infrared camera
	3. Trouble shooting	(1)	Confirmation method of disconnection between the module
		(2)	Influence of the shadow
		(3)	Introduction for trouble example ①(Tuval)
	4. Future O&M Work plan (draw it up with a budget)	(1)	Confirmation of existing plan
			1) Actual organization chart
			2) Actual budget for annual maintenance
			3) Actual content of works
		(2)	Future planning
			1) Future donor's support contents
			2) Future strengthen of the organization
			3) Future budget for maintenance
			4) Planning of work
		(3)	Finalization of the future planning with the counter part
RE Integration	1. Formulation/ Explanation / Update of manual of Hybrid generation plan	(1)	Variability of RE(Solar & Wind)generation system
			1)Power system basis and power quality
		(2)	Impact on the grid operation by integrating RE generation systems
			1)Frequency fluctuation
			2)Voltage Fluctuation
			3)Excess Energy

		(3)	Countermeasures for the mitigation of RE impact on the grid
			1)Grid Code
			2)Frequency fluctuation(Algebraic method, other simulation software)
			3)Voltage Fluctuation
			4)Excess of energy (HOMER software)
		(4)	Planning methodology for the Roadmap of RE integration
			1)Planning Methodology overview
			2)Inputs and assumption
			3)Consideration according to the system capacity. (reliability, service quality)
			4)Roadmap for small-grid to integrate RE generation system
			5)RE integration road map for large scale grid.
		(5)	1)Update of the manual according to the condition of the country, working with the counterpart,
			2)Follow up of the updated manual, implementation condition, by the project team
			3)Monitoring in the use of the manual together with the CP
	2. System Simulation	(1)	Overview
		(2)	Model case ① (Power system simulation in Hateruma island)
	3. Grid Connection of RE And Operation	(1)	Grid code (Interconnection requirement)
		(2)	Grid interconnection procedures
		(3)	Introduction for Operation and Output control
	4. Examples of Improvement in Okinawa for dissemination of RE	(1)	Miyako island Mega Solar Demonstration Research
		(2)	Overview of the MG set Demonstration Research in Hateruma island
		(3)	Abu Mega Solar Demonstration Research
		(4)	Ogimi Wind Power Demonstration Research
		(5)	Case study ① (Hybrid system in Yonaguni island)
	5. Use of Battery Storage in Power systems	(1)	Overview
		(2)	Overview of Batterie's output and capacity
	6. PV system plan and design	(1)	Study for number of panels in series and parallel (10kW PV system)
		(2)	Design of frame and array
		(3)	Estimation of yearly PV power generation
		(4)	Study of System Composition
	7. Performance ratio	(1)	Overview

		(2)	Inspection and Evaluation of Monitoring results
	8. HOMER	(1)	Overview
		(2)	Practice ① (Input of demand data)
		(3)	Practice ② (Analysis of long-term fluctuation)
		(4)	Practice ③ (Calculation of the facilities capacity for PV, Wind turbine, Battery storage)
		(5)	Data gathering and Modeling

6 Training record (On-site, remote)

6.1 Training Schedule

Training Schedule for Yap

1.Common Event

Year	Manth / Day	Remarks	JCC Meeting	Contents
2017 (H29)	November, 25th		1	1st JCC Meeting (Kosrae)
2018 (H30)	—	—	—	—
2019 (R1)	January, 29th		1	2nd JCC Meeting (Pohnpei)
2020 (R2)	January, 24th		2	3rd JCC Meeting (Yap)
	July, 8th	5		1st Meeting with manager class (Remote)
	September, 10th	4		2nd Meeting with manager class (Remote)
2021 (R3)	March, 11th	1		3rd Meeting with manager class (Remote)
	September, 13th	1		4th Meeting with manager class (Remote)
	October, 26th		2	4th JCC Meeting (Remote)
2022 (R4)	—	—	—	—
2023 (R5)	April, 7th		2	5th JCC Meeting (Remote)
Total		11	8	
Grand Total		18		

2.DG O&M Training

Year	Manth / Day	On-Site Training	Remote Training	Regional Training	Training Japan	Manual Revision	Seminar	Contents
2017 (H29)	Oct. 30	0						2nd On-Site Training
2018 (H30)	Aug. 10th	12						4th On-Site Training (Pohnpei) (2P×6Days)
	Sep. 26th				34			Kumejima Is. OH training (2P×17days)
2019 (R1)	Feb. 18th	12						6th On-Site Training(Pohnpei) (2P×6days)
	July, 26th						6	1st Seminar
	Aug. 12th	10						3rd On-Site Training(Chuuk) (6P×5days) Phase2
	Nov. 18th			20				1st Regional Training(Fiji)(2P×5days)

2020 (R2)	Jun. 20th	30						7th On-Site Training(Yap)(6P×5days) Phase2
	June, 22nd		5					1st DG Remote Training
	July, 27th		7					2nd DG Remote Training
	Aug. 24th		9					3rd DG Remote Training
	Oct. 19th		9					4th DG Remote Training
2021 (R3)	Jan. 25th		7					5th DG Remote Training
	May, 21st					3		1st DG O&M Manual revision follow-up
	May, 24th		8					6th DG Remote Training
	July 8th					3		2nd DG O&M Manual revision follow-up
	Sep. 30th		6					7th DG Remote Training
	Nov. 15th			16				2nd Regional Training (Remote) (2P×8Days)
2022 (R4)	May, 31st		5					8th DG Remote Training/DG O&M Manual revision follow-up
	Sep. 21st		8					9th DG Remote Training/DG O&M Manual revision follow-up
	Nov. 18th					6		3rd DG O&M Manual revision follow-up
2023 (R5)	Feb. 13th			10				3rd Regional Training (Fiji)(2P×5days)
	July, 6th						1	2nd Seminar (Remote)
合 計		64	64	46	34	12	7	
総 計		227						

3.RE Integration / PV O&M Training

Year	Manth / Day	On-Site Training	Remote Training	Regional Training	Training Japan	Manual Revision	Seminar	Contents
2017 (H29)	Nov. 2nd	0						2nd On-Site Training
2018 (H30)	July, 24th	21						4th On-Site Training(Pohnpei) (3P×7days)
2019 (R1)	Jan. 22nd	21						6th On-Site Training(Pohnpei) (3P×7days)
	July, 22nd	20						2nd On-Site Training (Yap) (4P×5days)
	July, 26th						6	1st Seminar (Yap)
	Oct. 28th	10						6th On-Site Training (Pohnpei) (2P×5days) Phase2
	Nov. 25th			10				1st Regional Training(Fiji)(1P×5days)
2020 (R2)	June, 29th		4					1st RE Remote Training
	Aug. 3rd		4					2nd RE Remote Training

	Aug. 31st		3					3rd RE Remote Training
	Sep. 7th		3					3rd RE Remote Training supplementary lecture
	Nov. 9th		4					4th RE Remote Training
2021 (R3)	Feb. 15th		6					5th RE Remote Training
	May, 25th					1		1st RE O&M Manual revision follow-up
	June, 7th		4					6th RE Remote Training
	Aug. 4th					1		2nd RE O&M Manual revision follow-up
	Sep. 28th		4					7th RE Remote Training
	Nov. 29th			18				2nd Regional Training (Remote) (2P×9days)
2022 (R4)	Mar, 31st					1		3rd RE O&M Manual revision follow-up
	May, 17th					2		4th RE O&M Manual revision follow-up
	June, 30th		3					8th RE Remote Training/DG O&M Manual revision follow-up
	Aug. 17th					2		5th RE O&M Manual revision follow-up
	Dec. 9th					1		6th RE O&M Manual revision follow-up
2023 (R5)	Feb. 20th			10				3rd Regional Training (Fiji)(2P×5days)
	July, 6th						1	2nd Seminar (Remote)
Total		72	35	38	0	8	7	
Grand Total		160						

6.2 Training Report

On-site Training (Phase 2)

6.2.1 1st Seminar Report

THE PROJECT FOR INTRODUCTION OF HYBRID POWER GENERATION SYSTEM
IN PACIFIC ISLAND COUNTRIES Seminar in YAP (FSM)
～Japan's contribution to promoting renewable energy～

16th, Aug 2019

1. Summary

Meeting name :

THE PROJECT FOR INTRODUCTION OF HYBRID POWER GENERATION SYSTEM IN
PACIFIC ISLAND COUNTRIES Seminar in YAP (FSM).

Japan's contribution to promoting renewable energy

Date :

Friday, July 26, 2019 9:30-12:30

Sponsorship :

Japan International Cooperation Agency (JICA)

Venue :

ECE / Early Childhood Education Center Conference Room

2. Participants

Opening Remarks :

Mr. Hong Henry Farang : Governor of Yap

Speakers :

Mr. Victor Nabeyan : YSPSC Assistant General Manager

Mr. Casmiro Yithmeng : YSPSC

Mr. Christopher IGEM : YSPSC

Mr. Masanori Shimabukuro : JICA Expert Team

Mr. Tsukasa Gaja : JICA Expert Team

Mr. Yusuke Kuniba : JICA Expert Team

Closing Remarks :

Mr. Faustino Yangmog : YSPSC General Manager

Participant :

28 persons

3. Background and Purpose

Most Pacific Island countries use imported fuel (diesel) for power generation, which means that overall electricity prices are higher than in developed countries. In addition, from the perspective of promoting mitigation measures to combat climate change, they have adopted a policy of actively introducing renewable energy (renewable energy) power sources, mainly solar power. Against the backdrop of the above, JICA is planning a five-year project titled "Pacific Region Hybrid Power Generation System

Introduction Project" starting in 2017, targeting five countries: Fiji, Kiribati, Tuvalu, Micronesia, and the Marshall Islands.

①Improve the ability to operate and maintain existing diesel electric generation facilities (DEGs)

②Optimal integration of renewable energy (RE) generation facilities and improvement of maintenance and management capabilities

and contribute to the reduction of fossil fuel consumption and greenhouse gas emissions in Pacific Island countries.

The purpose of this seminar was to introduce the project's activities to stakeholders other than counterparts (especially to senior management) and to share information on efforts to promote the introduction of renewable energy in other countries.

4. Contents

The seminar was attended by about 30 people, including the state governor.

The keynote speeches were delivered by Mr. Victor Naveyan (Assistant General Manager, YSPSC), Mr. Casmiro Yithmeng and Mr. Christopher Igem (YSPSC), and Mr. Yusuke Kuniba (JICA expert team).

We were also able to introduce the "Pacific Region Hybrid Power Generation System Installation Project" along with the progress of its activities.

Throughout the seminar, we were able to share with Yap State the importance of developing hybrid power generation systems, including the status of implementation and future plans for hybrid power generation systems in Yap State, the knowledge gained from the two training sessions in Okinawa (Japan) for the "Pacific Region Hybrid Power System Implementation Project," and the technology currently being studied and demonstrated in Okinawa to solve problems that occur in relatively small-scale systems similar to those in Yap State and Okinawa. The importance of the development of hybrid power generation systems was widely shared in Yap State.

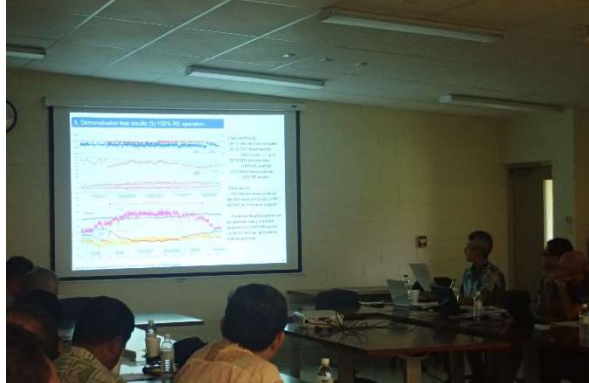
5. Documents

- “YAP’s RE Achievements & Plans”
- “Introduction of technical knowledge acquired during the RE training in Japan”
- “Training In Okinawa Japan On Diesel Power Generation

The Training was On Diesel Power Generator Overhaul and was held in Kumejima Island one of Okinawa Outer Island”

- “Overview of the MG set Demonstration Research Aimed at Maximizing RE Penetration in Hateruma Island”

6. Seminar Scene

	
View of the venue	Governor of Yap (Welcoming Remarks)
	
YSPSC General Manager (Keynote Speech)	YSPSC Electrical Engineer (Keynote Speech)
	
Mr. Yusuke Kuniba (Keynote Speech)	YSPSC Customer Service (Closing Remarks)

7. Point of Each Speech

○Mr. Hong Henry Farang : Governor of Yap

Opening remarks.

He mentioned that many programs ignore maintenance, but that he appreciated the project's focus on human resource development to ensure the long-term and sustainable use of energy equipment.

○Mr. Victor Nabeyan : YSPSC Assistant General Manager

He gave a speech on the status of Yap Province's grid operation and future development plans (until 2037). He also gave a speech titled "Technical knowledge gained from training in Japan" since he participated in training in Japan last year.

- He explained the content of the Japanese training program in Okinawa (operation of a hybrid power generation system on a remote island in Okinawa).

※ The lower limit of DG output in Okinawa is 50%, but in Yap State it is 30%. They are burning and removing the carbon by ramping DG output periodically to deal with carbon buildup at low output.

○Mr. Christopher IGEM, Mr. Casmiro Yithmeng : YSPSC

He gave a speech about the DG overhaul training in Kumejima, Okinawa.

Photos and explanations provided a good overview of the training situation.

○Mr. Masanori Shimabukuro, Mr. Tsukasa Gaja : JICA Expert Team

The objectives of JICA's Hybrid Power Generation Project in Pacific countries (target countries: Fiji, Tuvalu, Kiribati, Micronesia, and the Marshall Islands), as well as the Japanese training and training activities conducted to date, ongoing activities, and future plans were explained.

He explained that the activities of Diesel Generators (DG) and Renewable Energies (RE) are aimed at the expansion of the introduction of hybrid power generation systems and the establishment of appropriate and economical operation and management systems and methodologies for renewable energy (RE) and appropriate planning and operation and management, respectively, in order to reduce fossil fuel costs and greenhouse gas emissions.

○Mr. Yusuke Kuniba : JICA Expert Team

An overview of the MG set demonstration study aimed at maximizing RE on Hateruma Island, Okinawa, Japan was presented.

On the small island, where diesel generators (DG) are the main power source, the introduction of renewable energy is effective in reducing fuel costs, but DG has a lower operating limit, and the MG set has functions equivalent to DG with no lower operating limit. He also mentioned the achievement of 100% RE operation as a result of the demonstration test.

○Mr. Gidion Mafal : YSPSC Customer Service

Closing remarks.

Many donors have given us wind, solar, DG, and other equipment, but human resource development for maintenance has become a problem. We are grateful to JICA, Okinawa Enetech, and Okinawa Electric Power Company (OEPCO) for addressing the need for human resource development.

End

THE PROJECT FOR INTRODUCTION OF HYBRID POWER GENERATION SYSTEM IN PACIFIC ISLAND COUNTRIES

Seminar in YAP (FSM)

～Japan's contribution to promoting renewable energy～

Friday, July 26, 2019 / 9:30-12:30

Venue: ECE/Early Childhood Education Center Conference Room

【Program】

9:30-10:00 Sign in

10:00 Welcoming Remarks (Hon. Henry Falan, Governor, YAP State)

TEA break

Keynote speech (1)

10:25 “Implementation plan of hybrid power generation system in Yap”

(Mr. Victor Nabeyan, Assistant General Manager, YSPSC)

10:50 “Project introduction (including PR video) and progress report”

(Mr. Masanori Shimabuku, JICA Expert Team Subleader and Mr. Tsukasa Gaja, Okinawa Enetech)

Keynote speech (2)

11:15-12:00 “Introduction of technical knowledge acquired during the RE training in Japan,

Training period: February 15, 2018 - March 3, 2018

(Mr. Victor Nabeyan, Assistant General Manager, YSPSC)

“Introduction of technical knowledge acquired during the DGs Overhaul training in Kumejima Is, Okinawa Japan, Training period: September 26, 2018 - October 23, 2018”

(Mr. Casmero Yithemang and Mr. Christopher Igem, YSPSC)

“Overview of the MG set Demonstration Research Aimed at Maximizing RE Penetration in Hateruma Island”

(Mr. Yuusuke Kuniba, JICA Expert)

12:00-12:15 Q & A session

12:15-12:30 Closing remarks (Mr. Gidion Mafal, Customer Service, YSPSC)

12:30-13:30 Lunch

Invitee

No.	Organization	Position	Name
1	Yap State Government	Governor	Henry Falan
2	Yap State Government	Director, DY & CA	Stan Youblaw
3	Yap State Government	Director, Public Works	
4	Yap State Sports Complex		
5	EPA, Yap	Director	Christina Fillmed
6	IOM, Yap	Head of Sub office in Yao	Philip Raffilpiy

Organizer

No.	Organization	Position	Name
1	YSPSC	General Manager	Faustino Yangmog
2	YSPSC	Assistant General Manager	Victor Nabeyan
3	YSPSC	Power Plant Manager	Alphonsus Ruwema
4	YSPSC	Chief Mechanic	Casmiro Yithmeng
5	YSPSC	Electrician (DG)	Christopher Igim
6	YSPSC	Chief Operator	Roscoe Tamag
7	YSPSC	Technician	Charles Laman
8	YSPSC	Technician	Steven Ken
9	YSPSC	Technician, Lineman, RE	Jacob Jake Choay
10	YSPSC	Engineer	John Chieng
11	YSPSC	Power distribution Manager	Steven Libmad
12	YSPSC	Power Plant Mechanic	Rowino Yarofaliut
13	YSPSC	Customer Services Manager	Gidion Moofal
14	JICA	Short Term Expert	Masanori Shimabuku
15	JICA	Interpreter	Tukasa Gaja
16	JICA	Short Term Expert	Yuusuke Kuniba
17	JICA	Short Term Expert	Hirokazu Nakamura
18	JICA	Short Term Expert	Kaoru Ikehara

Observer

No.	Organization	Position	Name
1	CPUC	Head of Power Distribution	Albert Francis
2	CPUC	Solar Technician	Limus Setik
3	CPUC	Solar Technician	Chris Killion
4	KUA	Operation Manager	Robert Taualupe
5	KUA	Electrical Engineer	Gerardo Protacio
6	PUC	RE Manager	Sidney Kilmete
7	PUC	Solar Technician	Julian Pelep

YAP's RE Achievements & Plans



YAP HYBRID POWER SYSTEM

- **System Overview**
- **Diesel Installed Capacity**
- **PV Installed Capacity**
- **Wind Installed Capacity**
- **Energy Management System**
- **Grid Stability**
 - Maximizing RE w/o Storage
 - PV w/o Wind
 - PV & Wind
- **Design vs. Actuality**
- **Next Steps**

System Overview – Integrated Hybrid Power System



Diesel Installed Capacity

2 x 1600 kW (HS)

1 x 830 kW (HS)

1 x 3200 kW (MS)

High Speed Diesels: 4,030kW

Medium Speed Diesel: 3,200kW



Automated & Real-time control of high speed generators

PV Installed Capacity – 508.5 kWp

WTP	-	13 kWp
DPS	-	25 kWp
ECE	-	50 kWp
Sports Complex	-	194.5 kWp
Public Works	-	26 kWp
PEC	-	200 kWp



PV Installed Capacity – 825 kW

VERGNET GEV MP-C : 3 x 275 kW



Energy Management System

Real-time Integration & Control:

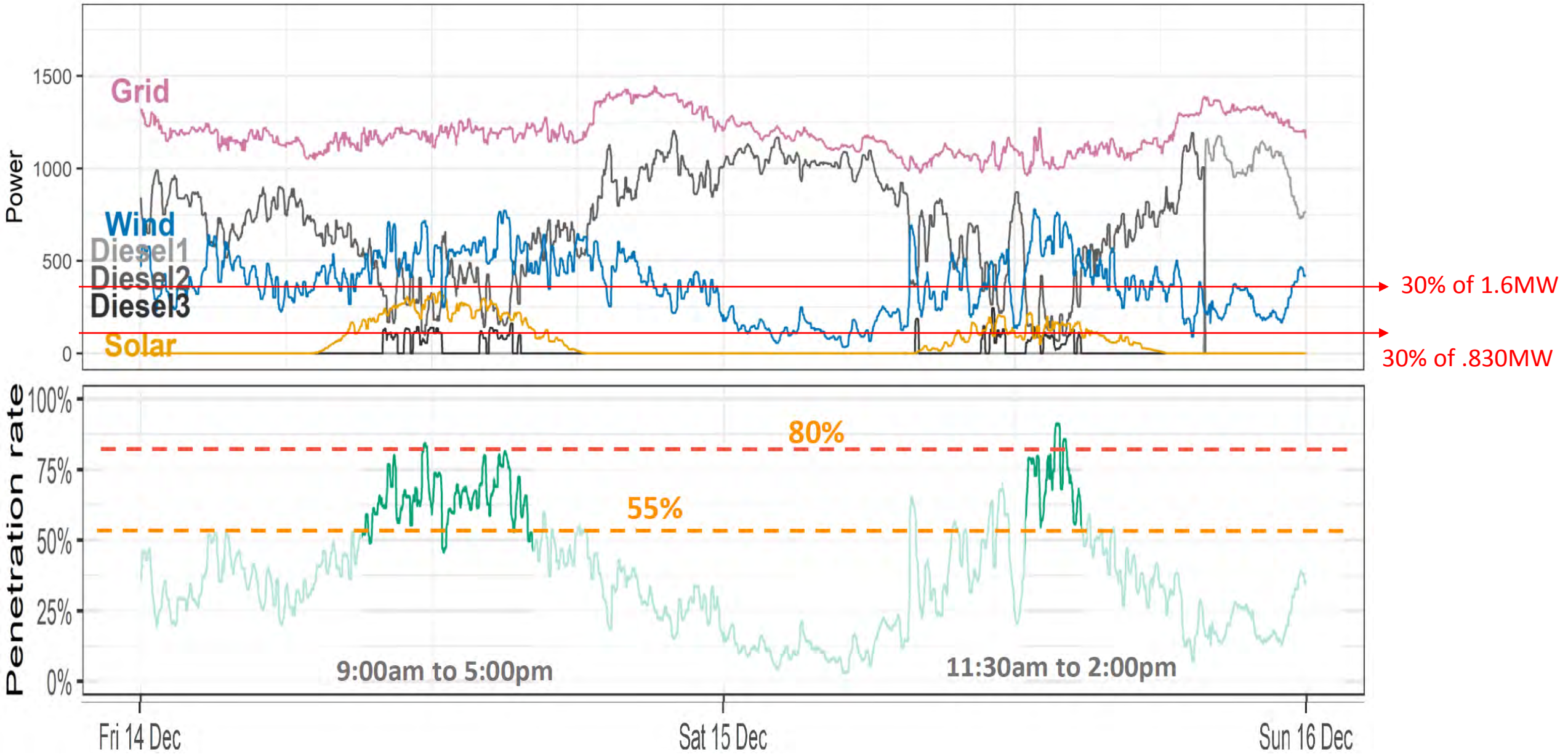
- 3 Local SCADAs
 - Diesel
 - PV
 - Wind
- Communication Network
 - Wind & SCADA – FOC
 - PV & SCADA – Radio/FOC
- Real-time Showcase
 - www.yspsc-sc.com



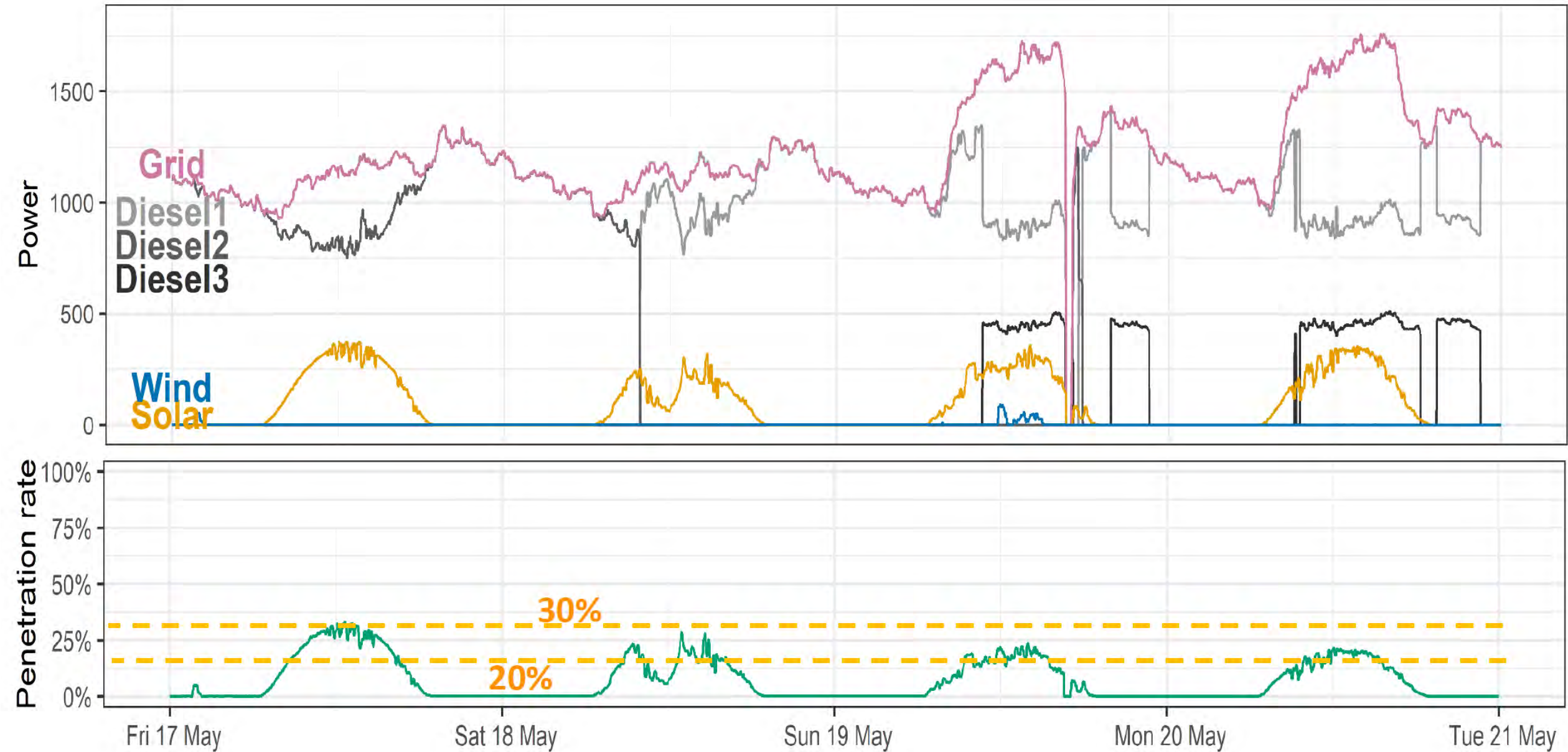
Hybrid Wizard©

- Automated Controller
- Algorithm and parameters incorporating a complete modeling of Yap's Electrical Grid

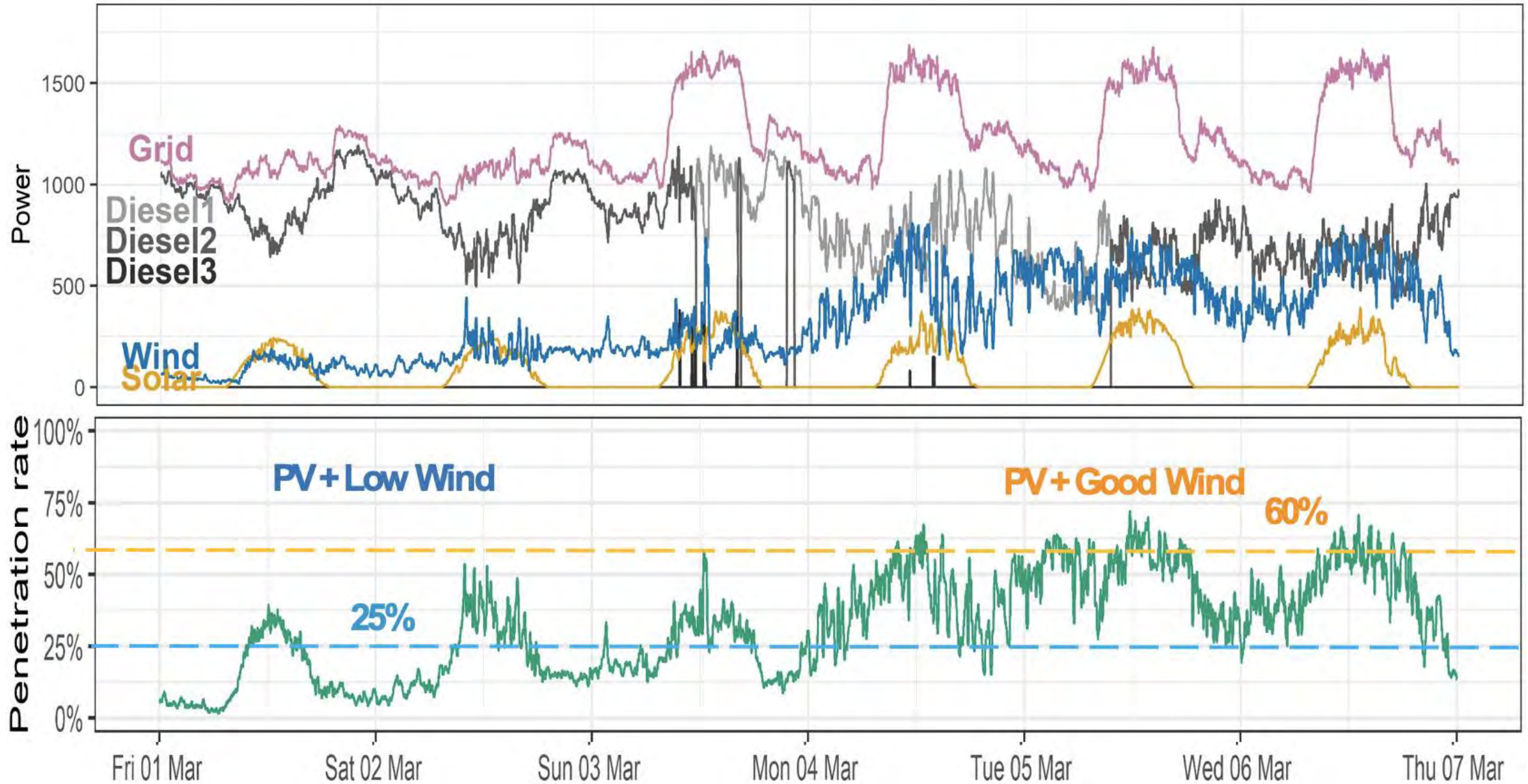
Grid Stability - Maximizing RE w/o Storage



Grid Stability – PV w/o Wind



Grid Stability – PV & Wind



Grid Stability – RE Curtailment

Issue

Number of
occurences

Corrective
action

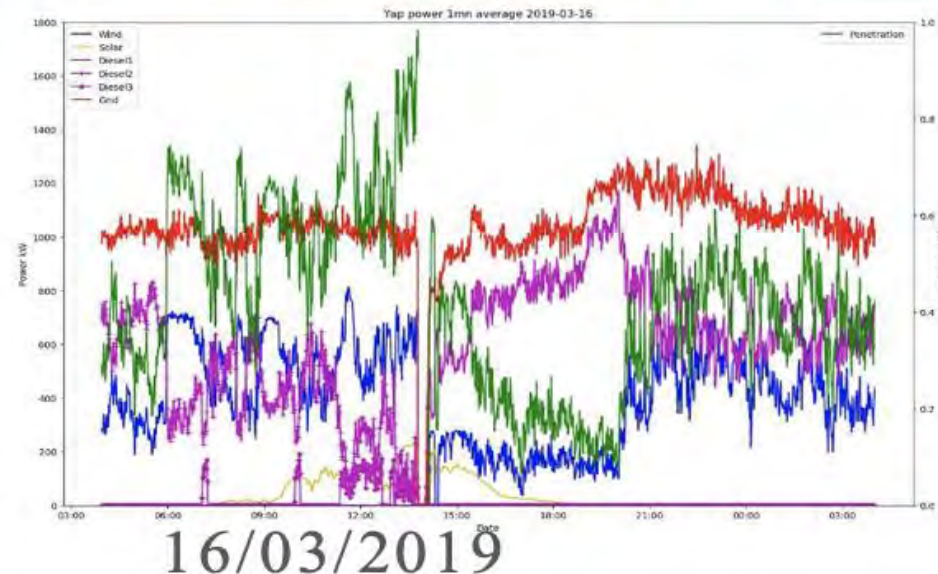
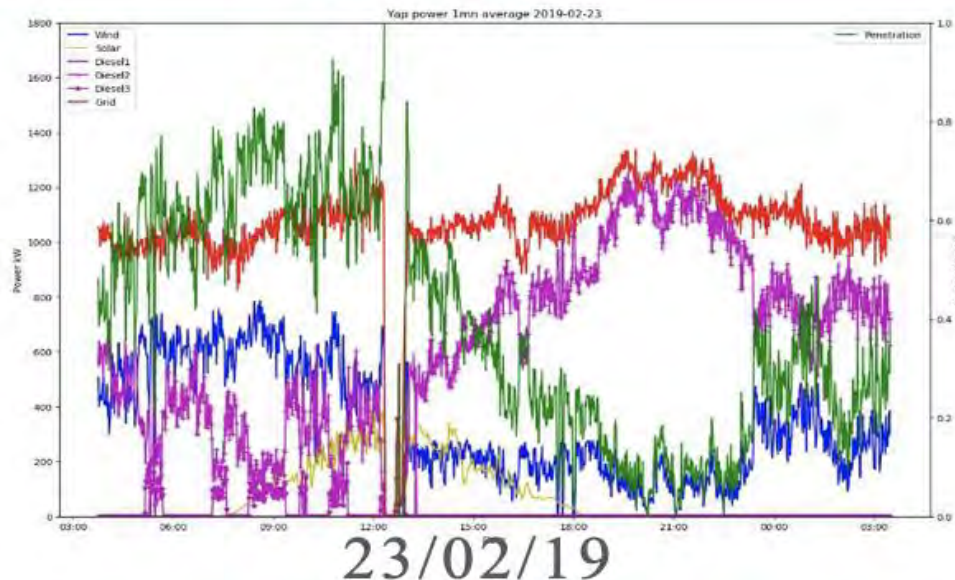
Problem Solved?

Reverse Power
to Gensets

2

Software
adjustment:
Dynamic Regulation
of curtailment
window

YES



Design vs. Actuality

Instant REshare

up to 70%

Up to 80 %

Monthly Average REshare

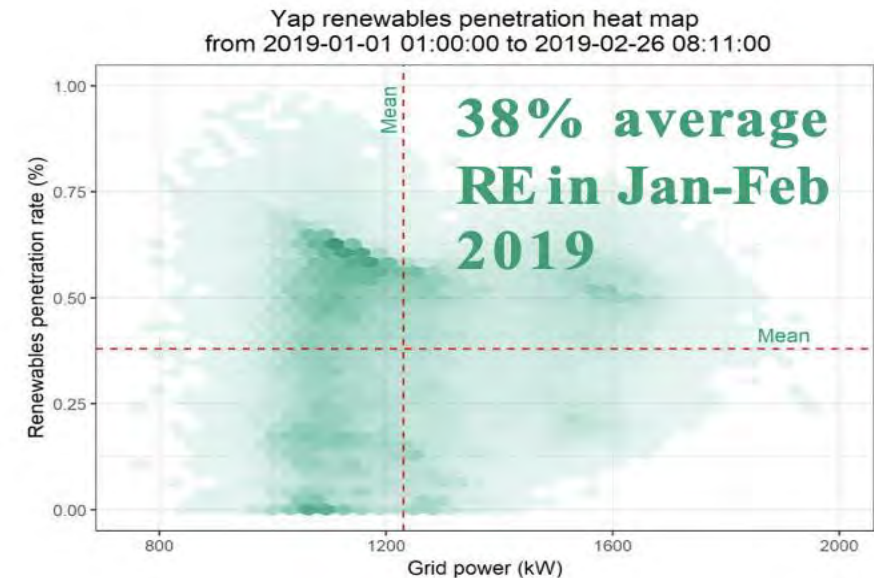
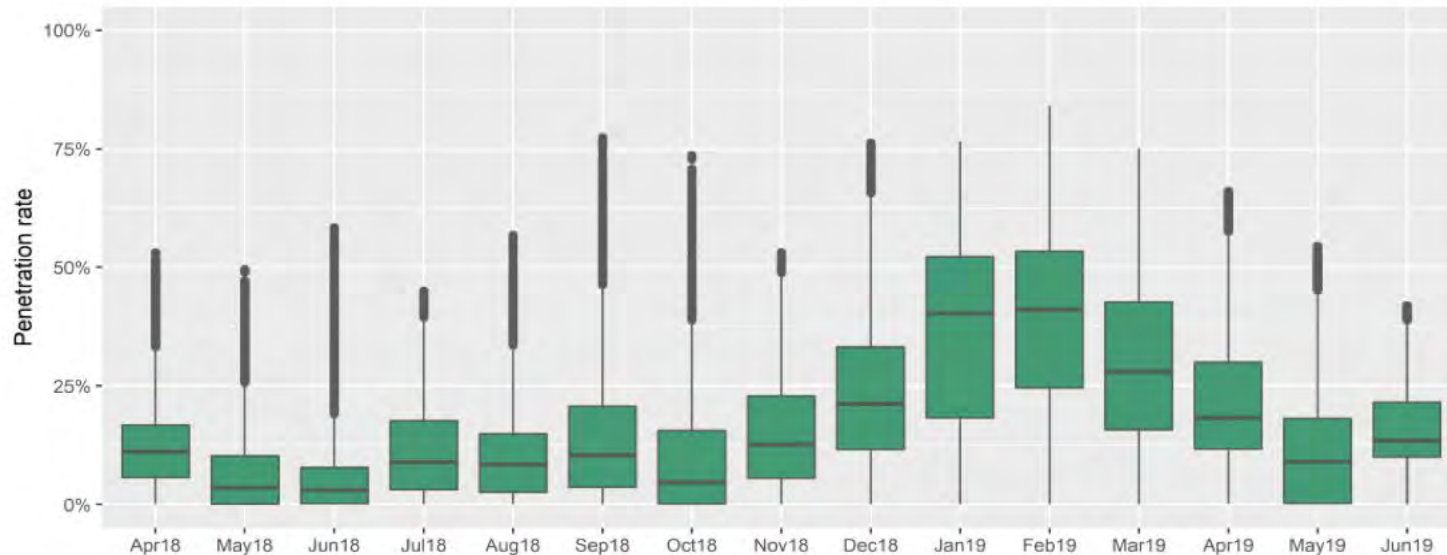
17%

up to 38%

**Diesel Displacement
(US Gallons/year)**

113,600

139,374



Next Steps - (2019-2023) Yap Main Island

➤ **Increasing RE**

- ❖ 2 MW Solar PV
- ❖ Result in Achievement of RE Target

➤ **Introducing BESS**

- ❖ 800kW (800kWh)
 - ✓ for smoothing & reducing diesel dispatch for spinning reserve

➤ **Improving System Robustness & Efficiency**

- ❖ Replacing all radio link with fiber optic cables
- ❖ Invest on Hybrid Wizard Upgrade

➤ **New Diesel**

- ❖ Installing new .830MW high speed diesel

Next Steps - (2024-2028) Yap Main Island

➤ **Increasing RE**

- ❖ 2 MW Solar PV

➤ **BESS**

- ❖ 1.5MW (7MWh)

➤ **Underground Distribution Network**

- ❖ Install underground cables from the airport to Colonia Area (5 of 21.4 miles)

Next Steps - (2029-2033) Yap Main Island

➤ **Increasing RE**

- ❖ 2.5 MW Solar PV

➤ **BESS**

- ❖ .5MW (10MWh)

➤ **Diesel**

- ❖ 1 New Replacement 1.6MW high speed diesel
- ❖ Retire 1 Deutz unit (3.2MW)

Next Steps - (2034-2037) Yap Main Island

➤ **Increasing RE**

- ❖ 1.8 MW Solar PV

➤ **BESS**

- ❖ 1.5MW (10MWh)

➤ **Diesel**

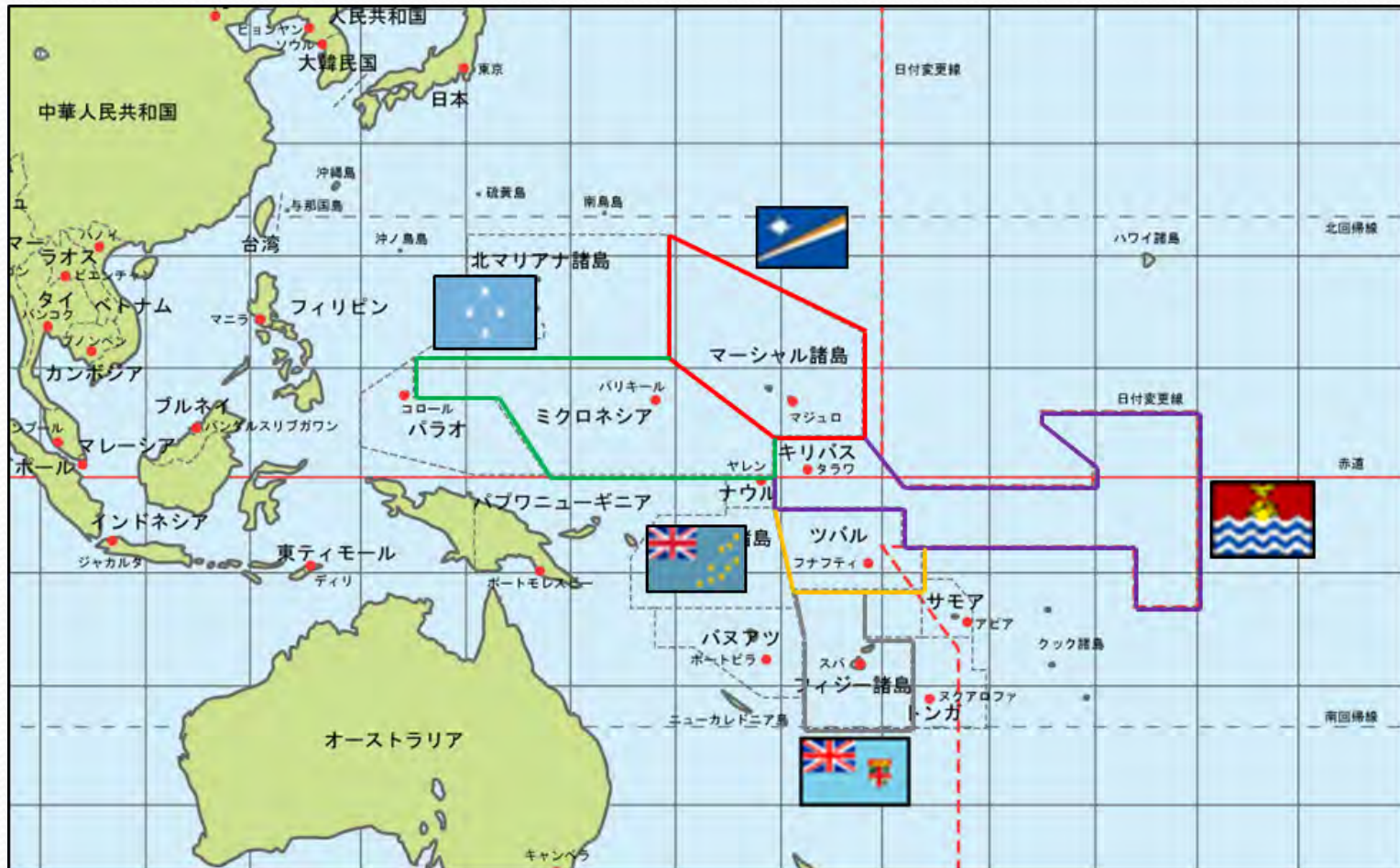
- ❖ 1 New Replacement 1.6MW high speed diesel
- ❖ 1 New Replacement .830MW high speed diesel

Outer Islands

- **Falalop, Ulithi & Falalop Woleai**
 - Additional PV (approx. 60kWp) to have 100% generation from PV during daytime
- **Mogmog, Fadrai, & Asor**
 - Replace Batteries
- **Ifalik & Lamotrek**
 - Replace SHS with PV Mini-Grid (approx. 60kWp, 40kWp)
- **Satawal, Fais & Falalop Ulithi**
 - Complete North Rep PV project

THANK YOU

The Project for Introduction of Hybrid Power Generation System in Pacific Island Countries



Okinawa Enetech Co., Inc.



Okinawa Electric Power Co., Inc.

■ INDEX

1. Project Objectives
2. Project Schedule (Phase 1)
3. Project Progress
4. Project Schedule (Phase 2)

1. Project Objective

■ Project design matrix for FIJI

Overall Goal

Necessary know-how and technologies for the Hybrid Power Generation System is continuously utilized by the target group of Fiji as well as other PICs.

Project purpose

Regional training system on the introduction of Hybrid Power Generation System is strengthened in Fiji.

Outputs

1. Training programs for appropriate and economical system of O&M for Diesel Generators (DGs) is prepared.
2. Training programs for methodology for appropriate planning and O&M of renewable energy (RE) is prepared.

Activities <Output 1>

- 1-1 Operational conditions of the existing DGs in the target area of Fiji are reviewed to identify training needs.
- 1-2 Capacity assessment of candidate trainers is conducted.
- 1-3 Current related training activities and implementation structure are reviewed, including confirmation on objectively verifiable indicators.
- 1-4 Training for trainers is implemented.
- 1-5 Training guideline, curriculums, schedule and textbooks for new/revised training program are prepared.
- 1-6 Necessary training equipment is identified and prepared (If necessary).
- 1-7 New/revised training programs are conducted.
- 1-8 The result of new training programs is evaluated, and lessons learned from evaluation are reflected to revised program.
- 1-9 Future training programs including necessary budget after project completion are prepared.
- 1-10 Knowledge on appropriate and economical system for O&M of DGs is disseminated among stakeholders through seminar.

1. Project Objective

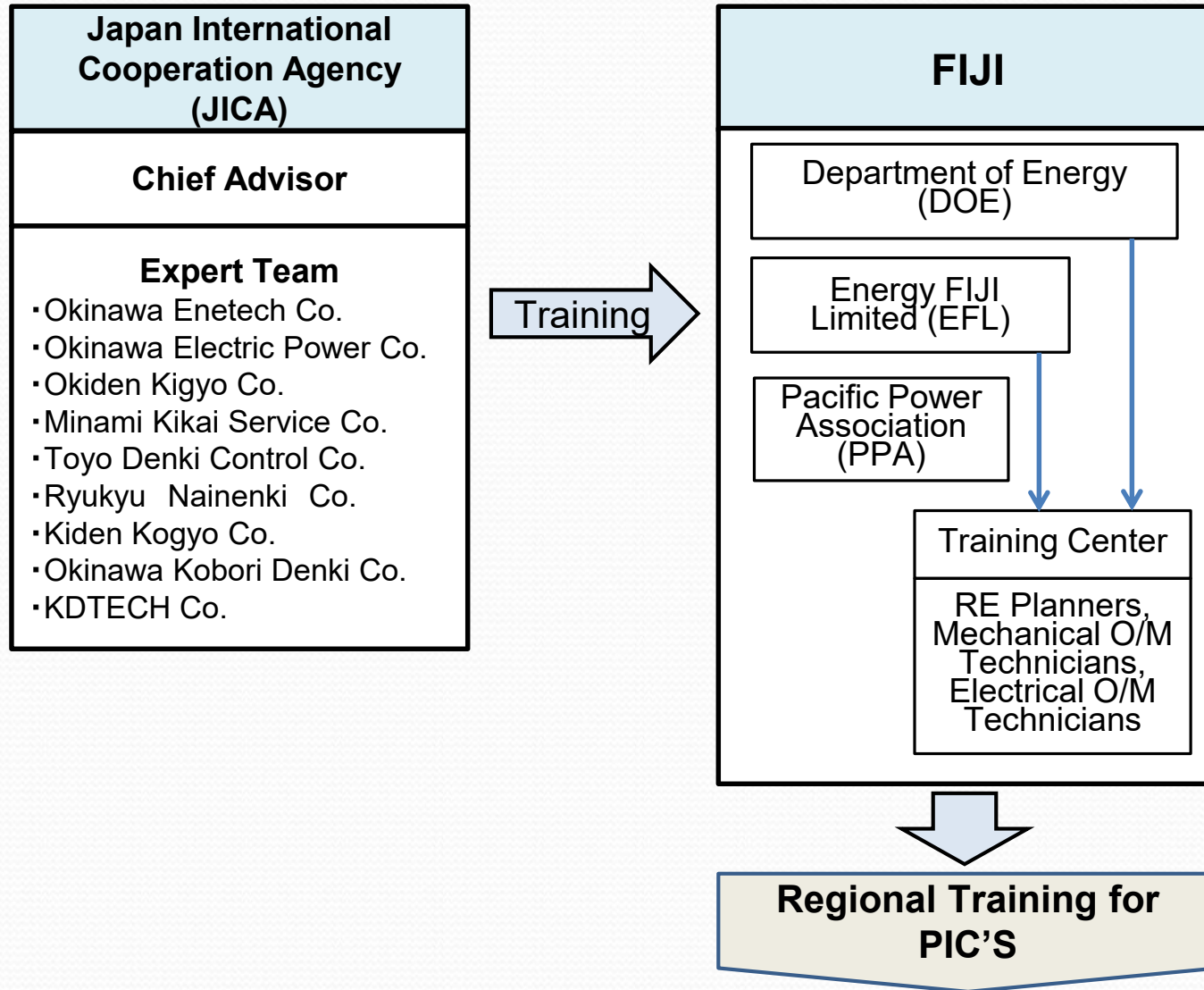
■ Project design matrix for FIJI

Activities <Output 2>

- 2-1 Current situation and future development plan of RE in the target area of Fiji is reviewed to identify training needs.
- 2-2 Operational conditions of the existing RE facilities are reviewed to identify training needs.
- 2-3 Capacity assessment of candidate trainers is conducted.
- 2-4 Current related training activities and implementation structure are reviewed, including confirmation on objectively verifiable indicators.
- 2-5 Training for trainers is implemented.
- 2-6 Training guideline, curriculums, schedule and textbooks for new/revised training program are prepared.
- 2-7 Necessary training equipment is identified and prepared (If necessary).
- 2-8 New/revised training programs are conducted.

1. Project Objective

■ Project Cooperative Structure for FIJI



1. Project Objective

■ Project design matrix for FSM, Marshall, Kiribati & Tuvalu

Project purpose

1. Hybrid Power Generation System is introduced



Overall Goal

Energy security is improved and greenhouse gases are reduced through the reduction of fossil fuels consumption



Outputs

1. Appropriate and economical system for O&M of Diesel Generators (DGs) is enhanced.
2. Methodology for appropriate planning and O&M of Renewable Energy (RE) is established.

1. Project Objective

■ Project design matrix for FSM, Marshall, Kiribati & Tuvalu

Activities <Output 1>

- 1-1 Operational conditions of the existing DGs are reviewed, including confirmation of objectively verifiable indicators for overall goal and project purpose.
- 1-2 Asset management plan of DG is reviewed including financial evaluation on overhaul.
- 1-3 Specific fuel consumption of pilot DG units is measured.
- 1-4 Improvement plan for the operation of pilot DG units is prepared.
- 1-5 Existing spare parts and maintenance tools of pilot DG units are confirmed.
- 1-6 Improvement plan for the operation of pilot DG units is implemented.
- 1-7 The result of implementation of the improvement plan is evaluated, and improvement plan is updated.
- 1-8 The concept of Economic Dispatch Control (EDC) is shared among operators and applied, if possible.
- 1-9 Necessary spare parts and maintenance tools for the pilot DG units are prepared.
- 1-10 Maintenance work schedule for the pilot DG units is prepared.
- 1-11 Check sheets and maintenance manuals for maintenance works for pilot DG units are prepared.
- 1-12 Maintenance works (daily/partial inspection/overhaul work) for pilot DG units are conducted in accordance with the maintenance schedule.
- 1-13 The result of maintenance works is evaluated, and future maintenance work schedule together with budget (including sub-contract fee, cost for tools and equipment) is prepared.
- 1-14 Specific fuel consumption of the pilot DG units is measured before and after implementation of the related project activities.
- 1-15 Related training programs for appropriate O&M system for DGs are implemented periodically.
- 1-16 Knowledge on appropriate O&M of DGs is disseminated among stakeholders.

1. Project Objective

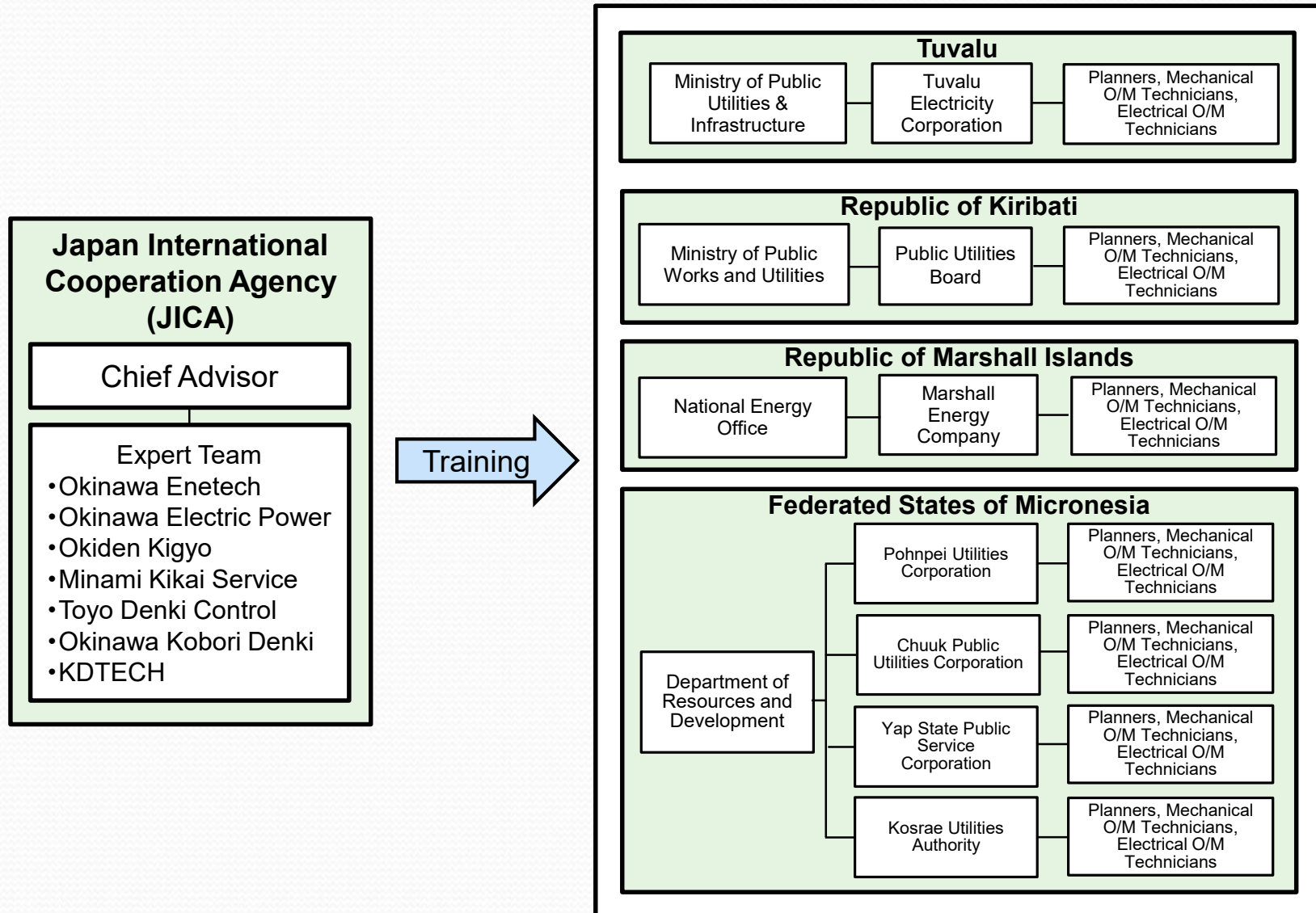
■ Project design matrix for FSM, Marshall, Kiribati & Tuvalu

Activities <Output 2>

- 2-1 Current situation and future development plan of RE is reviewed, including confirmation of objectively verifiable indicators for overall goal and project purpose.
- 2-2 Planning manual for Hybrid Power Generation System is prepared.
- 2-3 Planning manual for Hybrid Power Generation System is reviewed and updated in the target area.
- 2-4 Operating conditions of the existing RE facilities are reviewed, including confirmation of objectively verifiable indicators for overall goal.
- 2-5 O&M manual for RE facilities is prepared.
- 2-6 Maintenance works are conducted according to O&M manual of RE facilities.
- 2-7 The result of maintenance works is evaluated, and future maintenance work schedule together with budget is prepared.
- 2-8 Training program for Hybrid Power Generation System including O&M of RE facilities is conducted.
- 2-9 Knowledge regarding Hybrid Power Generation System is disseminated among stakeholders.

3. Project Introduction

■ Project Cooperative Structure for FSM, Marshall, Kiribati & Tuvalu



2. Project Cooperation schedule (Phase 1)

Project for the introduction of Hybrid power Generation System (Phase-1) Schedule																														
Work contents		2017												2018												2019				
		6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5					
I	Preparation works																													
II	Site training																													
	1st training in Japan (RE)																													
	2nd training in Japan (DEG)																													
	Southern area countries																													
	Fiji																													
	Tuvalu																													
	Kiribati																													
	Northern area countries																													
	Micronesia																													
	Marshall																													
III	Follow up																													
	PALM 8(May, 2018 Japan)																													

	Contents (Diesel O&M / RE O&M / RE Implementation)	Training period
1	Survey of the conditions power generation (RE and DEG's) system	South area : 8/27 to 10/ 5 (2017) North area : 10/27 to 12/6 (2017)
2	Training in Japan(Visit to Hybrid systems in Okinawa / Japan RE devices manufacturer/ RE research institutes)	Japan : 2/16 to 3/2 (2018)
3	Lectures in basic knowledge of RE and DEG'S operation and maintenance. Hand on training.	South area : 5/13 to 7/7 North area : 7/ 22 to 8/29
4	Training in overhaul of DEG in Okinawa remote island power station	Japan(Okinawa) 9/27 to 10/22
5	Preparation of the manual for O&M of DEG's and RE facilities	South area : 10/20 to 12/15 North area : 1/20 to 2/27 (2019)

3. Project progress (Fiji)

3.1 Survey of the conditions power generation (RE and DEG's) system

1. Lautoka Training Center

The Lautoka training center is a EFL facility used to educate its employees in different areas of work such as power generation (diesel & hydro), transmission & distribution, renewable energy, as well as safety works. Equipment for lectures and texts for training are prepared and well organized.

The maintenance work shop is located close to the main building. This is where the maintenance of all the diesel generators of all power plants in Fiji is performed and trainees get on-the-job training on how to conduct overhaul. This facility was selected as the best place to conduct the ToT for this project.



3. Project progress (Fiji)

3.1 Survey of the conditions power generation (RE and DEG's) system

2. Sigatoka DG Power Station

Sigatoka EFL power plant is composed by 3 Cummins units of 1,760 kW.



3. Butoni Wind Farm

This wind farm owned by EFL, was commissioned in 2007 and consists of 37 Vergnet wind turbines of 275 kW. The total rated capacity is about 10 MW, and it produces about 22,800 MWh per year.



3. Project progress (Fiji)

- Survey of the conditions power generation (RE and DEG's) system

4. FIJI National University (FNU)

We visited a workshop owned by the University of Fiji (FNU). Small diesel generators are installed inside of the workshop to teach the students regarding diesel generators.



5. Department of Energy (DOE)

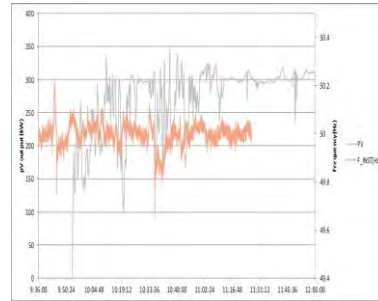
We visited the workshop of the Department of Energy where small DGs from remote islands are serviced. The rated output of all engines are below 50 kW.



3. Project progress (Kiribati, Tuvalu, FSM & RMI)

3.1 Survey of the conditions power generation (RE and DEG's) system

Kiribati



Tuvalu



3. Project progress (Kiribati, Tuvalu, FSM & RMI)

3.1 Survey of the conditions power generation (RE and DEG's) system

Marshall



Micronesia



3. Project progress

3.2 First training in Japan : February 16th to March 2nd (RE training)

INTRODUCTION OF HYBRID POWER GENERATION SYSTEM IN PACIFIC ISLAND COUNTRIES					
Counterpart training in Japan Schedule Plan					
Date		time	item	Contents	
2/15	Thu	~		Moving to Japan	
2/16	Fri	~	Lecture	AM Briefing	
		~	Lecture	PM Seminar	
2/17	Sat	~			
2/18	Sun	~			
2/19	Mon	10:00 ~ 10:30	Courtesy Visit	Courtesy Visit to Okinawa Enetech president	
		10:30 ~ 11:00	Courtesy Visit	Courtesy Visit to Okinawa Electric Power president, deputy president.	
		11:00 ~ 12:00	Lecture	Training program orientation, interchange of opinions	
		13:30 ~ 14:00	Courtesy Visit	Courtesy Visit to Okiden Kigyo president	
		14:00 ~ 16:00	Site Visit	Technical Training Center / Power Supply Center	
2/20	Tue	10:00 ~ 12:00	Presentation	Okinawa Mainland Grid, Grid stabilization Technology	
		13:00 ~ 14:00	Presentation	Presentation of Okinawa Remote Island Hybrid system technology	
		14:00 ~ 15:00	Presentation	Presentation of Okinawa Remote Island EDC	
		15:00 ~ 16:00	Presentation	Presentation of proof research project of Solar and wind power in Okinawa	
2/21	Wed	7:30 ~ 17:00	Site Visit	Visit to Tarama Is hybrid system(PV+ WT)facility	
2/22	Thu	10:00 ~ 12:00	Site Visit	Miyako Energy Management System(EMS)	
		13:00 ~ 15:00	Site Visit	Miyako mega solar facility	
2/23	Fri	10:00 ~ 16:00	Site Visit	Visit to Abu mega solar facility and Ogimi Wind power facility in Okinawa mainland	
2/24	Sat	11:45 ~ 13:45	Move	Moving to Osaka	
		14:30 ~ 16:00	Move	Moving to Kyoto	
2/25	Sun	9:30 ~ 14:30	Site Visit	Sightseeing of Kyoto	
2/26	Mon	10:00 ~ 12:00	Site Visit	Nissin Electric(Renewable Energy Control System)	
		12:00 ~ 15:00	Move	Moving to Nagoya	
		15:00 ~ 17:00	Site Visit	Hitachi Chemical(Industrial Batteries)	
2/27	Tue	10:00 ~ 17:00	Move	Moving to Fukushima	
2/28	Wed	10:00 ~ 15:00	Site Visit	Fukushima Renewable Energy Institute, AIST(Advanced Industrial Science and Technology)	
		17:00 ~ 19:00	Move	Moving to Tokyo	
3/1	Thu	10:00 ~ 12:00	Site Visit	Central Research Institute of Electric Power Industry(CRIEPI)	
3/2	Fri	9:00 ~ 10:00	Courtesy Visit	JICA Headquarters	
		10:00 ~ 11:00		Evaluation meeting	
		11:30 ~ 12:00		Closing ceremony	
3/3	Sat	~		Moving to respective countries	
3/4	Sun	~			

3. Project progress

3.2 First training in Japan : February 16th to March 2nd (RE training)

1. Lectures from Okinawa Electric Power Co.



2. Visit to Okinawa remote island Hybrid power generation facilities (Tarama Wind Turbine Hybrid System/Stabilizer/Photovoltaic System)



3. Project progress

3.2 First training in Japan : February 16th to March 2nd (RE training)

3. Visit to Okinawa remote island Hybrid power generation facilities (Miyako Mega Solar System)



4. Visit to Okinawa mainland RE power generation facilities (Ogimi WT Wind Turbine Demonstration Facilities , Abu Mega solar)



3. Project progress

3.2 First training in Japan : February 16th to March 2nd (RE training)

5. Visit to Nissin Electric Co. Control Device Factory (Kyoto)



6. Hitachi Chemical Co. Batteries manufacturer Plant (Nagoya)



3. Project progress

3.2 First training in Japan : February 16th to March 2nd (RE training)

7. Visit to National Institute of Advanced Industrial Science and Technology (AIST), Fukushima Renewable Energy Institute AIST (FREA)



8. Visit to the Central Research Institute of Electric Power Industry (CRIEPI)



3. Project progress

3.2 First training in Japan : February 16th to March 2nd (RE training)

9. Visit to JICA main office (Tokyo)



3. Project progress (Fiji)

3.3 Lectures in basic knowledge of DEG'S operation and maintenance.

Hand on training.

	Date	Venue	Training Content / Lectures
1	6/1(Fri)	Lautoka TC	Training opening / Project explanation / Level check test / Diesel Power generation Facility outline
2	6/4(Mon)	Lautoka TC	Main equipment of diesel generators Modifications in the text contents
3	6/5(Tue)	Lautoka TC	Diesel power plant maintenance and inspection procedure / Safety manual / Share of improvement issues of Kiribati, Tuvalu
4	6/6(Wed)	Lautoka TC	Remote island supply and demand management.
5	6/7(Thu)	Lautoka TC	Lecture on Safety Work / Visit to VUDA Power Station & National Control Centre
6	6/8(Fri)	Lautoka TC	Load allocation operation (EDC) / Consultation with trainees on the composition of the manual and training program.



3. Project progress (Fiji)

3.3 Lectures in basic knowledge of RE operation and maintenance.

Hand on training.

	Date	Venue	Training Content / Lecture
1	6/11(Mon)	Lautoka TC	Training opening / Project explanation / Level check test / Assembly of 3.5 PV structure.
2	6/12(Tue)	Lautoka TC	Planning method of solar power generation. Installation of solar panel
3	6/13(Wed)	Lautoka TC	Issues in the implementation of Re in small power grids. Installation of inverter and transformer board.
4	6/14(Thu)	Lautoka TC	Explanation of failure detection equipment (I-V checker, cell line checker), periodical inspection check sheet.
5	6/15(Fri)	Lautoka TC	Industrial PV construction. Report meeting on training in Japan (Mr. Krishneel Prasad, EFL) PV wiring work
6	6/16(Sat)	Lautoka TC	Initial setting of power control · Explanation of how to use I-V checker



3. Project progress (Fiji)

3.3 Lectures in basic knowledge of RE operation and maintenance.

Hand on training.



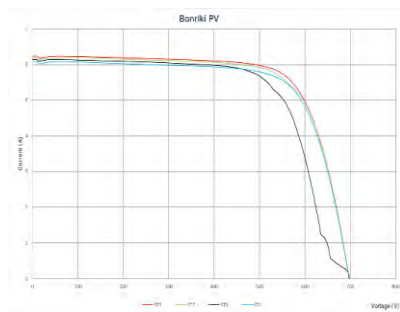
RE Training (construction of 3.5 kW solar power facility)

3. Project progress (Kiribati, Tuvalu, FSM & RMI)

3.3 Lectures in basic knowledge of DEG's & RE operation and maintenance.

Hand on training.

Kiribati



Tuvalu

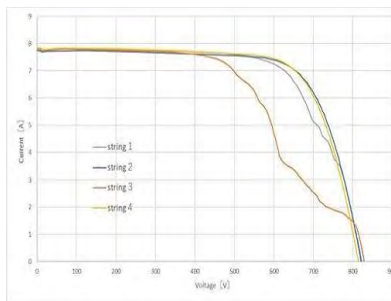
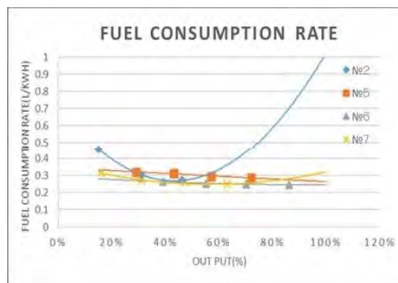


3. Project progress (Kiribati, Tuvalu, FSM & RMI)

3.3 Lectures in basic knowledge of RE operation and maintenance.

Hand on training.

Marshall



Micronesia



3. Project progress

3.4 Second training in Japan : September 27th to October 22nd (DEG overhaul training in Kume Is., Okinawa)



3. Project progress (Fiji)

3.5 Preparation of the manual for O&M of RE facilities

RE implementation lectures, simulation software Homer training



RE operation and maintenance training



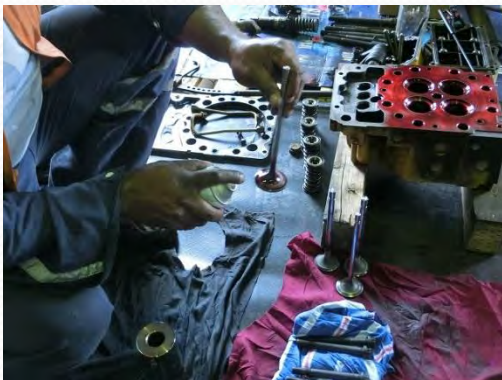
3. Project progress

3.5 Preparation of the manual for O&M of DEG's

Confirmation of Training lectures contents, hands-on maintenance



Diesel engine disassembly, parts washing & inspection, provision of electrical measurement instrument , hands-on training



4. Project Schedule (Phase 2)

Project for the introduction of Hybrid power Generation System (Phase-2) Schedule

Year& Month item		2019年												2020年												2021年												2022年						
		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7			
					PPA																																							
I	Preparation works		契約																																									
II	Site training																																											
2	North countries	北			北-1	北-2		北-3			北-4		北-5		北-6			北-7			北-8		北-9		北-10			北-11																
1	South countries	南		南-1		南-2	南-3	研修 1			南-4		南-5		南-6	南-7				南-8		南-9		南-10	南-11																			
III	Training in FIJI							研修 1									研修 2																											
	RE			Y・M				P・M					K・M					P・M									K・M													P・M				
	DEG				C・M					Y・M					K・M					C・M								Y・M																
IV	Seminar																																											
V	DEG Overhaul																																											
1	Marshall																																											
2	Tuvalu																																											
3	Kiribati																																											
4	Kosrae																																											
VI	South area follow up																																											
	North area follow up																																											
VII	PPA annual conference																																											

Training in Japan



Thank you very much for your kindly support to this project
 ありがとうございます。



Okinawa Enetech Co., Inc.



Okinawa Electric Power Co., Inc.

My Focus @ Okinawa Training

- Technical Information Relevant for Hybrid Power Systems
- Constraints of Maximizing RE Penetration
- R&D and Solutions for Micro-Grids in Remote Islands in Okinawa Prefecture

Technical Information – Frequency Regulation

➤ Frequency

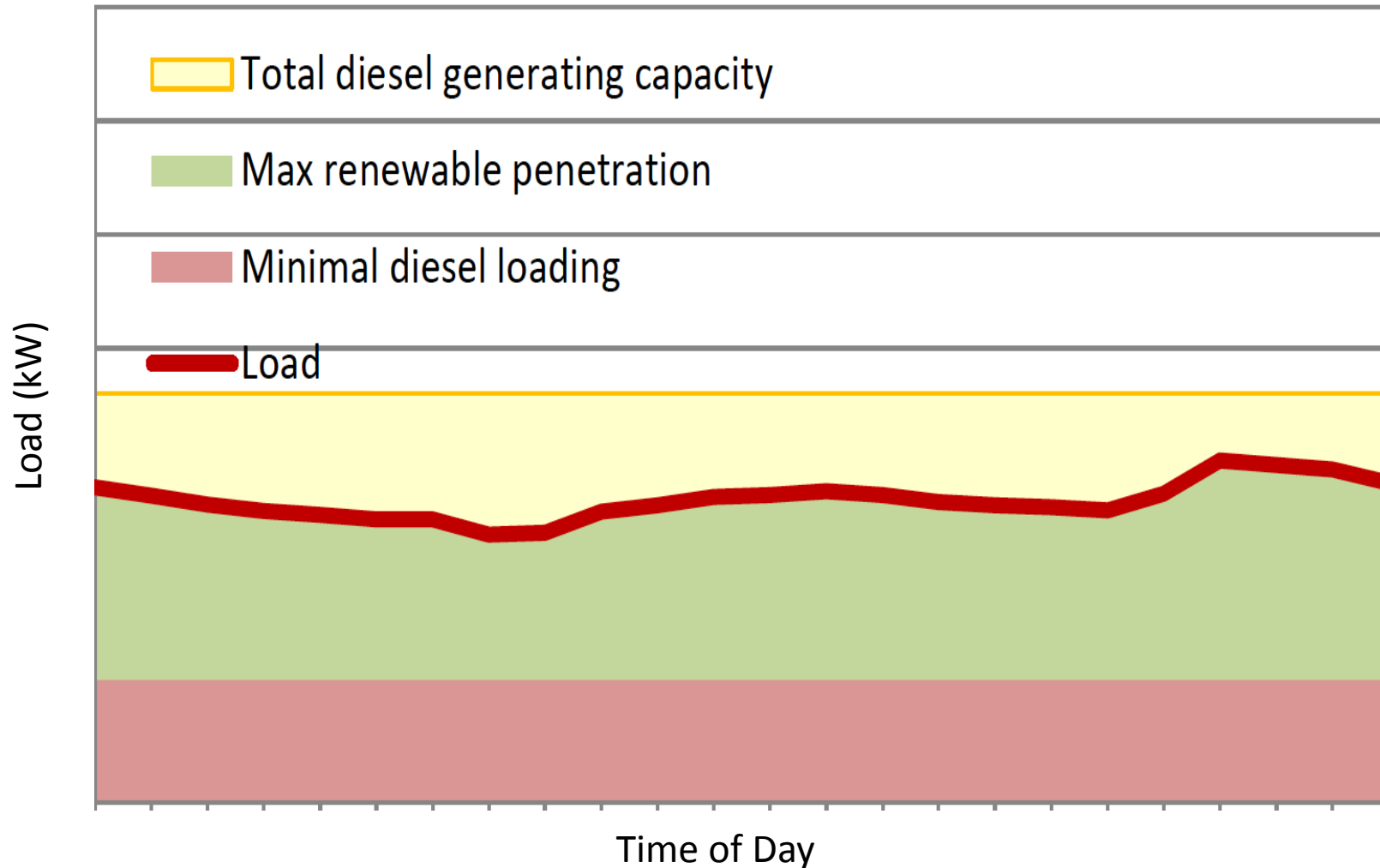
- Constantly changing variable consisting of the real time balance between system load and generation
- If load exceeds generation, frequency falls
- If generation exceeds load, frequency rises
 - Power becomes unstable

Technical Information – RE Intermittency/Frequency Regulation

- RE introduces intermittency of supply
 - Can result in over/under frequency thru imbalance between demand and supply caused supply volatility
- Frequency Control
 - Diesel – If there is enough active reserve in baseload DG, and/or spinning reserve in supplemental DG, diesel can adjust generation to balance with demand
 - Storage – Flywheel, battery, and other storage can provide smoothing to compensate for RE intermittency

Constraints of Maximizing RE

➤ Integration of RE into diesel-based grid faces limits of diesel gensets



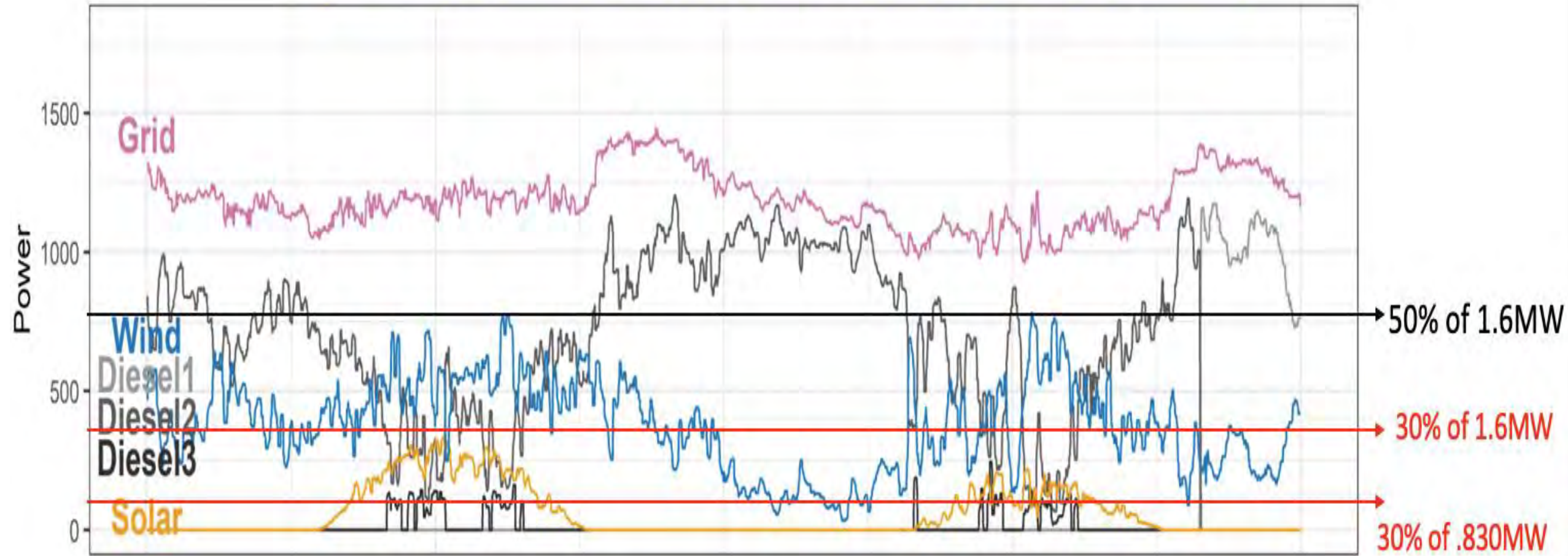
Problems w/Exceeding min diesel limits:

- Carbon build up in combustion chamber
- Other mechanical stresses

Constraints of Maximizing RE

- Acceptable floor for minimal diesel loading
 - ❖ Okinawa Training – 50% of diesel rating
 - ❖ YREDP Owner's Engineers – 30% of diesel rating
 - ❖ w/ periodic ramping to burn off carbon build up

Yap - Minimal Loading Floor



RE Integration R&D by OEPC

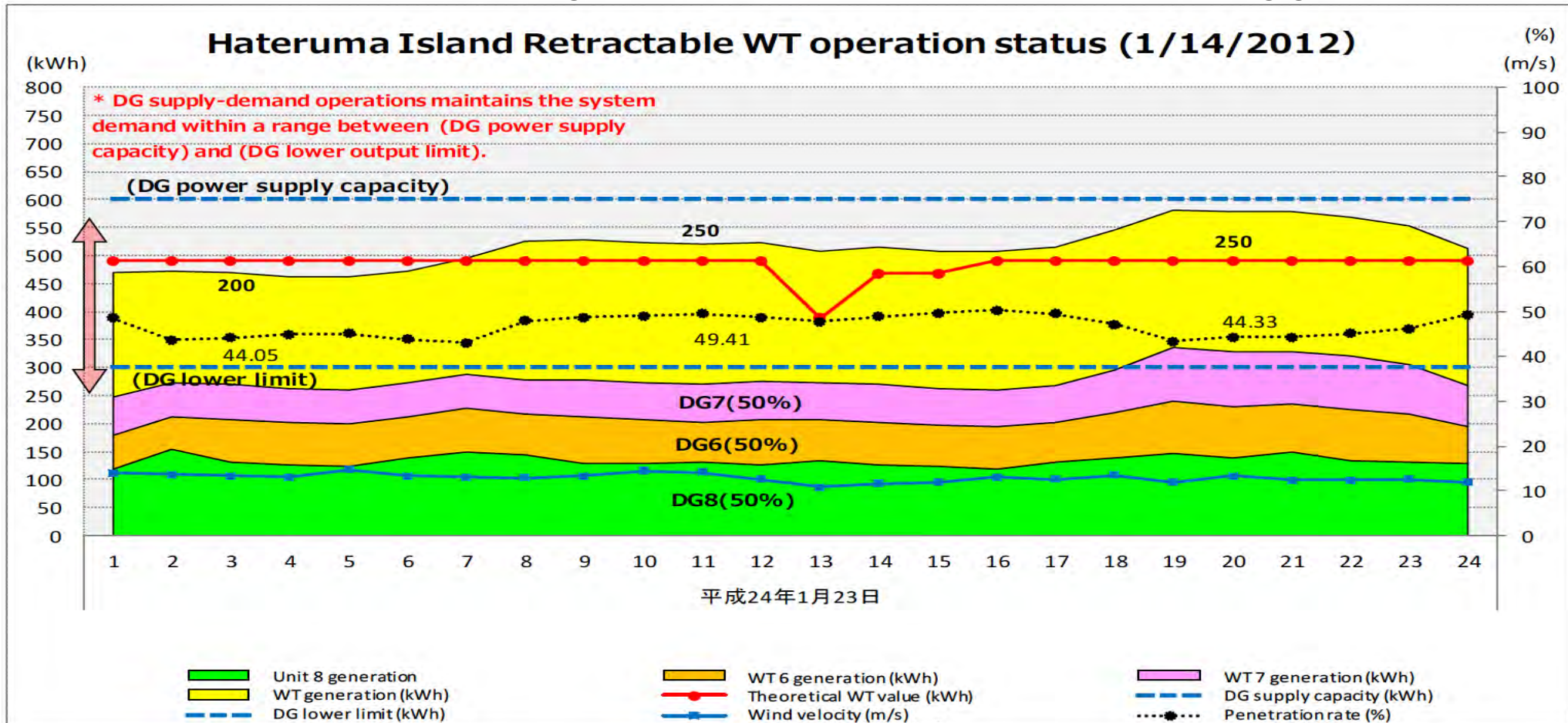
➤ With subsidies from Okinawa Prefecture, OEPC has installed and integrated wind and PV with storage on remote islands of Okinawa

- Tarama Island
- Hateruma Island
 - Diesel
 - Wind
 - Solar PV
 - BESS



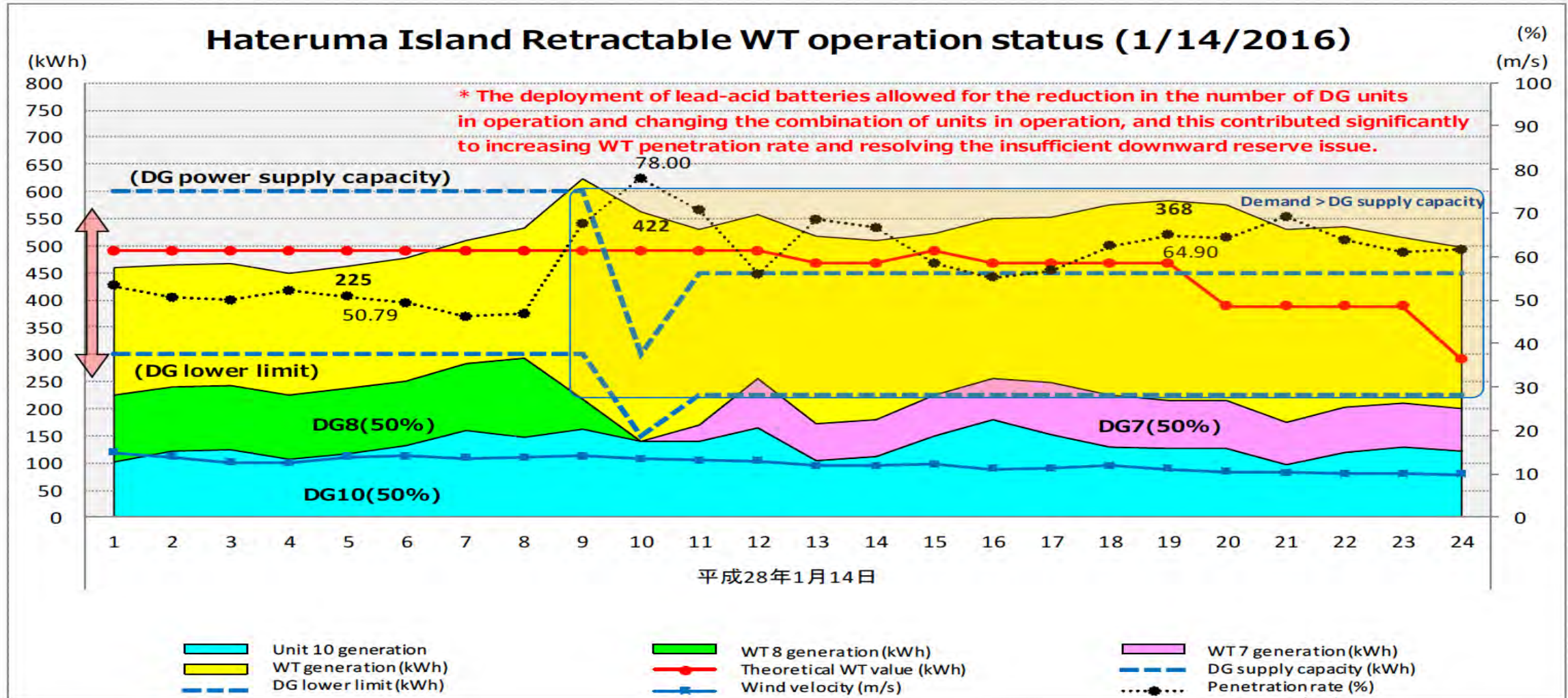
RE Maximization Constraints in Hateruma Island

- 2009 – 2 WT deployed (245 kW × 2 units)
- Diesel pushed down to 50% of its rating to allow room for RE
- Flywheel (190 kW x 30 sec) used initially for short-term storage
 - This was effective for smoothing, but it meant a lot of RE curtailment during good wind

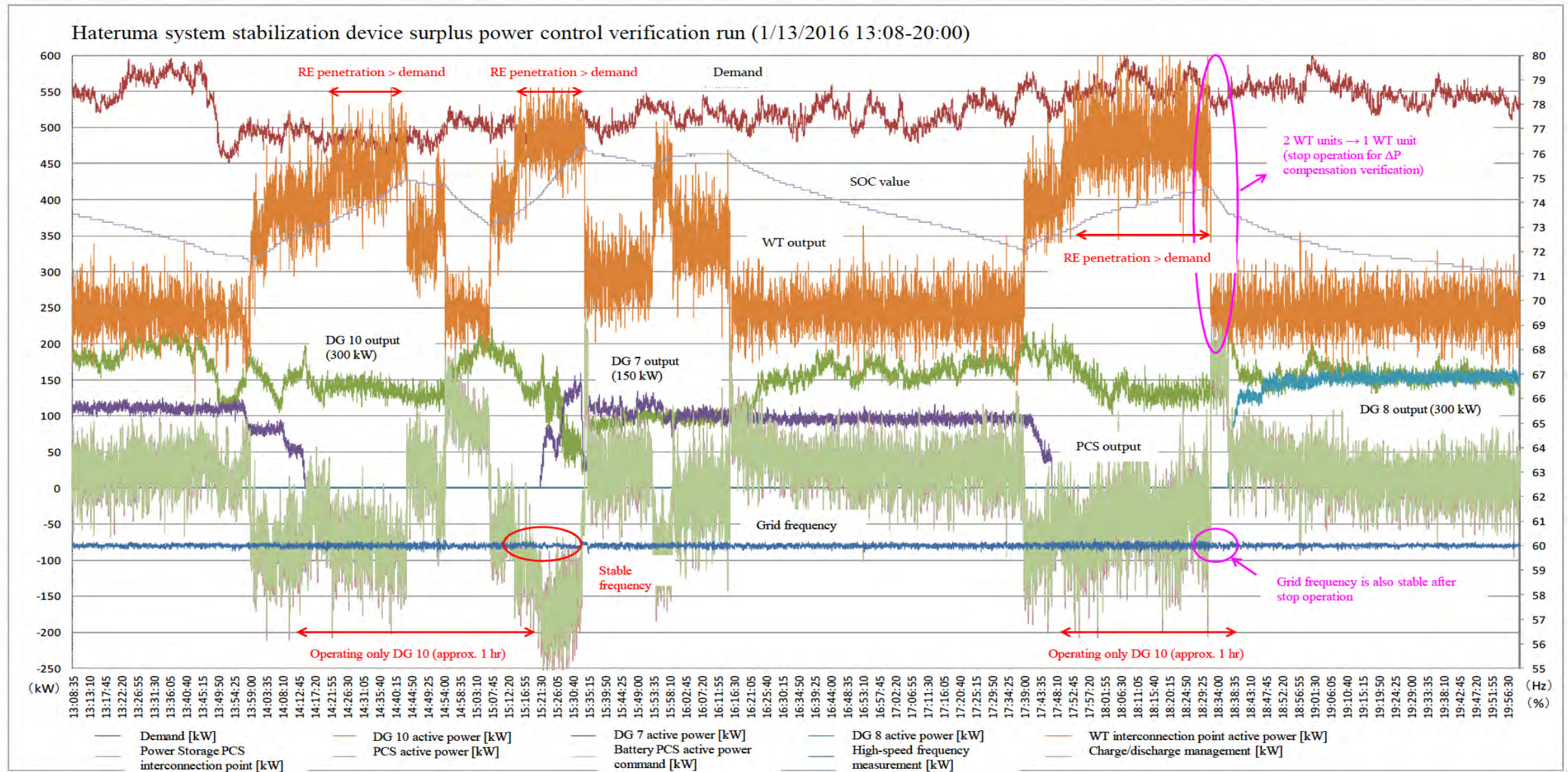


Solution in Hateruma Island

- Alternating Diesel Peak Capacity between 600kW to 450kW
- Introduce lead acid BESS (500 kW/1500 kWh)



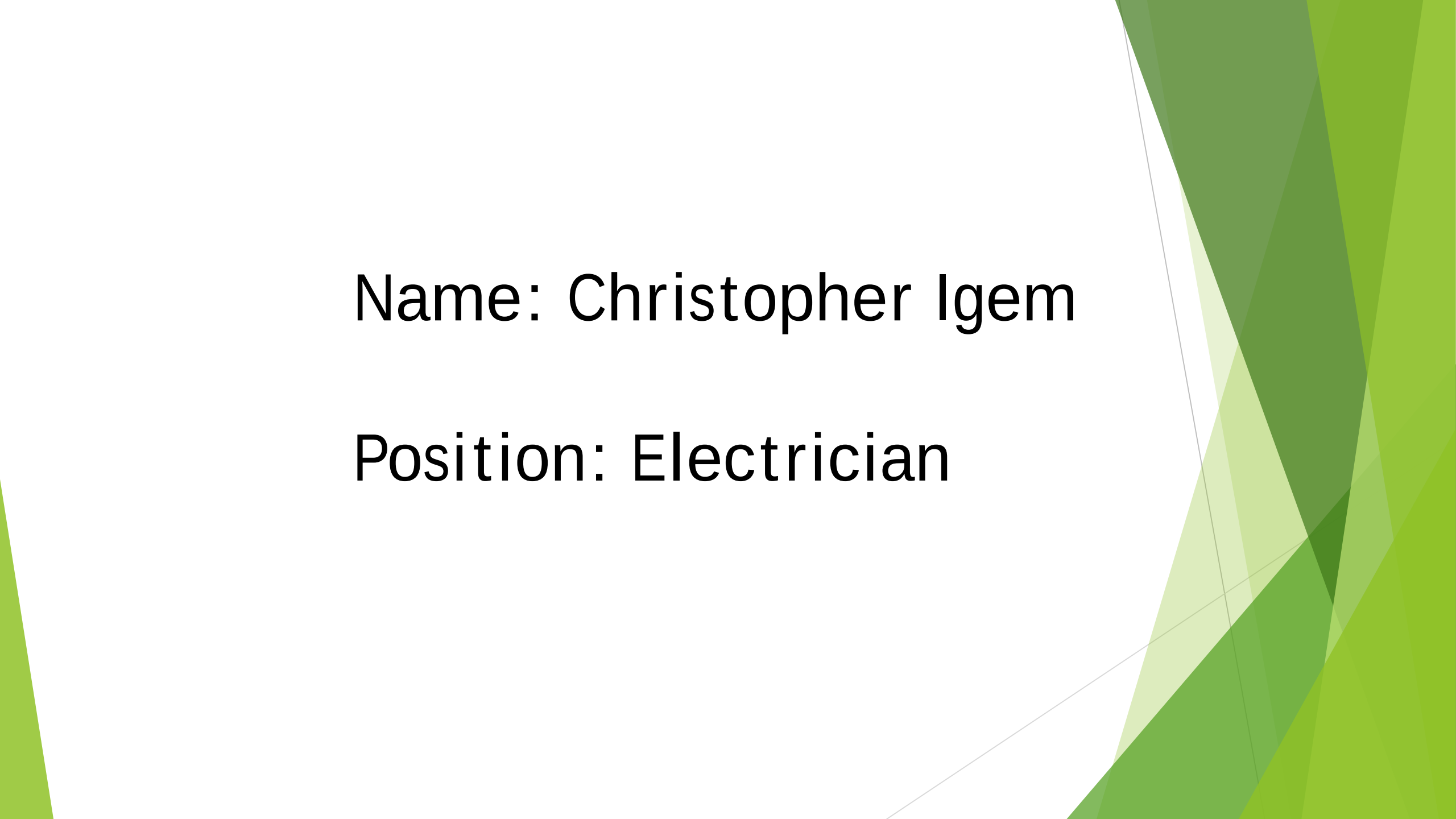
Actual Trend of Hateruma Island after BESS



Inefficiency of Minimal Diesel Loading

- The closer diesel operates at its rating, the more efficient it becomes. The more diesel is pushed to its minimal floor, the more inefficient it becomes
- Hybrid System can be economical if the savings in diesel gained from higher RE penetration will adequately compensate for diesel inefficiency, and cost of maintenance of diesel due to minimal diesel stress
- The more capital invested in RE can also burden production costs as the assets will have to be depreciated
- The key is to find the sweet spot for the right level of RE investment

Thank you

The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern, layered effect on the right side of the slide.

Name: Christopher Igem

Position: Electrician

Training In Okinawa Japan On Diesel Power Generation

The Training was On Diesel Power Generator Overhaul and was held in Kumejima Island one of Okinawa Outer Island



- At Okinawa International Center (OIC) we were introducing our self's to our translators and the JICA expert team.
- Presenting our country report to JICA Expert team.
- Brief on basic safety measures before going to the Island were the training actually took place.
- Distribution of our safety equipment's.

The training was conducted by:

Okinawa Enetech Co., Inc.

Okiden Kigyo Co.,Ltd

Okinawa Electric Power Company. Inc.

Okinawa Enetech Co., Inc and Okiden Kigyo Co.,Ltd
are private companies that were contracted by Okinawa
Electric Company. Inc



- On October 1st 2018 at around 7:00am We flew to Kumejima Island where the training actually took place
- From the air port straight to Kumejima Power station
- On this day was mostly Orientation and tour of the Power Station and Plant layout

D/G overhaul training in Kumejima Island Okinawa



Daihatsu Engine

1000kw

600rpm

- The engine was over 50yrs in service and still running very smooth

We were divided up into two groups

Electrician



Mechanic



A photograph of an electrical control panel or switchgear. Several thick copper cables are connected to terminals on a metal frame. Each cable is secured with a red plastic safety cap or tape. The cables are bundled together and run vertically. The background shows more of the equipment and some wiring. The text is overlaid on the bottom right of the image.

Before contacting any inspection
there as to be more than one person
checking to make sure its properly
grounded or Tag out with Red Tape

Because of the contract deadline
we were mostly observing the
work



Hands on simulation



They brought in some equipment's similar to what they have on the engine for hands on while the work was ongoing

For the electricians These are some of the things we did



- Main Circuit Breaker test and cleaning



- Wiring Sequence



Testing of RTD and Thermocouple with boil water



How to Test Relay Timer with special instrument



Cleaning Alternator winding with special chemical



Testing and Calibrating Pressure gage



- While doing tests or wiring sequences the other works were on going so we missed some of them.
- Within that time frame the things we learned are:
 - a) Wiring sequences
 - b) Test of Timer Relay or Measuring Instrument
 - c) How to test RDT and Thermocouple & the differences
 - d) Inspect, cleaning & Testing of Main circuit Breaker
 - e) Test and Calibrating of Pressure Gage
 - f) How to use those special instruments
 - g) Proper way of cleaning Alternator winding
 - h) Basic Single Block line diagram

Mechanic



Cylinder Head color check



Exhaust valve polishing & lapping



Installing Bearings



Measurement of Cylinder liner inner diameter



Valve Measurement



Crankshaft Deflection measurement before disassembly



Cylinder head disassembly, Explosion surface and washing



Cylinder Liner extraction



Piston parts measurements

- Piston outer diameter
- Piston Pin outer diameter
- Piston Boss inner diameter
- Piston Ring butting gap measurement



For the Mechanics these are some of those they learn

- How to measure Piston parts
- Proper way of extracting Cylinder Liner
- Cylinder Head disassembly, explosion surface & washing
- Crankshaft Deflection measurement before disassembly
- Valve Measurement
- Cylinder Head color check
- Exhaust valve polishing & lapping
- Bearing Installation
- Cylinder liner inner diameter

Any ????? *So far*

Kammagar and Thank you

Remote Training

6.2.2 Minutes of the 1st Meeting with Managers

1 st Minutes of Discussion with Managers (YAP)	
Date	Wednesday, July 8, 2020 14:00~15:00
Venue	Okinawa Enetech Conference Room (via Zoom) YSPSC (Yap): Head Office Conference Room and individual PCs
Attendees	JICA Headquarters: Mr. Ogawa
	Okinawa Enetech: Mr. Kakefuku, Mr. Shimabuku, Mr. Hokama (rec), Mr. Nakamura, Mr. Gaja, Mr. Hashimoto Observers: Mr. Fujita, Director Shinjo
	SMAECO: Mr. Masaru Miyagi
	YSPSC: GM Faustino Yangmog, Assistant GM Victor Nabeyan, PS Manager Alphonsus Ruwema, Engineering Manager John A. Chieng, FSM Department of Resources and Development: Ms. Vanessa Fread
Materials	• 0. Agenda • 1. PO HPGS (FSM) • 2. DG Remote Training Report Yap, Chuuk • 3. RE Remote Training Report Yap, Chuuk • 4. Remote Training Schedule for Yap • 5. Training Curriculum (DG & RE) • 6. DG Remote Training Time Schedule • 7. RE Remote Training Time Schedule
Minutes	
1. Greetings (14:05~14:10) Mr. Ogawa, Mr. Faustino 2. Plan of Operation (PO) (14:10~14:30) • We are planning to have each state participate to the OH in Kosrae. (Kakefuku) • We want to compare the specific fuel consumption before and after OH, so please measure it monthly. (Kakefuku) • We will send you a performance ratio calculation form, so please measure it monthly. (Kakefuku) • Please update the O&M manual according to the standards in YAP. (Mr. Ogawa) • We would like to check the contents of YAP O&M manual with you in the next remote training session. (Kakefuku) 3. Remote Training Report (14:30~14:45) • The maximum WT penetration is approx. 60 to 70%, but the average value is about 22%. The frequency standard is 50 ± 1 Hz, but it is controlled at ± 0.5 Hz by the Hybrid Wizard. When it deviates from this, the RE output is curtailed. (Mr. Victor) 4. Next remote training session content (14:45~14:55) • Please send the schedule for the next training session in advance. (Mr. Faustino) → We will send both the schedule and lecture materials as soon as possible. (Kakefuku)	

5. Others

- Currently, we are conducting remote training since we cannot travel due to COVID-19, but even if travel restrictions are lifted in the future, due we have a plan to go YAP only 1 to 2 times, we are planning provide support through remote training and meetings. (Kakefuku)

→What are your thoughts on this plan? (Mr. Ogawa)

→ On-site hands-on training is preferable, but I think it's good to train online until travel resumes. (Mr. Faustino)

→ I agree. (Mr. Victor)

- We would like to improve the content of remote training in the future, but if you have any suggestions or requests, please let me know. (Kakefuku)

End

July 8th, 2020
JICA Expert team

Agenda for Zoom Meeting

1. Opening Remarks by JICA Expert Mr. Ogawa Tadayuki
2. Explanation and confirmation of the Plan of Operation (PO)
3. Overview of the Remote Training
 - Training participants
 - Training contents
 - Implementation status (WiFi, usability, request, etc.)
 - Next remote training contents
 - Request for specific lectures or training
4. Closing Remarks

Yap & Chuuk Remote Training Report			
Date	June 22, 2020 12:00-15:11		
Venue	Okinawa Enetech Conference Room (ZOOM meeting) and YSPSC (Yap): Head Office Meeting Room CPUC (Chuuk): Power Plant Conference Room		
Participants	JICA Headquarters: Mr. Ogawa, Mr. Osaki		
	Okinawa Enetech: Mr. Kakefuku, Mr. Hokama (record keeper), Mr. Hashimoto Observer: Mr. Shinzo, Mr. Fujita SMAECO: Masaru Miyagi Okinawa Electric Power Company: Nakachi, Shimabukuro Okiden Kigyo: Ken Miyagi KDTech: Watanabe		
	YSPSC: assistant GM Victor Nabeyan, Christopher Igem, Roroino Yarofaliut, Mr. Benet, Mr. Ricky		
	CPUC : Dennis Triana, Jimmy Reyes, Basiente Jr. Kintin		
First DG Remote Training (June)			
Training details are shown in the following table			
Order	Time	Educational content	Trainer
1	12:00~12:05	Opening remarks (Mr. Kakefuku, Mr. Ogawa, Mr. Osaki)	
2	12:05~12:15	Explanation of remote training	Kakefuku
3	12:15~12:50	Basic knowledge of DG (each system)	M.Miyagi
4	12:50~13:10	DG daily inspection (Pmax adjustment, setting adjustment, FO rack adjustment)	K.Miyagi Kakefuku
5	13:10~13:20	Break	
6	13:20~13:50	How to read electrical drawings (single line, three-line, sequence diagrams)	K.Miyagi
7	13:50~14:30	Specific fuel consumption calculation exercise	M.Miyagi
8	14:30~14:35	Break	
8	14:35~15:10	Other Explanation of next training session	Kakefuku
■ Q&A on each training topic ▪ Basic knowledge of DG (each system) Q: What is the difference between class A heavy oil and class C heavy oil? (Mr. Osaki) A: Class A heavy oil is similar to diesel oil used in Pacific countries. Class C heavy oil is cheaper than class A heavy oil. It is used in large diesel generators in Okinawa, and requires auxiliary equipment such as steam equipment and oil cleaner. (Kakefuku) Q: Is it OK to use air without using an air dryer in the air system? (Chuuk) A: If an air dryer is not used, moisture will promote rusting and deterioration of the equipment. (Nakachi)			

Q: Isn't seawater used as a coolant for cooling water? (Yap)

A: Normally, the radiator system of the primary cooling water is adopted, but in large diesel generators, seawater may be used as the coolant for the tertiary cooling water.
(Shimabukuro)

- DG daily inspection (Pmax adjustment, setting adjustment, FO rack adjustment)

Q: Can the Pmax of the Yap units be measured? (Kakefuku)

A: Pmax of Unit 7 (made in Germany) was measured during OH. (Yap)

Q: Unit 7 can only output 80%, so how should Pmax be adjusted? (Yap)

A: Adjust Pmax when the output is as high as possible. (Ken Miyagi)

■ Confirmation items

- Requested submission of the specific fuel consumption record sheet. (Kakefuku) → OK.
(Chuuk, Yap)
- Requested update of the O&M manual. (Kakefuku) → OK. (Chuuk, Yap)
- Regarding OH schedule. (Kakefuku) → It will be next month or the month after, but not yet decided due to COVID-19. (Yap) Caterpillar engine major OH is scheduled for September 2020, and the remaining two OH are scheduled for June or July 2021. (Chuuk)
- Requested an update of the power plant improvement plan sheet to be sent. (Mr. Ogawa) → OK. (Chuuk, Yap)
- Please let us know if you have any requests for topics for the next training session. (Kakefuku) → Nothing in particular. (Chuuk, Yap)

■ Other thoughts on remote training

- The connection was good, and the materials were clearly visible. Please share the materials for calculating the specific fuel consumption. (Chuuk)
- Nothing in particular. (Yap)
→ It was difficult to hear your voices, so please prepare a microphone next time and place it near you. (Kakefuku)

End

Training Report			
Date	Monday, June 29, 2020 12:00-15:00		
Venue	• Okinawa Enetech Conference Room • YSPSC (Yap): Head Office Conference Room • CPUC (Chuuk): Power Plant Conference Room (Conducted via ZOOM web conferencing system)		
Attendees	JICA Headquarters: Mr. Ogawa, Mr. Osaki JICA Micronesia Branch: Mr. Takeda		
	Okinawa Enetech: Mr. Kakefuku, Mr. Shimabuku, Mr. Gaja, Mr. Hashimoto, Mr. Nakamura (record keeper) Observer: Mr. Fujita Okinawa Electric Power Company: : Mr. Taira Okinawa Kobori Electric: Mr. Yonashiro KD Tech: Mr. Watanabe		
	YSPSC: Jacob J. Choay, John A. Chieng, Mario Sukulbech, Sebastian S. Marleyang CPUC: Francis Albert, Limus Setik,		
Training Materials	• 1-1. Remote training schedule for Yap & Chuuk • 1-2. RE Remote Training Time Schedule • 2. Basic knowledge of Hybrid Power Generation System (HPGS) • 3-1. Performance Ratio • 3-2. Performance Ratio (Baseline) • 4. Basic knowledge for formulating and updating the hybrid power generation planning manual • 5-1. Operation and maintenance of renewable energy facilities • 5-2. I-V curve graph for FSM • 5-3. FSM record sheet • 6-1. Remote Training RE O&M Comprehension Test (Practice Questions)		
1 st Remote Training (June)			
1. Schedule			
Training details are shown in the following table.			
Order	Time	Educational content	Instructor
1	12:00-12:10	Explanation of remote training	Kakefuku, Shimabuku
2	12:10-13:20	Basic technology of hybrid power generation system (HPGS)	Shimabuku
3	13:20-13:40	Performance ratio measurement status	
4	13:40-13:50	Break	
5	13:50-14:30	4. Basic knowledge for formulating and updating the hybrid power generation planning manual	Taira
6	14:30-14:40	Break	
7	14:40-14:55	PV Maintenance Q&A	Yonashiro
8	14:55-15:10	RE Remote Training Closing	Shimabuku

2. Confirmation items

(a) Confirmation of training content, Q&A, etc.

(1) Basic technology of hybrid power generation system (HPGS)

- The role of "Watt-hour meter for sales" in the PV system diagram
 - Measures the amount of PV generated power fed to the grid. It is used to calculate electricity sales.
- For Yap's retractable wind turbines (three units), it is not yet clear whether they are feasible since they have not been in operation very long. Furthermore, there is currently no trade winds, so the output is about 5% of the rated output.
- It was confirmed that the "Hybrid Wizard" operated by Yap can also automatically start diesel generators.

- Chuuk confirmed that it uses an automated power distribution system. When a power failure occurs, the distribution line can be automatically disconnected.
- It was confirmed that the lower output limit of diesel generators is set at 30% for both Yap and Chuuk.
- The RE penetration rate is high at 50 to 70%, so is YAP using a storage battery system as a countermeasure for when the RE output suddenly drops?
 - We have no storage battery (Yap)
- What is the WT penetration rate?
 - 60%~70%. (Yap)
- Do DGs need to be stopped as a measure for the lower output limit when PV output is high? (Chuuk)
 - We curtail PV and WT output. (Yap)

- Are there other ways to increase RE penetration? (Mr. Ogawa)
 - Using high-speed engines is a potential countermeasure for further integrating RE.
 - Since some diesel engines such as low-load diesel engines can be operated at low loads, you may want to consider it when deploying diesel generators in the future.
 - Although measures may be taken by deploying storage batteries, it may be better to consider whether or not curtailing output is more economical before making a decision.
 - In the case of Hateruma Island (Okinawa), we considered curtailing output, but it would have required excess curtailment, so the MG set was deployed as a countermeasure instead for economic reasons.
 - Furthermore, there are many types and functions of batteries, so it is necessary to study them carefully for your required application. (Fast response, capacity, etc.)
 - We would like to introduce a case study of storage battery selection in Okinawa in a future training session.

- In order to reduce PV output curtailment, PV has been distributed to the extent possible (across several feeders). There is a plan to deploy 1.7 MW of PV funded by

the WB in the future, and it is planned to connect it to one feeder. In terms of operation, is it better to simply curtail the output? Or is there a better way? (Chuuk)
→ First, consider what kind of problems will occur after the deployment. For example, voltage rise and power flow calculation (soundness of cable specifications) are areas for consideration. Therefore, if the grid connection near the PV site is difficult, it may be possible to use a dedicated line to transmit power to the power supply (power plant) bus. In Japan, voltage classes (low-voltage, high-voltage, extra high-voltage, etc.) are set, and it is standard practice to manage the voltage value on the higher voltage side.

- Chuuk does not have a transmission system. What should we do when deploying 1.7 MW of PV under these conditions? (Chuuk)

→ 1.7 MW is a relatively large capacity, so it is recommended to take appropriate measures such as installing transformation equipment (substation). It was confirmed that the 1.7 MW PV planned to be interconnected at 13.8 kV and that the maximum voltage is 25 kV in Chuuk.

→ I suggest you consider propose factors to consider for future project activities such as frequency fluctuations, the thermal capacity of cables, etc. (Mr. Ogawa)

(2) Performance ratio measurement status

- Yap and Chuuk each confirmed the base value of the target performance ratio for this project.
- What is the current status for Yap (66% PEC)?
→ The inverter overheated at one point, but since then there have been no issues, so it should be the same.
- What is the current status for Chuuk (Airport: 72%, PEC: 71%)
→ I received the latest data from Dennis, so I will check again.

(3) Basic knowledge for formulating and updating the hybrid power generation planning manual

- Target frequency value
→ Yap, Chuuk both: 60 ± 1.0 Hz.
- Target voltage (low-voltage) value
→ Yap: 95-105 V, 240 V
- Target voltage (high-voltage) value
→ Yap: 13.8 kV and 25 kV, Chuuk: 13.8 kV and 25 kV.

(4) Basic knowledge for formulating and updating the manual

- Maintenance frequency

Yap: Initially, we normally conduct it every month, but we haven't been able to do that recently since we have been busy.

Chuuk: We do it quarterly.

(b) Other

- The next remote training session will be held August 3, 2020 (Mon) 10:00-13:00.

3. Other thoughts on remote training

- Was able to connect to the ZOOM before the scheduled start time and start the training session smoothly.
- During conversations with Chuuk, it was difficult to hear at times. We proceeded by reconfirming.
- Regarding the prepared schedule, since the first half required more time than expected, time allocation was adjusted. The content of the second half will be covered from the next session onward.

On the other hand, giving priority to questions and communication during lectures and giving priority to communication were also major factors, but by doing so, we were able to avoid one-sided lectures.

- We request the core trainers chosen in the JCC to continue to participate in future training sessions.

- Yap / Chuuk Local training time 13:00-16:00 (3h) (JST + 1h)
- Training time in Japan : 12:00 to 15:00

DEG Training Curriculum		Phase-1	Phase-2																												Achievement rate			
Subject	Contents	2017 / 2018	2019	2020												2021												2022						
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR		MAY	JUN	
			North countries																															
			South countries																															
1. Basic Knowledge of DEG power generation	1	•Understanding of Diesel Generators type, structure, operation principle and characteristic.																													100%			
	2	•Diesel engine performance curve, efficiency during operation, heat balance diagram.																													100%			
	3	•Understanding of mechanical devices on Diesel power generation. Purpose, type, characteristics of each device.																														100%		
		1) Cylinder head, valves, rocker arm, pushing rod, springs																														100%		
		2) Piston, rings, connecting rod, pin																														100%		
		3) Cylinder liner																														100%		
		4) Crankshaft, camshaft, main bearings, fly wheel																														100%		
		5) Turbocharger																															100%	
		6) Governor																															100%	
		7) Intercooler (air, oil)																															100%	
	8) Pumps, radiators and others																															100%		
	4	•Understanding of electrical components on Diesel power generation. Purpose, type, characteristics etc. of each electrical panels, etc.																															100%	
		1) Generator & Exciter																															100%	
		2) Transformer																															100%	
		3) Circuit breaker																															100%	
		4) Control panel / alarms / CT, PT’ s																															100%	
		5) Power center, AVR, AFC, Synchronous board																															100%	
		6) Electrical drawings, single line diagram																															100%	
		7) Device number / protection relays																															100%	
	8) Others electrical components																																100%	
5	•Understanding of each utilities in diesel power plants																															100%		
	1) Fuel System																															100%		
	2) Lubricant oil system																															100%		
	3) Cooling water																															100%		
	4) Air system																															100%		
	5) Exhaust gas																															100%		
2. Operation of DEG’ s	1	•Operation and control method of diesel power generation facilities (governor free, automatic control devices, etc.)																														100%		
	2	•Operating Procedure of Diesel Power Plant																															100%	
		1) Operation precautions																															100%	
		2) Patrol inspection																															100%	
	3	•Supply and Demand Management																															100%	
		1) Efficient operation																																

JICA Project for Introduction of Hybrid Power Generation System in the Pacific Island Countries

2nd (July) DG Remote Training Time Schedule

Time	Training Contents	Duration	Trainer	Items	Remark
13:00～14:10	1.Explanation of Remote training contents	10min	Mr. Kakefuku	Training process chart Time schedule	
	2.How to use measuring instruments (calipers, micrometer, dial gauge)	30min	Mr. K. Miyag Mr. Oshiro	How to Use Measuring Instruments How to read a Vernier Caliper (Video) How to read a Micrometer (Video)	
	3.Practice in the use of electrical measuring instruments (RTD, TC, pressure gauge)	30min	Mr. Oshiro Mr. K. Miyagi	Maintenance of diesel generators (Electrical side)	
14:10～14:20	Break time	10min			
14:20～14:50	4. Explanation of daily check sheet (daily, weekly, monthly)	30min	Mr. M. Miyagi		
14:50～15:20	5. Explanation of actual PUB power plant operation	30min	Mr. Nakachi Mr. Shimabukuro		
15:20～15:30	Break time	10min			
15:30～16:00	Specific fuel consumption measurement status (June data)	30min	Mr. Kakefuku		
	Revision of O&M Manual		Mr. Kakefuku		
	Confirm preparation status of OH		Mr. Kakefuku		
	Power plant improvement status		Mr. Kakefuku		
	Request for power plant operation data (June data)		Mr. Nakachi Mr. Shimabukuro		
JICA Experts Team members	Okinawa Enetech: Mr. Kakefuku, Mr. Hokama Sumaeco: Mr. M. Miyagi Okinawa Electric Power: Mr. Nakachi, Mr. Shimabukuro Okiden kigyo: Mr. K. Miyagi, Mr. Oshiro				

* During the training, time allocation will be prioritized for questions and discussion.

* If there is any training content that could not be covered within the set time, we will consider transferring it to later training sessions.

JICA Project for Introduction of Hybrid Power Generation System in the Pacific Island Countries

2nd (June 2020) RE Remote Training Time Schedule (draft)

Time	Training content	duration	Trainer	Material used	Remarks
13:00-13:10	1. RE Remote Training Orientation	10 min	Shimabuku		
13:10-14:10	(RE Integration Plan) 3. Basic knowledge for formulating and updating the hybrid power generation planning manual • Frequency fluctuation (algebraic method, detailed simulation) • TBD	60 min	Shiohama Taira	(PowerPoint text documents)	
14:10-14:20	Break	10 min			
14:20-15:20	(RE O&M) 3. Basics of formulating and updating manual • Explanation of facility system configuration, O&M • Patrol inspection and periodic inspection • Daily inspection, periodic inspection • Inspection check sheet formulation and recording (method, frequency, etc.) * Measurement data analysis and evaluation method (String Tracer) * Inspection report preparation/storage method	60 min	Nakamura Ikehara Yonashiro	Excerpts from past training texts (REO&M) (PowerPoint text) • Create I-V curves using String Tracer data (Excel file)	*Verification of operating conditions
	(RE O&M) 4. Basics of formulating and updating manual 2 • Lecture review quiz			Problems and answers/explanation (PowerPoint)	Q&A
15:20-15:30	Break	10 min			
15:30-16:00	(RE common field) 5. Performance ratio • Overview and measurement method summary • Current status check, evaluation/verification	20 min	Shimabuku	Performance ratio-related data	Interactive
	6. RE Remote Training Closing • Questions, exchange views, etc.	10 min	Shimabuku		
Attendees	Okinawa Enetech: Shimabuku, Nakamura, Gaja Okinawa Electric Power Company: Shiohama, Taira Okinawa Kobori Electric: Ikehara, Yonashiro				

* During the training, time allocation will be prioritized for questions and discussion.

* If there is any training content that could not be covered within the set time, we will consider transferring it to later training sessions.

6.2.3 Minutes of the 2nd Meeting with Managers

2 nd Minutes of Discussion with Managers (Yap)	
Date	September 10, 2020 14:00-15:00
Venue	Okinawa Enetech Conference Room (via Zoom) YSPSC (Yap): Head Office Conference Room and individual PCs
Attendees	JICA Headquarters: Mr. Ogawa JICA Micronesia Branch: Mr. Takeda
	Okinawa Enetech: Mr. Kakefuku, Mr. Shimabuku, Mr. Hokama, Mr. Nakamura, Mr. Gaja, Mr. Hashimoto OEPC: Mr. Kuniba SMAECO: Mr. Miyagi KD Tech: Mr. Watanabe
	YSPSC : GM Faustino Yangmog, Assistant GM Victor Nabeyan, PS Manager Alphonsus Ruwema, Engineering Manager John A. Chieng,
Materials	• 1. Agenda(Yap)_20200910 • 2. PO_HPGS(FSM)_ver5.1 • 3. 【Yap】 Summary_of_Remote_Training_20200909 • 【Attachment3-1】 Remote_training_schedule_(Results)Yap_20200909 • 【Attachment3-2】 Remote_training_participant_list(Yap)_20200909 • 【Attachment3-3】 Meeting_minutes_with_managers_(Yap)_2020.7.8 • 【Attachment3-4】 DG_Remote_Training_2nd_Report_Yap&Chuuk • 4. DG_RE_Remote_Training_Schedule_(draft)_Yap_Chuuk_20200909rev1
Minutes	
1. Greetings and roll call (14:00-14:10) Ogawa, Faustino 2. Explanation of Plan of Operation (PO) (14:10-14:20) • No confirmation items 3. Outline of remote training (14:20-14:40) • Prepare a revised draft of the manual. (Kakefuku) → Is there a schedule for the revision work? (Faustino) → All chapters are to be revised by the end of the project. First, we have instructed through remote training to revise Chapters 1 and 2 of the DG O&M Manual and Chapter 1 of the RE O&M Manual by the end of September. Please share the files you are working via OneDrive. (Kakefuku) → OK. (Faustino, John) • There were cases where some of the subjects did not participate in the remote training. (Kakefuku) → We ask you to encourage attendance when possible. (Faustino) 4. Confirmation items (14:40-14:55) Progress of power plant improvement plan • Please upload and share the progress of the power plant improvement plan via OneDrive. Please share the photos and check sheets for the status of the facilities.	

(Kakefuku)

OH Schedule

- Please provide information on the OH schedule. (Kakefuku)
 - Isn't FSM's OH training planned only for Kosrae? (Ogawa)
 - I want to check it for reference. (Kakefuku)

2020 JCC Meeting

- We are considering conducting the JCC meeting in 2020 remotely with Zoom. Is that OK? (Kakefuku)
 - No, I think it's a good idea. (Faustino, Victor)
 - If any subjects arise that should be discussed in the JCC by March 2021, it will be held in 2020 (JFY), but if there is not, could we hold it in 2021 (JFY)? (Ogawa)
 - OK. (Faustino, Victor)

2nd Regional Training

- The 2nd Regional Training is scheduled for around May or June 2021. If we cannot travel due to the cancellation of the flights at that time, training will be conducted remotely. Although hands-on training is not possible remotely, the advantage is that many participants can participate. (Ogawa)
 - OK. (Faustino, Victor)

Impact of COVID-19

- Please tell me about the status of Yap regarding COVID-19 (coronavirus). (Kakefuku)
 - We are currently locked down, but no one has been infected thus far. However, because Guam is near, I am afraid of infections spreading from Guam. (Faustino)

5. Closing remarks (14:55-15:00) Ogawa, Faustino, Victor

End

September 10, 2020
JICA Expert team

Zoom Meeting Agenda ▪ FSM (YAP)

1. Opening Remarks by JICA Expert Mr. Ogawa Tadayuki
2. Explanation and confirmation of the Plan of Operation (PO)
3. Summary of remote training
4. Confirmation topics
 - 4.1 Progress of power plant improvement plan
 - 4.2 Overhaul schedule
 - 4.3 Holding of FY 2020 JCC Meeting (remote)
 - 4.4 Holding of the 2nd Regional Training
 - 4.5 Impact of COVID-19
5. Closing remarks

Plan of Operation (PO)

Project Title: The Project for Introduction of Hybrid Power Generation System in Pacific Island Countries
Project Term: March 2017 - June 2022 (Phase 1: March 2017 – February 2019 , Phase 2: March 2019 – June 2022)
Country: Federated States of Micronesia
Target Area: Pohnpei, Chuuk, Yap and Kosrae
Target Group: Related engineers and other technical staff in the target area (DRD, PUC, KUA, CPUC, YSPSC)

[illegible]

Summary of Remote Training (YAP)

1. Training schedule (results)

Remote training was divided into DG training and RE training, and each was conducted three times (for details, see Attachment 1).

2. Participating organizations

Zoom was used to connect the Japanese side with the target countries.

Japan	Target Countries						
	Tuvalu	Kiribati	YAP	Chuuk	Pohnpei	Kosrae	Marshall
JICA Expert Team	TEC, etc. MTET TMTI	PUB MISE	YSPSC	CPUC	PUB	KUA	MEC KAJUR NEO

3. Participants

The number of participants was as follows (mainly core trainers) (see Appendix ② for details of participants).

- ① 1st Remote Training Session (DG and RE)
DG: 4 people RE: 4 people
- ② 2nd Remote Training Session (DG and RE)
DG: 7 people RE: 4 people
- ③ 3rd Remote Training Session (DG and RE)
DG: 9 people RE: 3 people RE (continuation of 3rd session): 3 people

4. Training content (topics)

The 1st to 3rd remote training sessions were conducted with a focus on reviewing the content of the training conducted in FY 2019.

1 st Remote Training Session	
DG Training	RE Training
(1) Training schedule	(1) Training schedule
(2) Basic knowledge of DG (each system)	(2) Basic technology of hybrid power generation system (HPGS)
(3) DG daily inspection (Pmax adjustment, setting adjustment, FO rack adjustment)	(3) Performance ratio measurement status
(4) How to read electrical drawings	(4) Basic knowledge for formulating and

(single line, three-line, sequence diagrams) (5) Specific fuel consumption calculation exercise	updating the hybrid power generation planning manual
--	--

2 nd Remote Training Session	
DG Training	RE Training
(1) How to use measuring instruments (Vernier calipers, micrometer, dial gauge) (2) How to use electrical measuring instruments (RTD, TC, pressure gauge) (3) Power plant operation (4) Confirmation of power plant improvement status	(1) Frequency fluctuation (system constant, algebraic method) (2) Basics of formulating and updating RE O&M manual • Explanation of facility system configuration and O&M • Patrol inspection and periodic inspection • Inspection check sheet formulation and recording (method, frequency, etc.) • Review questions and answers (3) Performance ratio • Overview and summary of measurement method • Confirmation, evaluation, and verification of the current situation

3 rd Remote Training Session	
DG Training	RE Training
(1) Revision of O&M Manual (2) DG maintenance (mechanical) (3) Fuel tank inspection (4) Specific fuel consumption measurement status (5) Power plant improvement items (6) OH status (7) Power plant operation data	(1) Revision of Manual (2) Q&A on frequency fluctuation (system constant, algebraic method) (3) Q&A related to RE O&M (4) Performance ratio (5) PV facility inspection

5. Benefits of Remote Training

- Participation is possible regardless of location.
- Since there is no need to be on-site, travel expenses will be reduced.
- With on-site training, we can only meet with each country about twice a year, but remote training, we can conduct one training session per month (more frequent communication).

6. Challenges of Remote Training

- It is difficult to grasp the level of understanding of all participants.
 - * With on-site training, we can grasp the understanding of each core trainer by observing his/her reaction
- It is difficult to have a one-on-one dialogue with each core trainer.
- It is difficult to provide detailed support through remote training.
- It requires getting acquainted with operating equipment such as PCs.
- While it is possible to remotely explain the handling of measuring instruments, etc. However, since we are not showing them how to operate the existing equipment on-site, it is unclear whether they can operate the instruments with remote training. ("Listening" and "doing" are different.)
- While in the on-site training, a comprehension test was conducted each in session, it is difficult to conduct a test for each individual remotely.
- If connectivity is poor, the audio and video will be interrupted.
- Training time is limited to 3 hours due to the time difference between Japan and the target countries.

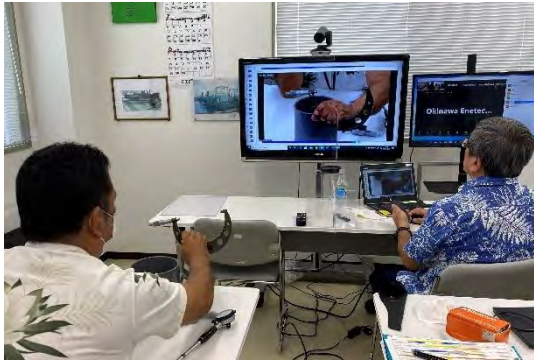
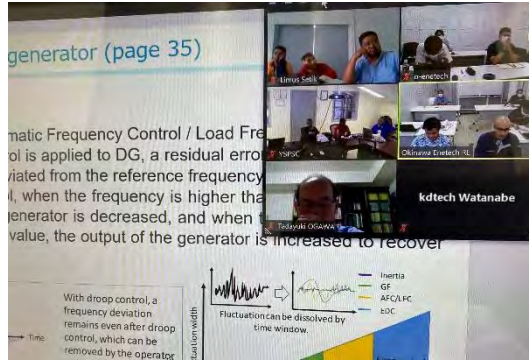
7. Requests to target countries

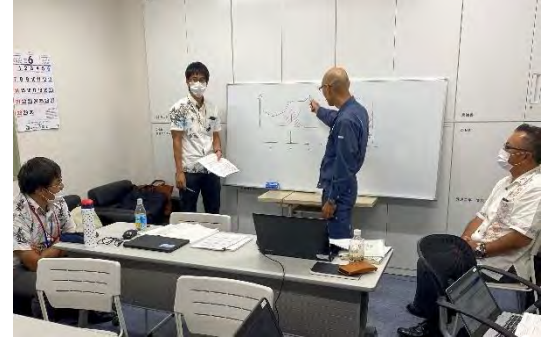
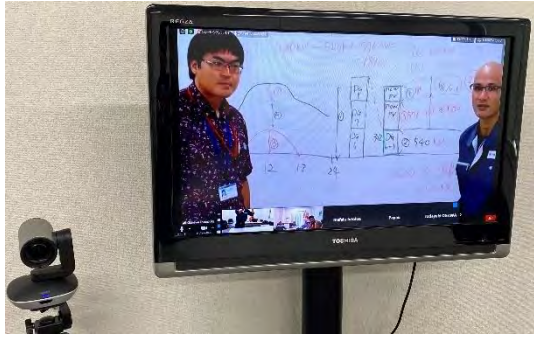
- We request management to encourage core trainers to participate interactively. If a core trainer cannot join, please let us know in advance. In particular, the following core trainers have a low attendance rate.
 - Mr. Alphonsus Ruwema
 - Mr. Roscoe Tamag
 - Mr. Chaem Charles Laman
 - Mr. Sebastian S. Marleyang
- Request participants to actively comment and ask questions.
- Request participants to take initiative in revising the manual.

8. Other thoughts on remote training

- Since the training was often delayed due to participants did not gathering at scheduled time, we request participants to be on time.

- Since some core trainers were not able to participate due to work circumstances, please let us know in advance if they will be absent.
- 60% of the remote training thus far was a review of the lectures given in the past, but we will cover new topics in future training sessions. In these sessions, we will ask questions and take other measures to ensure that the instructor does not give a one-way lecture. In addition, regarding texts, we will consider methods that make it easy for participants to understand the content by utilizing more photos and videos.

	
Remote Training	Explanation using equipment parts
	
Measuring instrument demonstration	Training participants
	
Discussion	Communication through interpreter



Exercise using whiteboard (Zoom image is left image)

End

Fiji
Kiribati
Tuvalu
Micronesia
RMI

JICA Project for Introduction of Hybrid Power Generation System in the Pacific Island Countries

DG/RE Training Schedule (draft)

June							
Day/Date	Sun	Mon	Tue	Wed	Thu	Fri	Sat
		6/1	6/2	6/3	6/4	6/5	6/6
DG		Schedule coordination w/each country	Schedule coordination w/each country	Schedule coordination w/each country	Schedule coordination w/each country	Schedule coordination w/each country	
RE							
	6/7	6/8	6/9	6/10	6/11	6/12	6/13
DG		Schedule coordination w/each country	Schedule coordination w/each country	Schedule coordination w/each country	Schedule coordination w/each country	Schedule coordination w/each country	
RE							
	6/14	6/15	6/16	6/17	6/18	6/19	6/20
DG							
RE							
	6/21	6/22	6/23	6/24	6/25	6/26	6/27
DG		FSM Yap, Chuuk (DG) 13:00~16:00 (JST12:00~15:00)	Holidays				
RE							
	6/28	6/29	6/30				
DG		FSM Yap, Chuuk (RE) 13:00~16:00 (JST12:00~15:00)					
RE							
	Jul						
				7/1	7/2	7/3	7/4
DG							
RE							
	7/5	7/6	7/7	7/8	7/9	7/10	7/11
DG				Discussion w/managers of Yap YSPC 15:00~16:00 (JST14:00~15:00)	Discussion w/managers of Chuuk CPUC 15:00~16:00 (JST14:00~15:00)		
RE							
	7/12	7/13	7/14	7/15	7/16	7/17	7/18
DG							
RE							
	7/19	7/20	7/21	7/22	7/23	7/24	7/25
DG					Japanese Holiday	Japanese Holiday	
RE							
	7/26	7/27	7/28	7/29	7/30	7/31	
DG		FSM Yap, Chuuk (DG) 13:00~16:00 (JST12:00~15:00)					
RE							
	Aug						
							8/1
DG							
RE							
	8/2	8/3	8/4	8/5	8/6	8/7	8/8
DG		FSM Yap, Chuuk (RE) 13:00~16:00 (JST12:00~15:00)	Kosrae Holiday				
RE							
	8/9	8/10	8/11	8/12	8/13	8/14	8/15
DG		Japanese Holiday					
RE							
	8/16	8/17	8/18	8/19	8/20	8/21	8/22
DG							
RE							
	8/23	8/24	8/25	8/26	8/27	8/28	8/29
DG		FSM Yap, Chuuk (DG) 13:00~16:00 (JST12:00~15:00)					
RE							
	8/30	8/31					
DG		FSM Yap, Chuuk (RE) 13:00~16:00 (JST12:00~15:00)					
RE							
	Sep						
			9/1	9/2	9/3	9/4	9/5
DG				Okinawa Holiday			
RE							
	9/6	9/7	9/8	9/9	9/10	9/11	9/12
DG		Supplementary lecture:FSM Yap & Chuuk (RE) 13:00~14:00 (JST12:00~13:00)			Discussion w/managers of Yap YSPC 15:00~16:00 (JST14:00~15:00)	Discussion w/managers of Chuuk CPUC 15:00~16:00 (JST14:00~15:00)	
RE							
	9/13	9/14	9/15	9/16	9/17	9/18	9/19
DG							
RE							
	9/20	9/21	9/22	9/23	9/24	9/25	9/26
DG							
RE							
	9/27	9/28	9/29	9/30			
DG							
RE							
	10月						
					10/1	10/2	10/3
DG							
RE							
	10/4	10/5	10/6	10/7	10/8	10/9	10/10
DG							
RE							
	10/11	10/12	10/13	10/14	10/15	10/16	10/17

DG							
RE							
	10/18	10/19	10/20	10/21	10/22	10/23	10/24
DG		FSM Yap, Chuuk (DG) 13:00～16:00 (JST12:00～15:00)					
RE							
	10/25	10/26	10/27	10/28	10/29	10/30	10/31
DG							
RE							
	11月						
	11/1	11/2	11/3	11/4	11/5	11/6	11/7
DG		Fiji holiday 予告者誕生祭	FSM Holiday インディペンステイ				
RE							
	11/8	11/9	11/10	11/11	11/12	11/13	11/14
DG		FSM Yap, Chuuk (RE) 13:00～16:00 (JST12:00～15:00)					
RE							
	11/15	11/16	11/17	11/18	11/19	11/20	11/21
DG		Fiji Holiday ディーワーリー					
RE							
	11/22	11/23	11/24	11/25	11/26	11/27	11/28
DG							
RE							
	11/29	11/30					
DG							
RE							
	12月						
			12/1	12/2	12/3	12/4	12/5
DG					Disoussion w/managers of Yap YSPC 15:00～16:00(JST14:00～15:00)	Marshall Holiday ゴスペルデイ	
RE							
	12/6	12/7	12/8	12/9	12/10	12/11	12/12
DG		Disoussion w/managers of Chuuk CPUC 15:00～16:00(JST14:00～15:00)				Kiribati Holiday 人権と平和の日	
RE							
	12/13	12/14	12/15	12/16	12/17	12/18	12/19
DG							
RE							
	12/20	12/21	12/22	12/23	12/24	12/25	12/26
DG					クリスマスイブ	クリスマス	
RE							
	12/27	12/28	12/29	12/30	12/31		
DG			年末休み	年末休み	大晦日		
RE							
	1月						
						1/1	1/2
DG						正月	
RE							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9
DG							
RE							
	1/10	1/11	1/12	1/13	1/14	1/15	1/16
DG		成人の日 Japanese Holiday					
RE							
	1/17	1/18	1/19	1/20	1/21	1/22	1/23
DG		FSM Yap, Chuuk (DG) 13:00～16:00 (JST12:00～15:00)					
RE							
	1/24	1/25	1/26	1/27	1/28	1/29	1/30
DG							
RE							
	1/31						
DG							
RE							
	2月						
		2/1	2/2	2/3	2/4	2/5	2/6
DG							
RE							
	2/7	2/8	2/9	2/10	2/11	2/12	2/13
DG		FSM Yap, Chuuk (RE) 13:00～16:00 (JST12:00～15:00)			建国記念日 Japanese Holiday		
RE							
	2/14	2/15	2/16	2/17	2/18	2/19	2/20
DG							
RE							
	2/21	2/22	2/23	2/24	2/25	2/26	2/27

DG			天皇誕生日 Japanese Holiday				
RE							
	2/28						
DG							
RE							
	3月						
		3/1	3/2	3/3	3/4	3/5	3/6
DG					Discussion w/managers of Yap YSPC 15:00~18:00(JST14:00~15:00)		
RE							
	3/7	3/8	3/9	3/10	3/11	3/12	3/13
DG		Discussion w/managers of Chuuk CPUC 15:00~18:00(JST14:00~15:00)					
RE							
	3/14	3/15	3/16	3/17	3/18	3/19	3/20
DG							
RE							
	3/21	3/22	3/23	3/24	3/25	3/26	3/27
DG							
RE							
	3/28	3/29	3/30	3/31			
DG							
RE							

- Local training time 13:00-16:00 (3h)
- Japan training time

12:00 to 15:00 (JST + 1h) Yap, Chuuk
11:00-14:00 (JST + 2h) Pohnpei, Kosrae
10:00-13:00 (JST + 3h) Fiji, Tuvalu, Kiribati, RMI

Remote training schedule (Results)

① 1st Remote training : June 17, 2020 - July 1, 2020

●:conducting date

Trainings	Date	Tuvalu	Kiribati	Micronesia				Marshall
				Yap	Chuuk	Pohnpei	Kosrae	
DG	6/17		●					
	6/18	●						
	6/22			●	●			
	6/24					●	●	
DG・RE	6/25		● (RE)					● (DG)
RE	6/26	●						
	6/29			●	●			
	7/1					●	●	●

② 2nd Remote training : July 21, 2020 - August 6, 2020

●:conducting date

Trainings	Date	Tuvalu	Kiribati	Micronesia				Marshall
				Yap	Chuuk	Pohnpei	Kosrae	
DG	7/21	●						
	7/22		●					
	7/27			●	●			
	7/28						●	
DG・RE	7/29	● (RE)						● (DG)
	7/30		● (RE)			● (DG)		
RE	8/3			●	●			
	8/5					●		
	8/6						●	●

③ 3rd Remote training : August 19, 2020 - September 9, 2020

●:conducting date

Trainings	Date	Tuvalu	Kiribati	Micronesia				Marshall
				Yap	Chuuk	Pohnpei	Kosrae	
DG	8/19		●					
	8/20	●						
	8/24			●	●			
	8/25					●	●	
RE	8/26		●					
	8/27	●						
	8/31			●	●			
	9/3							●
	9/4		● (additional)					
	9/7			● (additional)	● (additional)			

Minutes of Discussion with Managers (YAP)	
Date	Wednesday, July 8, 2020 14:00~15:00
Venue	Okinawa Enetech Conference Room (via Zoom) YSPSC (Yap): Head Office Conference Room and individual PCs
Attendees	JICA Headquarters: Mr. Ogawa
	Okinawa Enetech: Mr. Kakefuku, Mr. Shimabuku, Mr. Hokama (rec), Mr. Nakamura, Mr. Gaja, Mr. Hashimoto Observers: Mr. Fujita, Director Shinjo
	SMAECO: Mr. Masaru Miyagi
	YSPSC: GM Faustino Yangmog, Assistant GM Victor Nabeyan, PS Manager Alphonsus Ruwema, Engineering Manager John A. Chieng, FSM Department of Resources and Development: Ms. Vanessa Fread
Materials	• 0. Agenda • 1. PO HPGS (FSM) • 2. DG Remote Training Report Yap, Chuuk • 3. RE Remote Training Report Yap, Chuuk • 4. Remote Training Schedule for Yap • 5. Training Curriculum (DG & RE) • 6. DG Remote Training Time Schedule • 7. RE Remote Training Time Schedule
Minutes	
1. Greetings (14:05~14:10) Mr. Ogawa, Mr. Faustino 2. Plan of Operation (PO) (14:10~14:30) • We are planning to have each state participate to the OH in Kosrae. (Kakefuku) • We want to compare the specific fuel consumption before and after OH, so please measure it monthly. (Kakefuku) • We will send you a performance ratio calculation form, so please measure it monthly. (Kakefuku) • Please update the O&M manual according to the standards in YAP. (Mr. Ogawa) • We would like to check the contents of YAP O&M manual with you in the next remote training session. (Kakefuku) 3. Remote Training Report (14:30~14:45) • The maximum WT penetration is approx. 60 to 70%, but the average value is about 22%. The frequency standard is 50 ± 1 Hz, but it is controlled at ± 0.5 Hz by the Hybrid Wizard. When it deviates from this, the RE output is curtailed. (Mr. Victor) 4. Next remote training session content (14:45~14:55) • Please send the schedule for the next training session in advance. (Mr. Faustino) → We will send both the schedule and lecture materials as soon as possible. (Kakefuku)	

5. Others

- Currently, we are conducting remote training since we cannot travel due to COVID-19, but even if travel restrictions are lifted in the future, due we have a plan to go YAP only 1 to 2 times, we are planning provide support through remote training and meetings. (Kakefuku)

→What are your thoughts on this plan? (Mr. Ogawa)

→ On-site hands-on training is preferable, but I think it's good to train online until travel resumes. (Mr. Faustino)

→ I agree. (Mr. Victor)

- We would like to improve the content of remote training in the future, but if you have any suggestions or requests, please let me know. (Kakefuku)

End

2 nd DG Training Report (Yap & Chuuk)			
Date	July 27, 2020 12:00-14:50		
Venue	Okinawa Enetech Conference Room (via Zoom) YSPSC (Yap): Head Office Meeting Room CPUC (Chuuk): Conference Room		
Attendees	JICA Micronesia Office: Mr. Takeda		
	Okinawa Enetech: Mr. Kakefuku, Mr. Hokama (record keeper), Mr. Gaja Observer: Mr. Fujita SMAECO: Mr. Masaru Miyagi Okinawa Electric Power Company: Mr. Nakachi Okiden Kigyo: Mr. Ken Miyagi, Mr. Oshiro KD Tech: Mr. Watanabe		
	YSPSC: John Chieng, Christopher Igem, Rowno Yarofaliut, Castero Yithemang, Benneth Sermaeiling, Ricky Igelmanai, Syivester Mauemai		
	CPUC: Dennis Triana, Jimmy Reyes, Basiente Jr.Kintin		
Training Materials	• 1-1 Remote training schedule • 1-2 DG Remote Training Time schedule • 2 How to Use Measuring Instruments • 3-1 Thermocouple inspection • 3-2 Pressure gauge inspection • 3-3 Resistance temperature detector (RTD) inspection • 5-1.Improvement Plan Progress report (Yap) • 5-2.Improvement Plan Progress report (Chuuk) • 6-1.Power plant operation (Yap Dec2019) • 6-2.Power plant operation (Chuuk Aug2019)		
2 nd Remote Training (July)			
Training details are shown in the following table			
Order	Time	Educational content	Instructor
1	12:05-12:10	Greetings and explanation of training content	Kakefuku
2	12:10-12:35	How to use measuring instruments (Vernier calipers, micrometer, dial gauge)	Ken Miyagi
3	12:35-13:10	How to use electrical measuring instruments (RTD, TC, pressure gauge)	Oshiro
4	13:10-13:25	Break	
5	13:25-14:05	Revision of O&M Manual	Kakefuku Masaru Miyagi
6	14:05-14:15	Break	
7	14:15-14:25	Confirmation of power plant improvement status	Kakefuku
8	14:25-14:50	Power plant operation	Kakefuku Nakachi

■ Q&A on each training topic

- The deflection for American dial gauges is + on the right and - on the left, so the deflection is opposite for us. (Jimmy)
- Is the RTD not used for cooling water system? (Dennis)
 - RTD is mainly used for high temperatures such as exhaust gas temperature, lubricating oil temperature, bearing temperature, etc., but it may be used for cooling water.
- For the O&M manual revision, review the content of Chapters 1 Safety and Chapter 2 Basic principle, basics symbols, features, composition of DG (201901), and prepare a revised draft by the next training session. (Example: Unit MPa → PSI) → OK. (Yap, Chuuk)
- I sent you the data for the power plant improvement proposal last week, so please update it. (Kakefuku)
- During our last visit (February 2020), it was confirmed from the analysis of YAP power plant operation data that Unit 3 started and stopped frequently, and we recommended the deployment of batteries as a countermeasure. I also heard that you are planning to deploy a large-capacity storage battery. Has there been any progress? (Nakachi)
 - There was a problem when Unit 3 was first installed, but currently there is no problem. With regard to the deployment of a large-capacity battery, I heard that 1 to 2 MW will be deployed in Phase 2. (Yap, Christopher)
- Is there any difference in the operation of Chuuk's power plant since our last trip (August 2019)? (Nakachi)
 - Currently, one GE unit and one Caterpillar unit are used due to maintenance work. (Dennis)
- If you can send me the hourly operation (kW) data for each DG unit and PV power generation data for July next week, I would like to explain the analysis results during the next DG training session. (Nakachi)
 - OK, we will send the data. (Yap, Chuuk)

■ Other thoughts on remote training

- Chuuk is attending the training on a notebook computer, so it would be better to have a TV or projector.
- Yap has a large number of 7 participants, but since only Christopher answers questions, it seems that other participants are less assertive.

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- Since the latest operational data was not available, we confirmed operation status using the data collected during our trip last year. The participants said that there have been no changes in operation. It was also confirmed that Chuuk is currently performing maintenance on one of their units.
- We would like to discuss efficient operation after obtaining the latest operation data and confirming the operation.

<Okiden Kigyo>

- I think the use of a measuring instruments was easy to understand with the English video used for the explanation of how to use them.

We will proactively incorporate materials such as videos in the future.

<SMAECO>

- It sometimes took time to connect to the Internet. Especially in Tuvalu, Kiribati, and Kosrae, we lost 20 or more minutes. There are various causes such as connection issues and not being accustomed to procedures for connecting to ZOOM, so we need to determine the situation in each country and address them.

We requested the trainees to connect 10 minutes prior to the start of the next session, so we will decide what measures to take based on the response.

- Some participated in the training on a PC screen. Since it is difficult for many people to see on the PC screen, a projector or a large monitor should be prepared (or provided by JICA).
- In Kiribati, etc., the equipment provided is used for inspection, and they are proactive in the training, so we feel the project if fruitful.
- During the online training, there were few responses to the questions from the JICA team, and only certain trainees responded to them, so we feel that we need to improve motivation for the training.
- In the caliper and micrometer training, video was incorporated from the latter half, so we believe it was good that the content was easy to understand.

End

2 nd RE Training Report (Yap & Chuuk)			
Date	Monday, August 3, 2020 12:00-15:00		
Venue	Okinawa Enetech Conference Room (via Zoom) YSPSC (Yap): Head Office Meeting Room CPUC (Chuuk): Conference Room		
Attendees	JICA Headquarters: Mr. Ogawa JICA Micronesia Branch: Mr. Takeda		
	Okinawa Enetech: Mr. Shimabuku, Mr. Nakamura, Mr. Uezu, Mr. Gaja Observer: Mr. Fujita Okinawa Electric Power Company: Mr. Shiohama, Mr. Taira Okinawa Kobori Electric: Mr. Yonashiro KD Tech: Mr. Watanabe		
	YSPSC : Jacob Jake Choay, Steven Ken, Charles Laman, John Chieng,		
	CPUC (Joined at 12:30) : Limus Setik, Chris Killion, Jimmy Reyes		
Training Materials	• 1-1_Remote_trainig_schedule_for_Yap_Chuk_200610 • 1-2_RE_remote_training_time_schedule_200722v1 • 2-1_Operation_and_maintenance_of_renewable_energy_facilities_200727v2 • 2-2_I-V_curve_graph_for_FSM__191028r1 • 2-3_FSM_record_sheet_20191030r3 • 3-1_Remote_Training_RE_O&M_Comprehension_Test_(Practice_Questions)_200728v2 • 4_Basic_knowledge_for_formulating_and_updating_the_hybrid_powergeneration_planning_manual_v6(2)_202007 • 5_Perfomance_Ratio_Calculation_Sheet_Yap_20200708 • 5_Perfomance_Ratio_Calculation_Sheet_Chuk_20200708		
2 nd Remote Training (August)			
Schedule			
	Time	Educational content	Instructor
1	12:10-12:15	Greetings and Remote Training Orientation	Shimabuku
2	12:15 PM-13:00	Basics of formulating and updating RE O&M manual ▪ Explanation of facility system configuration, O&M ▪ Patrol inspection, daily inspection, and periodic inspection ▪ Inspection check sheet formulation and recording (method, frequency, etc.)	Nakamura
3	13:05-13:30	Basics of formulating and updating manual 2 Review questions and answers	Yonashiro
4	13:30-13:40	Break	

5	13:40-14:30	Basic knowledge for formulating and updating the hybrid power generation planning manual ▪ Frequency fluctuation (system constant, algebraic method)	Shiohama
6	14:30-14:40	Break	
7	14:40-14:55	Performance ratio ▪ Overview and summary of measurement method ▪ Confirmation, evaluation, and verification of the current situation Manual revision	Shimabuku
8	14:55-15:00	Greetings	Ogawa

■ Q&A on each training topic

Basics of formulating and updating RE O&M manual

→ How often do you perform periodic inspections? (Nakamura)

→ I understand that it should be done every month, but it is conducted twice a year because of our busy schedule. (John)

→ We inspect 4 times a year. (Limus)

→ Please inspect every month, if possible, to practice using the instruments we provided. (Nakamura)

▪ Has a person been put in charge of performing inspections? (Nakamura)

→ We have a team of four people. (John)

→ We have two people. (Limus)

▪ Have you prepared a record of measured values and issues found in the inspections and stored them in the designated place. (Nakamura)

→ We have a form. We have a hardcopy which is shared among the team. We will digitize it in the future. (John)

→ We have a hardcopy which is shared among the team. (Limus)

▪ The inspection sheet for FSM (2-3_FSM_record_sheet_20191030r3) was prepared through the training so far. Are you using it? Is it usable without problems? (Nakamura)

→ We do not use it on the main island of Yap, but we have used it on the outer islands. We have used it without problems. (John)

→ Yes. (Limus)

→ If there are FSM or state standards that can be used for this inspection sheet,

please revise and use it. (Nakamura)

- Why are you not using the inspection sheet on the main island of Yap? (Ogawa)
 - I haven't used the check sheet because we are busy with other work on the main island. → It is used on outer islands. In addition, on the main island, data is collected with the Hybrid Wizard. (John)
 - Please share it with us once the data has been entered. (Ogawa)
 - OK. (John, Limus)

Basics of formulating and updating manual 2 (Review questions and answers)

- Is there a standard measurement value for insulation resistance? (Yonashiro)
 - Yap is 9 MΩ. (John)
 - 2 MΩ for Chuuk. (Limus)

Basic knowledge for formulating and updating the hybrid power generation planning manual

- Is LFC or AFC used to control your DGs? (Shiohama)
 - I think we have it, but I'll have to check. (John)
 - Yes. (Limus)
- Have you ever heard or learned about the concept of system constant? (Shiohama)
 - I have heard about it. (Limus)
- Is the value of the system constant used for power generation operation? (Shiohama)
 - No response.
- Have you ever conducted a load rejection test in power generation operation?
(Shiohama)
 - No. (John)
 - If it is conducted in the future, please save the data so that it can be used to determine the RE penetration threshold. (Shiohama)
- Do you have frequency fluctuation and load (output) fluctuation data which were measured simultaneously? (Shiohama)
 - Yap records such data with the Hybrid Wizard. (John)
 - No. (Limus)
- What is your target frequency value? (Shiohama)
 - In Yap, the maximum is 60 Hz + 2 Hz. A storage battery has not been deployed yet, so we set the range wide. It will be adjusted after installing the storage battery. (John)
 - Yap allows frequency fluctuations of 2 Hz, so do you know the value (capacity) of

how much RE such as PV can be integrated? (Shiohama)

→ No. (John)

- What kind of storage battery is Yap planning to install? (Shimabuku)

→ There are plans to install it, but details have not been decided. The capacity is 2 MW. (John)

- What is the RE penetration? (Shiohama)

In Yap, it was 11% this morning. There is not much wind now. (John)

→ I will cover storage batteries in future training sessions, so please ask if you have any questions. (Shiohama)

Performance ratio

- Performance ratio is one of the important indicators of the project.

The 2016 baseline values for are set at 66% PEC (Yap), 71% PEC (Chuuk), and 72% Airport (Chuuk). If the performance ratio drops significantly, it indicates that something is wrong, so please check it every month. Please enter the monthly data for the yellow parts (PV power generation amount and average solar radiation amount) of the table "PEC Fund PV Performance Ratio". (Shimabuku)

→ Please share the entered data with the JICA expert team. (Ogawa)

- We can measure solar radiation for Yap's PEC Fund PV. Is it better to calculate the performance ratio using actual measurement values? These are 10-minute values. (John)

→ If you can measure it, it is better to use the actual measured values. (Shimabuku)

- Do you have data on the amount of power generated? (Shimabuku)

→ Yes. (John, Limus)

- Do you have data on the amount of solar radiation? (Shimabuku)

→ Yes. The average amount of solar radiation in January for YAP is 6.21 (kWh/m²/day). (John)

→ Please use the pyranometer provided by the PEC fund to enter the measured values instead of the same values every year. (Shimabuku)

- Please prepare a revised draft of Chapter 1 of the RE manual provided in March 2019, taking into account FSM and each state's standards. The manual data will be shared via a cloud server (OneDrive). Please check and revise it. We are planning our next training on August 31, so please share your revisions by August 24, if possible. If you have any questions, please contact us. (Shimabuku)

→ OK. (John, Limus)

■ Other thoughts on remote training

- Generally, it was a PowerPoint lecture format, but I felt that we were able to facilitate successfully by using videos and whiteboard, asking questions during the session, and setting appropriate break times.

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- The content of this lecture was to introduce the basic knowledge for calculating the RE interconnection threshold. The content is catered for those who are involved in system operations and RE integration planning. However, most of the participants were in charge of RE O&M, and the lecture was not directly related to their work, we felt content was a little difficult for the trainees.
- Due to the reasons mentioned above, it seemed that the content was even more difficult for the participants than the previous session, and we felt that there were not as many interactive questions as the previous session. Although it included a review of the content of the lectures given in the past trips, we felt the need to give lectures repeatedly to deepen the trainees' understanding little by little.
- In some cases, there were no clear answer to questions such as target frequency values, presence/absence of AFC, and the presence/absence of frequency and RE output fluctuation data. As we proceed, we hope that the participants will take the initiative in collecting such information as necessary in preparing the customized manuals.
- This was the second remote training session, we were able to perform smoothly including preparation and lecture facilitation, but we got the impression that it will take more time than face-to-face lectures. As an instructor, I would like to improve the method of conducting remote training by incorporating short problems and exercises so that the remote training will be fruitful within a limited time.

<Okinawa Kabori Electric>

- Yap and Chuuk performs inspections on their PV facilities 2 to 4 times a year, so I felt that there was no problem with their knowledge of insulation resistance testers. In the future, I would like to give advice on how to organize and how to store the records after performing inspections.

End

3rd DG Training Report (Yap & Chuuk)	
Date	August 24, 2020 12:00-15:00
Venue	Okinawa Enetech Conference Room (via Zoom) YSPSC: Head Office Meeting Room CPUC (Chuuk): Power Plant Conference Room
Attendees	JICA Headquarters: Mr. Ogawa JICA Micronesia Branch: Mr. Takeda
	Okinawa Enetech: Mr. Kakefuku, Mr. Hokama, Mr. Hashimoto Observer: Mr. Fujita SMAECO: Mr. Miyagi Okinawa Electric Power Company: Mr. Nakachi Okiden Kigyo: Mr. Oshiro KD Tech: Mr. Watanabe
	YSPSC : PS Manager Alphonsus Ruwema, Rowino Yarofaliut, Chief mechanic Casmero Yithmang, Sylvester Maiwemai, Ricky Igelmai, Benneth Sermaeilig, Chief operator Roscoe Tamag, Christopher Igem, Engineering Manager John Chieng
	CPUC : Dennis Triana, Jimmy Reyes, Minoru Stephen
Training Materials	• 1-1. Remote training schedule for Yap Chuuk 200610 • 1-2. DG remote training time schedule Yap & Chuuk • 2-1. DEG Lectures Index (201901) • 2-2. Safety rev.1 • 2-3. Basic principle, basics symbols, features, composition of DG (201901) • 3-1-1. DK 26 M-02 Cylinder Head • 3-1-2. M02 Periodic mechanical inspection • 3-1-3. M02 Main composition of diesel engine • 3-2-1. DK26 M-03 Cylinder head maintenance (2) • 3-2-2. M03 Periodic mechanical inspection • 3-2-3. M03 Main composition of diesel engine • 3-3-1. DK26 M-04 Starting Valve • 3-3-2. M04 Periodic mechanic inspection • 3-3-3. M04 Main composition of diesel engine • 3-4-1. DK26 M-05 Fuel oil injection nozzle • 3-4-2. M05 Periodic mechanical inspection • 3-4-3. M05 Main composition of diesel engine • 3-5-1. DK26 M-07 Fuel oil injection pump • 3-5-2. M07 Periodic mechanic inspection • 3-5-3. M07 Main composition of diesel engine • 4-1. FUEL OIL SYSTEM • 4-2. Fuel service tank inspection • 4-3. Fuel tank inspection 20200811 • 4-4. Fuel tank inspection process sheet • 4-5. Fuel tank drawing (500kL) • 4-6. Fuel tank inspection checklist • 5-1. Improvement plan progress report (Yap • July 2020) • 5-2. Improvement plan progress report (Chuuk • July 2020)

3rd Remote Training (August)

Training details are shown in the following table

	Time	Educational content	Instructor
1	12:00-12:15	Remote Training Orientation	Takefuku
2	12:15-12:45	Revision of O&M Manual	Takefuku Miyagi
3	12:45-13:15	DG maintenance (mechanical)	Oshiro
4	13:15-13:30	Break	
5	13:30-13:50	DG maintenance (mechanical) (continuation)	Oshiro
6	13:50-14:30	Fuel tank inspection	Oshiro
7	14:30-14:55	Power plant improvement plan progress Specific fuel consumption measurement status	Takefuku
8	14:55-15:00	Greetings	Ogawa

■ Q&A on each training topic

- What is the status of the DG O&M manual revision? (Takefuku)
 - CPUC hasn't been able to do it yet because we have been busy with OH work. (Dennis)
 - YSPSC has not done it yet. (YSPSC)
 - Please update Chapters 1 and 2 by the next training. If you need help, please contact us by email. (Takefuku)
- Please appoint a person to be in charge of the revision of the DG O&M manual. (Takefuku)
 - OK. I am considering John as a candidate. (YSPSC)
 - CPUC was busy with DG (GE) OH for a while. Once we secure some time, I will proceed with Jimmy. OH of DG Unit 1 (GE) will be completed by this week. OH of DG Unit 2 (GE) will start this Wednesday. A major OH of the Caterpillar unit will be carried out in the Philippines after the completion of DG Unit 2 (GE) OH. (Dennis)
- Is there an existing O&M manual? (Ogawa)
 - We have the manufacturers' manual, but it is not as detailed as those prepared by the JICA expert team. (Dennis)
- When will CPUC be able to revise the O&M manual? (Ogawa)
 - We expect to revise it around the second week of September. (Dennis)
- Is there a regulation for cleaning the fuel tank? (Takefuku)
 - There are no such laws in FSM and Yap State, but we inspect and clean them every five years. (YSPSC)
- How are the fuel tanks cleaned? (Takefuku)
 - There is no sandblasting tool, but we wash the inside. The day tank is inspected monthly. (YSPSC)
 - Chuuk has not yet inspected the tank because the power plant is new. (Dennis)
- Please update the power plant improvement progress report. Also, when the improvement is completed, please take photos. (Takefuku)

→ OK. YSPSC has completed curing the opening of the electric panel. (Ruwema)
→ CPUC has completed most of the items listed in the power station improvement progress report. However, the addition of the in-house transformer has not been completed because the generator must be stopped (Dennis)

- Please measure the specific fuel consumption and provide the data. (Kakefuku)
→ OK. (Ruwema, Dennis)
- Please send us a record of the power plant operation by July 2020. If you have created graphs, please send them as well. (Kakefuku)
→ OK. (Ruwema, Dennis)
- Please let us know any topics you want us to include in the remote training. (Kakefuku)
→ OK. (Ruwema, Dennis)

■ Other thoughts on remote training

- From 12:00 to 14:00, YSPSC's audio was poor and hard to hear, but it improved after that.
- Because there are many participants in Yap, we feel that there are high expectations for this project.
- During the DG maintenance, we were not able to obtain videos on foreign engines such as Caterpillars, so we used videos for engines made in Japan (Daihatsu). It may have been difficult to understand, but we would like to revise and enhance the O&M manual to supplement it.

<Okinawa Electric Power Company>

- It was confirmed that Chuuk carried out the inspection that was confirmed during the previous survey at 24,000 hours as planned. I believe we have managed well since we have been steadily implementing the plans from two years ago.
- Many technical staff from both Yap and Chuuk attended, so I think they are eager to attain new skills. In particular, I was impressed that Chuuk participated despite being busy with maintenance of DG Unit 1.
- Although training on the inspection of fuel tanks and fuel service tank was conducted in each country as per Tuvalu's request, Yap and Chuuk have not inspected them because they have relatively new equipment, but I believe they were able to acquire good knowledge.
- We need to obtain operation data for Yap and Chuuk to compare the operating conditions with those of the previous survey and propose improvements.
- Although classroom education is the main practice, we hope that the counterparts will continue to participate in the training to improve and maintain their technical capabilities.

<Okiden Kigyo>

- Yap and Chuuk do not have Daihatsu diesel engines, so the video of the Daihatsu diesel engine may not match their situation, but I think they were able to learn the basics.
- Yap conducts regular inspections of fuel tanks, so I hope they utilize the content of this training in the future. Since Chuuk has a new tank, they have not conducted inspections, but we hope they utilize the training content in the future.

<SMAECO>

- In the revision of the O&M manual, there are likely to be many revisions for power plants that use engines other than those made by Daihatsu, so the JICA expert team will provide sufficient support.
- Yap's audio was often difficult to hear, so we asked them to repeat many times. I don't think there was a problem last time, so there may have been a problem with the microphone settings and placement. I think we need to consult with the counterparts to improve these issues for future training sessions.
- The core trainers for Chuuk attended despite their OH work. Yap also had many participants (9 people). I could sense their high interest in this project.
- It seems that data is not downloaded from One Drive very often, so it is necessary to remind them frequently and to provide support if anything is unclear.

End

6.2.4 Minutes of the 3rd Meeting with Managers

3rd Minutes of the Periodical Counterpart Meeting (Yap)	
Date, Time	11 th March, 2021, 14:35-15:45 (Japan Standard Time)
Attendance	YSPSC: Mr. Victor Nabeyan, Assistant General Manager
	JICA HQ: Mr. Tadayuki Ogawa, Chief Advisor JICA FSM: Mr. Shingo Takeda, Project Formulation Advisor
	Okinawa Enetech: Mr. Masanori Shimabuku, Team Subleader Mr. Hideyasu Hokama Mr. Hirokazu Nakamura, Mr. Tsukasa Gaja, Interpreter Mr. Gaku Hashimoto, Coordinator
	Smaeco: Mr. Masaru Miyagi KDTECH: Mr. Takahisa Watanabe, Coordinator
Documents	-Agenda -PROJECT_MONITIRING_SHEET_FSM_rev1 -PO HPGS(FSM)_ver5 -Training_Schedule_for_Yap_(Plan)
Contents	
1. Opening Remarks by Mr. Victor, Assitant General Manager, YSPSC (14:35~14:40) - We are very greateful to JICA expert team to prodivre trainings, despite the restriction undert the CODIV-19. 2. Explanation of the Project Monitoring sheet, and Plan of Operation (PO) (14:40~15:35) - Where is Planning manual for Hybrid Power Generation System?(Victor) →It is a part of RE manual, which consists of planning and O&M. (Ogawa) JICA expert team is requesting YSPSC to revise DG and RE manual. Regarding DG manual, even the 1st chapter is not rivedes yet. Please assist Mr. Roscoe, incharge of this task. (Ogawa) →Thare was a difficulty to DL the data. Mr. Victor will help to find the way. (Victor) →This manual is expected to show general O&M to be applied to any model of DG. This is not the one provided by manufacturer and JICA expert team shared the draft with counterparts. There may be some minunderstandings.(Ogawa) - Is there any pipeline project for integration of new PVs or battery storage?(Ogawa) - Through ADB project, it was planned to install 2MW PVs and 800kWh of BESS. YSPSC is now considering to increase the capacity of BESS to 1.6 MWh. (Victor) - On weekend during low load time, YSPSC can make 100% of electricity demand can be covered by renewable energy. (Victor) - Does YSPSC have any plan to introduce new grid stabilization technology?(Ogawa) →No. (Victor) - Please share Entura report on grid impact study.(Ogawa) - (Project Purpose Indiator1) Please kindly share the latest data for OVI.(Ogawa) - (Project Purpose Indiator2) Perfomance ratio in 2020 is remarably better than the base	

line data taken in 2017.(Ogawa)

- (Project Purpose Indicator3)

Has YSPSC applied planning tools?(Ogawa)

→Engineers of YSPSC are utilising HOMER. Check sheet is utilized at both of the mainland and remote islands.(Victor)

- How is the situation of COVID-19?(Ogawa)

→Travel is still restricted. People can exit from FSM. But cannot come back in FSM. Most likely, vaccination will be obliged for those who travel to FSM. (Victor)

- Activity 1-4 “Existing spare parts and maintenance tool of pilot DG unit are confirmed” is delayed. For other activities, there is no significant delay. (Ogawa)

How to check procurement of spare parts under COVID-19? (Takeda)

JICA expert team is checking document and it is not difficult to collect the information. In case the border does not open, we need to consider to assist OH work remotely. (Ogawa)

It is time to discuss about the next phase. JICA-FSM needs idea what topic is required for the next phase project.(Takeda)

There are a lot of idea. For example, YSPSC needs assistance to enhance grid resiliency, and accessibility in remote islands. (Victor)

Mr. Takeda is requesting JICA HQ to conduct a survey to formulate next phase project, although it is not guaranteed that the survey is conducted.(Takeda)

Did YSPSC request international partners to implement resiliency investment plan?(Ogawa)

→Resiliency investment plan was published as a part of the updated energy master plan for all of development partners, including ADB, WB, and JICA. But actually, it is not yet discussed with these partners. (Victor)

→Please share the master plan with Ogawa-san. (Takeda)

3. Progress and future plan of remote training, 2nd Regional Training (15:35~15:40)

- JICA expert team is planning to continue trainings remotely. Next training for DG and RE will start around May. (Shimabuku)
- The 2nd regional training is scheduled around August. The contents will be updated from the 1st regional training. It is desirable that same participants join. (Shimabuku)
- The 3rd Regional training is scheduled around February, 2022. (Shimabuku)

4. Closing remarks by Mr. Ogawa. (15:40~15:45)

- We are going to finish the project in almost one year. We need to gear up for remaining activities to achieve the project purposes.
- Please keep close collaboration with all members.

(End)

Agenda for Counterpart Meeting (Yap)

1. Opening Remarks by Mr. Faustino Yangmog ,Chief Exective Officer, YSPSC
2. Explanation of the Project Monitoring Sheet, Project Design Matrix (PDM) and Plan of Operation (PO)
3. Progress and future plan of remote training, 2nd Regional Training.
4. Other
 - Request for upcoming training content
5. Closing remarks by JICA Expert Mr. Ogawa Tadayuki

Attachments:

- PROJECT MONITORING SHEET for Yap
- PO for the Project in Yap
- Yap Training Schedule 2021(Plan)

PROJECT MONITORING SHEET

Project Title: The Project for Introduction of Hybrid Power Generation System in Pacific Island Countries

Version of the Sheet: Ver.4 (Feb. 2020 – Dec. 2020)

Project Term: March 2017 -June 2022

Name: Mr. Marion Henry

Title: Project Director

Name: Tadayuki OGAWA

Title: Chief Advisor

Submission Date: th January, 2021

I. Summary**1 Progress****1-1 Progress of Inputs****(1) Japanese side**

- 1) Since March 2019, Chief Advisor has been based in Japan and assists JICA expert team & FSM counterparts to continuously upgrade skills and knowledge mainly through on-line support.
- 2) JICA expert team has been working for on-line remote trainings since June 2020. In total four (4) remote sessions were held for O&M of Diesel Engine Generator (DEG) and another four (4) sessions were conducted for grid integration of RE. In addition, key learnings and reflections up to the previous year have also been covered during the first half of the sessions.

(2) FSM side

In total 31 number of core trainers are registered under the Project, 10 from YSPSC, 5 from CPUC, 9 from PUC and 7 from KUA staff. Facilities and equipment (e.g. training classrooms) for the trainings in FSM were provided by FSM side.

1-2 Progress of Activities

No.	Activity	Progress
Output 1: 1. Appropriate and economical system for O&M of Diesel Generators (DGs) is enhanced.		
1-1	Operational conditions of the existing DGs are reviewed, including confirmation of objectively verifiable indicators for overall goal and project purpose.	The result of discussions and analysis for future training needs was compiled as "Training Needs Assessment Report" and submitted to all members in February 2018.

ATTACHMENT 3

1-2	Specific fuel consumption of pilot DG units is measured.	Specific fuel consumption needs to be measured in PUC and KUA after installation of fuel flow meters procured under the project. The baseline figure for project evaluation shall be updated after measurement. Fuel flow meters provided to PUC under the project has not been installed completely yet and specific fuel consumption for baseline figure for the project evaluation has not been reported. It has been caused due to the delay of procurement of connecting franges by PUC. PUC is committed to finish the work by Feb. 2021.
1-3	Improvement plan for the operation of pilot DG units is prepared.	Improvement plan was prepared and shared with FSM side in the letter issued on 28 th September 2018.
1-4	Existing spare parts and maintenance tools of pilot DG units are confirmed.	Existing spare parts and maintenance tools were confirmed in July 2020.
1-5	Improvement plan for the operation of pilot DG units is implemented.	Improvement plan has been implemented by April 2019 under consultation with JICA Expert.
1-6	The result of implementation of the improvement plan is evaluated, and improvement plan is updated.	Updated improvement plan has been implemented since Dec. 2019.
1-7	The concept of Economic Dispatch Control (EDC) is shared among operators and applied, if possible.	The basic concept of EDC has been explained by JICA Expert in August 2018. Necessary software has been shared with FSM side.
1-8	Necessary spare parts and maintenance tools for the pilot DG units are prepared.	Necessary spare parts and maintenance tools will be confirmed by July 2021.
1-9	Maintenance work schedule for the pilot DG units is prepared.	Maintenance work schedule for the pilot DG units will be prepared by July 2021.
1-10	Check sheets and maintenance manuals for daily maintenance works for pilot DG units are prepared.	Pilot DG maintenance manual (OH) was delivered to each state by March, 2019. Check sheets was provided again in the training of August 2019. The manual revision has started in June 2020, updating the contents according to FSM standards.
1-11	Maintenance works (daily/partial inspection/overhaul work) for pilot DG units are conducted in accordance with the maintenance schedule.	Yet to be commenced.
1-12	The result of maintenance works is evaluated, and future maintenance work schedule together with budget (including sub-contract fee, cost for tools and equipment) is prepared.	Yet to be commenced.
1-13	Specific fuel consumption of the pilot DG units is measured before and after implementation of the related project activities.	Yet to be commenced.
1-14	Related training programs for appropriate O&M of DGs are implemented periodically.	In total four (4) remote sessions were provided in 2020.

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1-15	Knowledge on appropriate O&M of DGs is disseminated among stakeholders.	Project Seminar was first held in Yap in 2019.
Output 2: Methodology for appropriate planning and O&M of renewable energy (RE) is established.		
2-1	Current situation and future development plan of RE is reviewed.	Same as activity 1-1
2-2	Planning manual for Hybrid Power Generation System is prepared.	First issue of the planning manual was delivered to each state by March, 2019.
2-3	Planning manual for Hybrid Power Generation System is reviewed and updated in the target area.	Each utility is expected to review and update the manual under the support by JICA Expert.
2-4	Operating conditions of the existing RE facilities are reviewed, including confirmation of objectively verifiable indicators for overall goal and project purpose.	Same as activity 1-1 Objectively verifiable indicators for overall goal was confirmed at the 1st JCC meeting in 2017.
2-5	O&M manual for RE facilities is prepared.	First issue of the O&M manual was delivered to each state by March, 2019.
2-6	Maintenance works are conducted according to O&M manual of RE facilities.	Each utility is expected to conduct maintenance works under the support by JICA Expert. O&M manual shall be revised and updated after evaluation of maintenance works. The manual revision has started in June 2020, updating the contents according to FSM standards.
2-7	The result of maintenance works is evaluated, and future maintenance work schedule together with budget is prepared.	Yet to be commenced.
2-8	Training program for Hybrid Power Generation System including O&M of RE facilities is conducted.	In total four (4) remote sessions were provided in 2020.
2-9	Knowledge regarding Hybrid Power Generation System is disseminated among stakeholders.	Project Seminar was first held in Yap in 2019.

(Remarks) Yellow-highlighted activities have already been completed.

1-3 Achievement of Output

(1) Output 1

Technical advice for the improvement of O&M of DGs has been provided by JICA Experts based on the initial survey of current conditions conducted in 2017. Also, classroom lecture & hands-on training have been provided to ensure appropriate and economical O&M of DGs with draft manuals and check sheets. In addition, counterpart training has been conducted with site visits and hands-on trainings to learn the necessary O&M of DGs in Japan. Since June 2020, on-line support by JICA Experts has been carried out to monitor the progress of related activities.

From now on the contribution from FSM side should be enhanced to implement the improved O&M of DGs based on the learnings from the advice and trainings by JICA Experts. Especially, operation data such as specific fuel consumption and daily log

ATTACHMENT 3

sheet shall be kept on records and shared with JICA Expert team periodically. The progress of the updated improvement plan shall be recorded and shared with JICA Experts periodically to further support O&M activities in each state.

(2) Output 2

Technical advice for the appropriate planning and O&M of RE has been provided by JICA Experts based on the initial survey of current conditions conducted in 2017. Also, classroom lecture & hands-on training have been provided to ensure appropriate planning and O&M of RE with draft manuals and check sheets. In addition, counterpart training has been conducted with site visits and hands-on trainings to learn the methodology of planning and O&M of RE in Japan. Since June 2020, on-line support by JICA Experts has been carried out to monitor the progress of related activities.

From now on the contribution from FSM side should be enhanced to implement the improved planning and O&M of RE based on the learnings from the advice and trainings by JICA Experts.

“Planning manual for Hybrid Power Generation System” and “O&M manual for RE facilities” shall be utilized and updated in accordance with the current O&M practices by each utility. Also, the results of O&M works for all solar PV systems shall be recorded and shared with JICA Expert Team. Therefore, further contribution from FSM side should be expected to implement the improved planning and O&M of RE based on the learnings from the advice and trainings by JICA Experts.

1-4 Achievement of the Project Purpose

(Indicator 1) Improvement of specific fuel consumption of pilot DG units

State	Baseline (2017)	Achievement (2020)
Yap	13.0 kWh/G (Deutz) 14.5 kWh/G (CAT 3516) 14.3 kWh/G (CAT C32)	13.23 kWh/G (0.286 l/kWh) ↓
Chuuk	14.91 kWh/G (total average)	(Unit 1) 15.16 kWh/G (0.2496 l/kWh) ↓ (Unit 2) 15.24 kWh/G (0.248 l/kWh) ↑ (Unit 4) 14.50 kWh/G (0.261 l/kWh) ↓ (Unit 5)

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		12.50 kWh/G (0.302 l/kWh) ↓ Avg: 14.57 Wh/G ↓ (0.259 l/kWh)
Pohnpei 2020N/A	13.4 kWh/G (total average)	Unit #4 16.3 kWh/G (0.232 l/kWh) Unit #5 14.3 kWh/G (0.264 l/kWh) Avg: 15.3 kWh/G (0.247 l/kWh)
Kosrae	13.6 kWh/G (total average)	14.5 kWh/G (0.261 l/kWh) (Average in 2019)

(Indicator 2) Improvement of performance ratio for RE power generation systems

State	Baseline (2017)	Achievement (2020)
Yap	66% (PEC)	72.67% (PEC) (Average up to July)
Chuuk	72% (Airport) 71% (PEC)	55.46% (Airport) 65.41% (PEC) (Average up to October)
Pohnpei	76% (COM) 78% (President's Office) 71% (PEC)	42.93% (COM) 5.0% (President's Office) 41.17% (PEC) 29.31% (UAE) (Average up to August)
Kosrae	66% (PEC) 56% (EU)	54% (PEC/EU) (2019 Average value)

Deterioration of performance indicators are observed in Chuuk, Pohnpei and Kosrae due to prolonged PV output reductions. It is requested to record and monitor the indicator every month and report any issues which may reduce power output by PV systems.

(Indicator 3) Proper application of planning and O&M method of HPGS

State	Planning Manual	O&M Manual
Yap	N/A	Check sheet has been used for outer islands PV systems.

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Chuuk	N/A	Check sheet has been used for outer islands PV systems.
Pohnpei	N/A	N/A
Kosrae	N/A	N/A

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by the Parties

N/A

1-8 Progress of Environmental and Social Considerations (if applicable)

1-9 Progress of Considerations on Gender/ Peace Building/ Poverty Reduction (if applicable)

1-10 Other remarkable/ considerable issues related/ affect to the Project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs, etc.)

Due to the continuing influence by COVID-19, it is expected that on-site assistance by JICA Expert team would be postponed for the time being. In order to address the imminent and emerging issues on the O&M of DEGs and RE power generation systems, on-line support by JICA Expert team has been undergoing since June 2020, together with remote meetings with key counterparts and managers. It is expected that the JICA Expert team could continue working with FSM counterparts through on-line and possibly on sites after 2021, so the delay of project activities would not be caused in this regard.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

2-2 Cause

2-3 Action to be taken

2-4 Roles of Responsible Persons/ Organization (JICA, the Parties, etc.)

3 Modification of the Project Implementation Plan

3-1 Plan of Operation

3-2 Other modifications on detailed implementation plan

4 Preparation of Government of FSM toward after completion of the Project

Government of FSM and each state utility will be further requested to utilize and update the related manuals and tools for the planning and O&M of Hybrid Power Generation System. Also, those core trainers who have participated in the training in FSM, Japan and Fiji need to continue on the OJT for other staff inside the organization to share the necessary skills and knowledge for the introduction of Hybrid Power Generation System.

II. Project Monitoring Sheet I & II as Attached

(Project Design Matrix and Plan of Operation)

Plan of Operation (PO)

Project Title: The Project for Introduction of Hybrid Power Generation System in Pacific Island Countries
Project Term: March 2017 - June 2022 (Phase 1: March 2017 – February 2019 , Phase 2: March 2019 – June 2022)
Country: Federated States of Micronesia
Target Area: Pohnpei, Chuuk, Yap and Kosrae
Target Group: Related engineers and other technical staff in the target area (DRD, PUC, KUA, CPUC, YSPSC)

[illegible]

Training Schedule for Yap (Plan)

[illegible]

6.2.5 Minutes of the 4th Meeting with Managers

4 th Minutes of the Periodical Counterpart Meeting (Yap)	
Date, Time	September 13, 2021 10:00-11:00 (Japan Standard Time)
Attendance	YSPSC: Mr. Victor Nabeyan, Assistant General Manager
	JICA HQ: Mr. Tadayuki Ogawa, Chief Advisor
	Okinawa Enetech: Mr. Luis Kakefuku, Team Leader Mr. Masanori Shimabuku Team Subleader Mr. Hideyasu Hokama Mr. Hirokazu Nakamura, Mr. Tsukasa Gaja, Interpreter Mr. Gaku Hashimoto, Coordinator
	KDTECH: Mr. Takahisa Watanabe, Coordinator
Documents	01- Agenda(Yap)_20210913 02- Marshall Capacity Assessment Report (2020) rev1 03- Training Program rev1
Contents	
1. Opening Remarks - We are glad that the YSPSC team has been actively engaged in all the project activities. Once the border opens, we will visit the power plant and PV sites in Yap for hands-on training. Until then, we hope to continue this good relationship with the team members. (Ogawa) 2. Capacity Assessment in 2020-2021 DG - The JICA expert team has provided 6 remote DG O&M remote trainings sessions and 2 DG Manual Revision training sessions. The result of the summary tests showed that 5 core trainers achieved about 65% of the training objectives on average. The JICA expert team advised DG counterparts to participate actively in the revision of the DG O&M manual in order to increase the knowledge and skill which will result in the efficient operation and maintenance of the entire power plant. (Kakefuku) RE - The JICA expert team has provided 6 remote RE integration and O&M training sessions and 2 RE Manual Revision training sessions. (Kakefuku) - The result of the summary tests showed that Mr. John Chieng achieved about 70% of the training objectives for RE integration, and for RE O&M, Mr. Steven Ken and Mr. Jacob Choay achieved on average 80% of the training objectives. We need to confirm if Mr. Sebastian Marleyang will continue as a core counterpart since he only attended 1 training session in this period. (Kakefuku) - How is the achievement rate calculated? (Victor) →It was calculated by averaging the test scores. For DG, since Mr. Casmiro's score was not good, the total achievement rate dropped slightly. (Kakefuku)	

- It might be better to ask questions to the participants to confirm whether they understand the content. It you find any other recommendation to improve trainings, please let us know. (Ogawa)
→Okay. We will do that. (Victor)

3. Project extension

- We are going to propose extending the project period for one year. Due to the pandemic, the JICA expert team could not visit Yap and other countries. Although the JICA expert team has continued the training remotely, they could not provide hands-on training, so some of the content was suspended. We would like to extend the period of the project to be able to do the hands-on training when the border opens. At the JCC meeting, it will be officially agreed on by the concerned parties. And the R&D (Record of Discussion) should be changed and signed by the government of FSM and Japan. (Ogawa)
→We agree and support the extension. (Victor)
→Please discuss this with Mr. Faustino. At the JCC meeting in October, we would like to discuss this in detail. (Ogawa)

4. Project schedule and content 2021-2023

Schedule

- We hope to be able to travel to Marshall after April 2022. We will continue the online training and Regional Training as well. “03-Training_schedule_rev1” shows the tentative schedule. (Kakefuku)

Content

- For RE, we are considering to add new content such as system stabilization study, overview of grid code, and follow up on the revision of the Energy Masterplan. (Kakefuku)
- For DG, the JICA expert team will support upgrading the manual and improving the existing DGs and power plant facilities. Other additional content will be considered upon request. (Kakefuku)
- Please ask the project members if they have any requests for topics for future training. (Kakefuku)

5. Other

Manual

- Progress on the revision of the DG O&M manual is behind schedule. They mentioned that they were busy with maintenance work and could not focused on the manual revision. Please try to support them. (Ogawa)

JCC

- JCC is scheduled for October 26 1-3 pm, Pohnpei time and 12-2 pm Yap time. (Kakefuku)

The 2nd Regional training

- The tentative schedule for the DG training is from November 15 to 26, and from November 29 to December 10 for RE. (Kakefuku)
- We request the same members who participated in the 1st Regional Training held in

November 2019 to participate in the 2nd regional training. (Kakefuku)

OH

- Are there any plans for OH? (Kakefuku)
 - YSPSC has just completed a top-end OH for a Caterpillar DG. For the Deutz engine, YSPSC has the necessary spare parts for major OH. YSPSC is currently waiting for travel restrictions to be lifted and engineers from Australia to be able to travel. Although it is expensive to hire a supervisor from overseas, at this time, we don't have enough confidence to conduct the OH by ourselves. (Victor)
 - Please let us know what topics they need to learn to conduct OH by themselves. (Ogawa)
 - Okay. I will talk with our mechanics. (Victor)
 - One area for improvement is the updating of the O&M manual. We will try to set a meeting for updating the manual. Who is the person in charge? (Kakefuku)
 - Mr. Roscoe is in charge. (Victor)

Additional training content

- If there is any request for additional topics, please inform us. (Kakefuku)

ADB project

- What is the status of the project?
 - Sagemcom was selected as the first potential contractor and Vergnet was selected as the second. Both of which are French companies. Sagemcom has withdrawn due to the pandemic, and now, Vergnet is negotiating to be a contractor. (Victor)
- Will the project cover both PV facility and battery storage? (Ogawa)
 - Yes. (Victor)
 - Please let us know if there is any progress. We are interested in the RE penetration to be reached after the project. (Ogawa)
- What is the capacity of the PV facility and the battery to be installed? (Kakefuku)
 - 1.9 MW PV facility and 800 kWh battery. YSPSC has requested Entura to develop a simulation model to scale the BESS up by another 800 kWh. (Victor)

6. Closing remarks

- Mr. Victor thanked the JICA expert team for their extraordinary effort in continuing to provide support amid the pandemic.

(End)

September 13, 2021
JICA Expert team

Agenda for Counterpart Meeting (Yap)

1. Opening Remarks by JICA Expert Mr. Ogawa Tadayuki
2. Capacity Assessment in 2020-2021
3. About project extension
4. Project schedule and contents 2021-2023
5. Other
 - JCC meeting schedule
 - Overhaul schedule
 - Request for upcoming training content
6. Closing remarks by Mr. Faustino Yangmog, General Manager ,YSPC

Attachments:

- Capacity Assessment in 2020-2021
- Project schedule

The Project for Introduction of Hybrid Power Generation System in Pacific Island Countries
FY 2020 Training Evaluation
(FSM • YAP)

1. Executive Summary

In order to achieve the objectives of the Project for Introduction of Hybrid Power Generation System in Pacific Island Countries, two main outputs "1. Enhancement of an appropriate and economical system for O&M of Diesel Generators (DG's)," and "2. Establishment of a methodology for appropriate planning and O&M of Renewable Energy (RE)" are required.

Since the JICA expert team could not conduct the necessary activities for these two outputs on site due to the Covid-19 pandemic, 12 online training sessions (6 for output 1 and 6 for output 2), 2 meetings to facilitate manual revision and other technical support through Facebook and email correspondence was provided.

Following the training on DG O&M and RE integration and PV facility O&M provided on site in 2019, the following online training was provided from June 2020 to June 2021.

2. Training Contents

2.1 Enhancement of an appropriate and economical system for O&M of Diesel Generators (DG's)

The first 2 online training sessions were a review of the lectures previously provided on site by the JICA expert team. From the third training session, new topics on the maintenance of DG's and auxiliary devices such as fuel storage tanks, turbocharger, heat exchangers were covered.

For overhaul works, videos on the maintenance of generators, circuit breakers, cylinder heads, pistons, main bearing, fuel injection valve, etc. were shown.

For operation of the power plant, lectures on operation analysis, planning the addition of DG's according to the power reserve, specific fuel consumption, improvement plan, preparation for periodic inspection, and blackout restoration procedures were conducted.

Also, the expert team assigned the main counterparts' homework such as monthly measurement of SFC, maximum explosion pressure (Pmax), vibration, preparation of OH schedule, and revision of the maintenance manual according to YSPSC standards.

As a result of the June 2020~June 2021 training, it appears that the 5 core trainers were able to achieve in average about 65% of the training objectives based on the summary tests conducted in June 2021, the evaluation of the generation manager and also findings from the expert team members.

The JICA expert team advises the DG counterparts to participate more actively in the training sessions and in the revision of the DG O&M manual in order to improve their knowledge and skill which will result in a more efficient operation and maintenance of the entire power plant.

Training No./ Date		DG O&M / Online Training Content
1	6/18/20	1. Basic knowledge of DG (each utility system) 2. Daily inspection of DG's, Pmax measurement, exhaust gas temperature verification and FO rack adjustment 3. Description of electrical drawings (Single-line, three-line, sequence diagram) 4. Fuel consumption calculation exercise
2	7/29/20	1. Use of measuring instruments for mechanical side (Vernier calipers, micrometer, dial gauge) 2. Use of measuring instruments for electrical side (RTD, TC, pressure gauge) 3. Power plant operation 4. Power plant improvement progress 5. Revision of DG O&M manual
3	9/23/20	1. Safety 2. Basic knowledge of DG 3. DG maintenance: DK26 Daihatsu engine Cylinder head, starting valve maintenance video 4. Periodic mechanical inspection 5. Power plant improvement progress 6. Fuel tank inspection 7. Specific fuel consumption measurement
4	10/21/20	1. Revision of the O&M manual 2. DG maintenance: DK26 Daihatsu engine - Fuel oil injection nozzle, pump, piston and connecting rod, main bearing maintenance video 3. Turbocharger maintenance video 4. Periodic mechanical inspection 5. Power plant improvement progress
5	1/27/21	1. Daily inspection 2. Generator inspection 3. Preparation of a Remote Island Power Plant Periodic Inspection Plant 4. Power plant improvement progress 5. Specific fuel consumption measurement
6	5/26/21	1. Circuit breaker inspection 2. Nondestructive Testing (Penetrant Testing, Magnetic Particle Testing) 3. Blackout restoration procedure 4. Heat exchanger 5. Power plant improvement progress 6. Specific fuel consumption measurement
7	7/16/21	1 st DG O&M Revision Training
8		2 nd DG O&M Revision Training

2.2 Establishment of a methodology for appropriate planning and O&M of Renewable Energy (RE)

As with the training for DG O&M, online training was provided in replacement of hands-on training on site. Following the review of past lectures, the content of the training included the follow:

- RE integration

Review of previous lectures, case study on initiatives in Okinawa to disseminate RE, grid interconnection and operation (grid code, flow of grid interconnection, output control, etc.), output and frequency fluctuation mitigation control (ΔP & ΔF control)

- RE O&M (PV facilities)

For operation, training on verifying the actual operating status of PV facilities, including an overview and summary of how to measure performance ratio, confirmation and evaluation of the current condition, and PV power generation cost calculation, was conducted.

For maintenance, lectures on configuration of PV systems, patrol inspection, daily and periodic inspections, update of inspection check sheet, future maintenance system, schedule, and budget were done.

The other main component of the RE training was focused on basic knowledge for preparing and updating of the manual for RE integration and O&M.

As a result of the training, it appears that the core trainers for RE integration, Mr. John Chieng was able to achieve about 70% of the training objectives, and for RE O&M, Mr. Steven Ken and Mr. Jacob Choay achieved in average 80% of the training objectives. We need confirm if Mr. Sebastian Marleyang will continue as a core counterpart due only attend 1 training in this period.

These evaluations are based on the summary tests conducted in June 2021, evaluation by the generation manager, and also findings from the expert team members.

PV facilities are subject to evaluation by performance ratio, so the JICA expert team requests the sharing of measurements results, so JICA expert team can monitor them and advise accordingly.

The expert team advises the RE counterparts to participate actively in the revision of the RE integration and O&M manual in order to increase the knowledge and skill which will result in the efficient operation and maintenance of all facilities in Yap.

Training No. / Date		Training content
1	7/1/20	1. Basic knowledge of Hybrid power generation system (HPGS) technology 2. Explanation of performance ratio 3. Basic knowledge on preparation and updating of RE integration manual 4. Q&A on PV maintenance
2	8/6/20	1. Basics of preparing and updating manual 1 • Explanation of facility system configuration, O&M • Patrol inspection, daily inspection, and periodic inspection • Inspection check sheet preparation and recording (method, frequency, etc.) 2. Basic knowledge for preparing and updating the RE integration manual • Frequency fluctuation (system constant, algebraic method) 3. Performance ratio. • Overview and summary of measurement method • Confirmation, evaluation, and verification of the current situation 4. O&M manual revision. Requested revision of Chapter 1
3	9/3/20	1. Basic knowledge for formulating and updating the RE integration manual • Review questions 2. Basics of formulating and updating RE O&M manual • Review questions 3. PV facility inspection • Power generation cost exercise 4. Performance ratio
4	11/11/20	1. RE O&M manual revision (Chapter 1) 2. Performance ratio 3. RE grid interconnection and operation (system stabilization method) • Output fluctuation mitigation control (ΔP control) • Frequency fluctuation mitigation control (ΔF control) 4. Example of initiatives in Okinawa to disseminate RE • Yonaguni Hybrid System 5. Explanation of Plan of Operation (PO) 6. Future maintenance system and budget

5	2/18/21	- Performance ratio - How to acquire solar radiation data (using NASA site) - Discussion on manual revision - Grid interconnection and operation of RE - Grid code (interconnection requirement) - Flow of grid interconnection - Operation (output control) *Case study - Future Maintenance System and Budget - Maintenance system - Maintenance budget - Assistance from other donors
6	6/11/21	- Example of initiatives in Okinawa to disseminate RE - Abu Mega Solar facility - Ogimi Wind Power facility (demonstration research facility) - Control of power fluctuation (ΔP & ΔF control) - Future maintenance system and budget - Future maintenance schedule plan
7	5/24/21	1 st DG O&M Revision Training
8	7/27/21	2 nd DG O&M Revision Training

3. Training schedule

The Introduction of Hybrid Power Generation System in Pacific Island Countries / FSM Yap / On-Line Remote Training Schedule (2020~2021)

		2020							2021									
		Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1	Diesel Operation & Maintenance																	
	1st DG On-line training																	
	2nd DG On-line training																	
	3rd DG On-line training																	
	4th DG On-line training																	
	5th DG On-line training																	
	6th DG On-line training																	
2	RE integration / RE (PV's) O&M																	
	1st RE On-line training																	
	2nd RE On-line training																	
	3rd RE On-line training																	
	4th RE On-line training																	
	5th RE On-line training																	
	6th RE On-line training																	
3	DG O&M manual revision																	
	1st training																	
	2nd training																	
4	RE Intrgration / O&M manual revision																	
	1st training																	
	2nd training																	

3. Core counterparts

No.	Core Trainer Name	Position	Comments
1) Operation and Maintenance of Diesel Engine Generators			
1	Alphonsus Ruwema	PS Manager	
2	Casmiro Yithmang	Chief mechanic	
3	Christopher Igem	Electrician	
4	Roscoe Tamag	Chief operator	
5	Rowino Yarofaliut	Mechanic	
2) Plan for introduction of hybrid power generation systems			
1	John Chieng	Engineering manager	

3) Operation and Maintenance of Renewable Energy generation system			
1	Charles Lama	Technician Engineering division	
2	Steven Ken	Technician Engineering division	
3	Jacob J. Choay	Technician PV operator	
4	Sebastian Marleyang	PV operator	

4. FY2020 YSPSC counterpart training evaluation

Training content	
1. DG	• Review of 2020 training • Handling of mechanical and electrical measuring equipment • Inspection, troubleshooting of each part of diesel generator • Update of power plant maintenance manual *CPs have the capacity to perform disassembly inspection, verification of spare parts condition, and measurement of operation parameters (Pmax, fuel consumption rate, etc.)
2. RE integration	• Review of 2020 training • RE grid interconnection and operation method • Examples of initiatives in Okinawa to disseminate renewable energy • Use of storage battery in power systems • PV system design • Data measurement for performance ratio calculation • Update of RE integration manual *CPs will acquire more detailed knowledge on RE integration
3. RE O&M	• Review of 2020 training • Operation and maintenance of PV system. • Inspection check sheet revision and use • Practice in the use of measurement equipment (String Tracer, Cell Line Checker, insulation resistance tester) • Revision of PV system O&M manual *CPs will have the capacity to perform maintenance planning, inspection, and prepare, manage, and analyze work reports

Results

See following Core trainers' evaluation check sheet and annual training objectives achievement rate graphs.

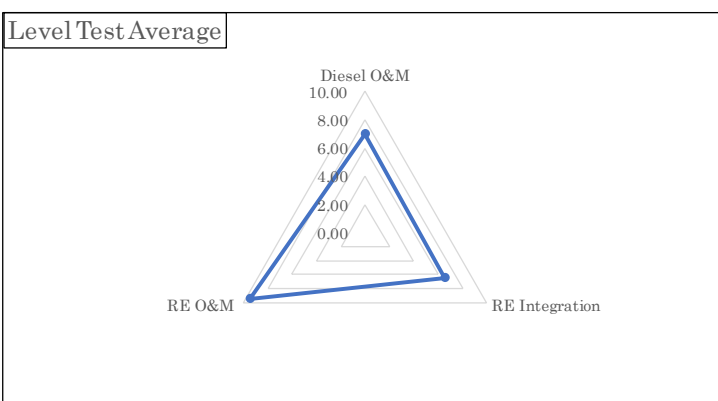
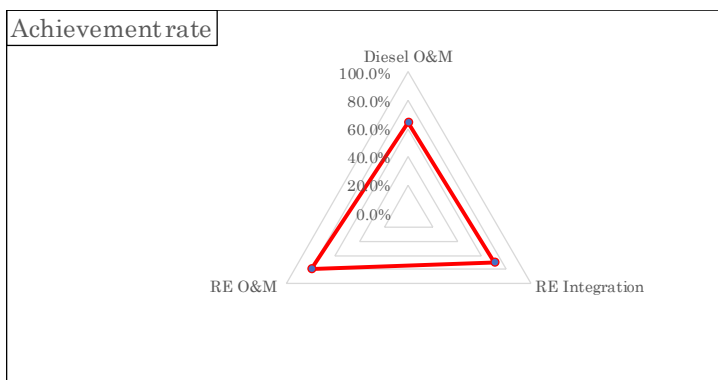
➤ **June 2020 to June 2021 Summary**

Diesel O&M		
Name	Test points	Achievement
Alphonsus Ruwema	7.60	70.0%
Casmiro Yithmang	4.60	53.0%
Christopher Igem	6.00	62.7%
Roscoe Tamag	8.00	67.3%
Roroino Yarofaliut	8.60	70.3%
Average	6.96	64.7%

RE Integration		
Name	Test points	Achievement
John Chieng	6.5	70.3%
Average	6.5	70.3%

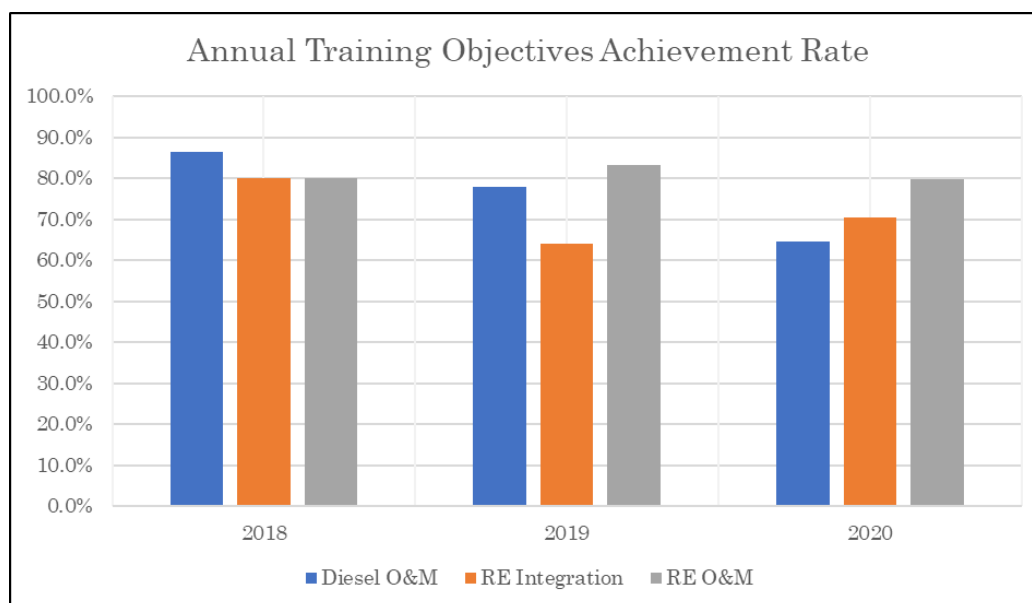
RE O&M		
Name	Test points	Achievement
Charles Lama	N/A	N/A
Steven Ken	5.5	60.67%
Jacob J. Choay	9.5	80%
Sebastian Marleyang	N/A	N/A
Average	9.50	79.7%

YSPSC average	Test points	Achievement
Diesel O&M	6.96	64.7%
RE Integration	6.5	70.3%
RE O&M	9.50	79.7%



➤ **Annual training objectives achievement**

YSPSC average	2018	2019	2020
Diesel O&M	86.4%	77.8%	64.7%
RE Integration	80.0%	64.0%	70.3%
RE O&M	80.0%	83.3%	79.7%



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The project for introduction of Hybrid Power Generation System in Pacific Countries / Training Program

[illegible]

July 26th, 2021

JICA Expert Teaam

DG O&M Manual updating schedule (FSM / YSPSC)

Rescheduled

No.1	DG O&M Manual updating / Chapter		2020	2021												2022		
			July start	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March
1	Safety	Plan																
		Action																
2	Basic principle, basics symbols, features, composition of DG	Plan																
		Action																
3	Main equipment of diesel generation	Plan																
		Action		6/22 Request of manual revision														
	3.1 Main equipment of diesel generation (Mechanical)	Plan		7/27 Request of revision chapter 1 & 2														
		Action		8/24 Not started yet														
	3.2 Main equipment of diesel generation (Electrical)	Plan		▲ 10/19 Roscoe not started yet														
		Action																
4	Operation of diesel generator	Plan																
		Action		▲ 1/25 will upload at the end of february(Alphonsus)														
	4.1 Operating procedure of power plant (+daily inspection, fault reporting, etc.)	Plan																
		Action																
	4.2 Trouble shooting (Automatic control device number)	Plan																
		Action																
	4.3 Supply and Demand Management	Plan																
		Action																
	4.4 Economical Load Dispatch system (EDC)	Plan																
		Action																
5	Maintenance of diesel generator	Plan																
		Action																
	5.1 Power plant maintenance and inspection procedure	Plan																
		Action																
	5.2 Maintenance of diesel generators (Mechanical)	Plan																
		Action																
	5.3 Maintenance of diesel generators (Electrical)	Plan																
		Action																
	Remind from JICA team			●			●		●	●								

- Initial plan
- Completed /checked by JICA Expert Team
- ▲ advices
- Rescheduled
- Remind from Watanabe
- ★

draft received

6.2.6 2nd Seminar Report

Meeting Memo of 2nd Seminar in FSM ~About the results of the five-year project~ (On-line)	
Date, Time	July 6, 2023 13:00-16:00 (Pohnpei/Kosrae time), 12:00-15:00 (Chuuk/Yap Time) 11:00-14:00 (Japan time)
Attendance	FSM R&D: Mr. Faustino Yarofaisug, Acting Secretary YSPSC: Mr. Victor Nabeyan, General Manager CPUC: Ms. Lei Shirai, Chief Financial Officer Mr. Dennis Tariana, Generation Manager PUC: Mr. Julian Pelep, Solar Technician KUA: Mr. Robert Tualupe, Operations Manager Mr. Hairom Livaie, Customer Service Supervisor
	Yap State Government: Ms. Vivian Leyarofyang, Training Coordinator at Dept. of Resources and Development
	JICA HQ: Mr. Tadayuki Ogawa, Chief Advisor JICA FSM: Mr. Kunihiro Yamauchi, Resident Representative Ms. Trishfarrah Billen, Program Officer
	JICA Expert Team: Mr. Luis Kakefuku, Team Leader Mr. Masanori Shimabuku, Sub Team Leader Mr. Hideyasu Hokama Mr. Hirokazu Nakamura Mr. Takahisa Watanabe
Documents	① Project Summary by Mr. Ogawa ② Capacity Assessment Report by Mr. Kakefuku ③ Dennis: Experience, knowledge, and expertise in maintenance and management of diesel power plants gained through the project (Chuuk) ④ Robert: Experience, knowledge, and expertise in maintenance and management of diesel power plants gained through the project (Kosrae) ⑤ John: Experience, knowledge, and expertise in renewable energy installation planning and maintenance gained through the project (Yap) ⑥ Julian: Experience, knowledge, and expertise in renewable energy installation planning and maintenance gained through the project (Pohnpei)
Content	
1. Opening Remarks by: Acting Secretary, FSM DRD, Mr. Faustino Yarofaisug Mr. Faustino Yarofaisug provided remarks including the following points.	

- We appreciate assistance of JICA and the government of Japan on hybrid power generation.
- While utilities learnt a lot through the project, they still need further technical support for energy transition depends on specific needs of each state. We hope JICA will be able to continue support for the four states of FSM even after the completion of the project.
→ We will be happy to discuss about the next phase project. (Ogawa)

2. Project Summary by JICA Chief Advisor, Mr. Tadayuki Ogawa

Mr. Ogawa thanked today's participation and expressed his biggest appreciation for long term contribution to the project towards to FSM DRD and four utilities. He summarized the activities of the project from the JICA's viewpoint which highlighted the challenges, the strategy, the concept and the ultimate goal of the project. Especially, he expected that the project outputs such as manuals would be fully utilized in the long term in the future. He also mentioned the concept of the region wide training based in Fiji and fully supported this concept to continuously keep on the training within the region. New concept which is called "Green Power Island Programme" was also introduced. Under this new concept, JICA is going to launch the next phase of the technical cooperation project by the end of this year or early next year.

Q/A and Comments:

Is there a possibility that JICA will support to establish a training center for Micronesia sub-region which covers Micronesian countries? (Faustino)

→ We understand that it would be more comfortable if a training center is established in FSM or Micronesia sub-region. Since the project started, we found that their knowledge and skill in Fiji is more advanced. They provided good opportunities to share knowledge and experiences with PICs through regional trainings. For the next phase, we are thinking to expand the concept of the regional training based in Fiji.

Does JICA support to provide HOMER software for each utility? (Faustino)

→ HOMER software have been provided to all of four utilities and they learnt how to use through the training program under the project. (Ogawa)

Did each utility achieve improvement in Performance Ratio (PR)? (Faustino)

→ It depends on states. In case of Yap state, PR improved from 66%, 2016 to 75%, 2020. (Ogawa)

Please explain about RE Integration Manual. (Faustino)

→Each utility developed the manual through the project. Then, it is expected to be institutionalized within each utility as an official document to be amended from time to time. (Ogawa)

→We sincerely appreciate for the support of JICA. At the COP23, FSM government declared the target to increase RE share to 70% by 2023. FSM needs further assistance to enhance the knowledge and skills of utilities. We are planning to have a roundtable meeting with international development partners. We will reach out JICA(Faustino)

→We are happy to discuss more. Please do not hesitate to contact with JICA. (Ogawa)

3. Capacity Assessment report(JICA Expert Team leader Mr. Luis Kakefuku)

Mr. Luis explained the Capacity Assessment report for the period of July 2022 to April 2023 which included the Executive Summary, Training Contents, the training schedules, the attendance records and the result of the trainers' evaluation for each utility.

Q/A and Comments:

I noticed not all of the members attended trainings. Did COVID-19 prevented them attending trainings? (Faustino)

→COVID-19 is the one of the main reasons but there is also another reason. Each utility has their work plans and sometimes schedule of their work did not match with on-line trainings and they could not participate. (Kakefuku)

This report shows very important and detailed information. It is better to share the individual score with manager of each utility. FSM DRD needs only summary without individual names because of privacy issues. (Faustino)

→We will send to each utility. And also, we will prepare a summary. (Kakefuku)

4. Keynote speech

① 「Experience, knowledge, and expertise in maintenance and management of diesel power plants gained through the project (Chuuk)」 by CPUC, Generation Manager, Mr. Dennis Triana

Mr. Dennis Triana introduced knowledge and experience gained through the trainings. He emphasized preventive maintenance for diesel engine generators plays a critical role in maximizing reliability, minimizing repairs and reducing long-term costs.

By following generally recognized diesel maintenance procedures and specific manufacturer recommendations for our application, we'll be assured that our diesel power system will start and run when we need it most.

Q/A and Comments:

Manuals for DG and RE developed through the project should be adapted as official documents in your utility. These manuals are supposed to be revised and updated. What is the status of the manual documentation? (Ogawa)

→Now we are working on it. DG manual is completed about 90%. Once it is completed, we will share. (Dennis)

Cost of OH is a big issue because we need to outsource. Did each utility learn how to conduct OH through the project? (Faustino)

→Although the type of DGs in Chuuk are different from Okinawa, we gained a lot of knowledge from Okinawa Enetech team. At the moment, we still have warranty of the manufacturer and we do not conduct OH by ourselves. We are trying to transfer knowledge to younger technician so that they will be able to do it by CPUC in the future. DG manual developed through the project will be a guide for future OH work. (Dennis)

→The manual does not explain how to make maintenance in very detail. Instead, it guides necessary process, necessary parts, points to consider, etc. JICA expert team will share the latest DG manual for each state. (Kakefuku)

② 「**Experience, knowledge, and expertise in maintenance and management of diesel power plants gained through the project (Kosrae)**」 by KUA, Operations Manager, Mr. Robert Taulupe

Mr. Robert Taulupe introduced knowledge and experience gained through the project which includes the following points.

- Basic Competencies which cover the knowledge, skills and attitude required to lead in the dissemination and discussion of ideas, information and issues in the workplace.
- Common Competencies which cover the knowledge, skills and attitudes in identifying handling and using measuring instruments.
- Core Competencies which cover the required performance in executing the preparation and tending of diesel and its auxiliary equipment.
- Safety
- Basic Principle of Diesel Engine
- Operation of Diesel Power Plant
- Trouble Shooting
- Overhaul, and Fuel Consumption

He concluded the project helped in preparing top OH of KUA's Daihatsu engine.

Q/A and Comments:

We hope KUA will be able to maintain DGs even after completion of project in proper matter. Is KUA planning to conduct OH by itself? (Ogawa)

→We do it by ourselves, due to our limited budget. (Robert)

→If you have any questions, please let us know so that we can give you advise. (Ogawa)

When will KUA conduct top end OH? (Kakefuku)

→It was planned in July. But it may be delayed. (Robert)

What is the latest situation of the manuals now? (Ogawa)

→DG manual is already developed. In terms of RE, we are waiting from JICA expert team. (Robert)

→JICA expert team uploaded to OneDrive. Please check it. (Kakefuku)

→These manuals are supposed to be adapt as official documents in KUA. Please proceed on the documentation process, and let us know once completed. (Ogawa)

③ **「Experience, knowledge, and expertise in renewable energy installation planning and maintenance gained through the project (Yap)」 by YSPSC, Engineering Manager, Mr. John A. Chieng**

Mr. John A Chieng explained knowledge and experience gained through the project with a case study of trouble shooting for their system which was displaying ground fault error. He showed that they are utilizing equipment provided by JICA such as; insulation tester and IV Curve tester for their maintenance work.

He concluded that, with JICA's training throughout the past 5 years, YSPSC has gained useful knowledge in the fields of solar plant. We want to thank JICA and Enetech for taking the time to support us with our solar plants.

Q/A and Comments:

Regarding RE manual, we uploaded to the OneDrive. Please check it. (Kakefuku)

→Yes, I will check. (John)

Please institutionalize the manuals in YSPSC. (Ogawa)

→Yes. Once we finalize it, we do it. (John)

④ **「Experience, knowledge, and expertise in renewable energy installation planning and maintenance gained through the project (Pohnpei) by PUC, Solar Technician Mr. Julian Pelep**

Mr. John A Chieng presented knowledge and experience gained through the project, on behalf of Mr. Sidney Kilmete, which includes the following points;

Integration of RE

- Variability of RE (Solar & Wind) generation system (Short & Long fluctuation range)
- Possible impact on the grid operation by integrating RE generation system
- Introduction to HOMER

Operation & Maintenance

- PV facility Inspection, Testing & troubleshooting PV arrays; using IV-curve tester and string line tracer
- Cleaning schedule of PV panels

- Inspection record
- Inspection Plan (Daily, Monthly & Yearly)
- Performance Ratio calculation sheet

He summarized that the trainings overall are very good and very well organized.

By completing the project,

- PUC solar technicians are able to trouble shoot and identify problems in any solar plant in Pohnpei by way of using special testing equipment provided by JICA.
- We are able to understand the effect of high RE penetration to grid.

Q/A and Comments:

Regarding RE manual, we will upload to the OneDrive. Please check it. Then, please finalize it as an official document of PUC. (Kakefuku)

→Yes. (Julian)

Can you pick up some practical skills which you can apply to the day-to-day job? (Ogawa)

→Some of measurement instruments were provided by the project. We conduct PV maintenance with the very useful equipment. (Julian)

→Please try to keep these instruments in good conditions. (Ogawa)

Announcement for all utility:

- Please share the latest data for PR, and SFC for June 2023. (Nakamura, Ogawa)

5. Closing remarks by JICA FSM, Resident Representative, Mr. Kunihiro Yamauchi

Mr. Yamauchi Kunihiro thanked all participants and introduced himself as new Resident Representative. He also congratulated the project team on the success and completion of the seminar. He recognized that improvement of energy security and environmental consideration in the Pacific by introducing renewable energy had been actively promoted, however, the input of renewable energy is unstable. Considering diesel generator is essential to some extent as a base load power supply in the region, but in order to secure sustainable power supply and sustainable implementation system, it is necessary to maximize the introduction of renewable energy. He pointed that in FSM, the power is mainly supplied using DGs and those facilities are aging and power generation efficiency is going down, and stable power supply is crucial and urgent issue in FSM. In order to assist the government in achieving the goals, JICA has extended the granted project for these power and renewable energy. In today's seminar, he found that so many achievements and said that those kind of efforts and achievement such as the maintenance, prepared manuals would be the next step for pursuing the project objectives. He also noticed that other organizations such as WB, ADB and EU also extended their assistance to the energy sector. He is happy to attend any meetings to discuss a way forward with them. He encouraged that lesson learned would be share with other states or other countries while the situation might be different. He hoped that the corrective efforts would continue and achieve the ultimate goal of the project which is improving

energy security as well as contribute to reduce CO2 emission.

(End)

**THE PROJECT FOR INTRODUCTION OF HYBRID POWER GENERATION SYSTEM
IN PACIFIC ISLAND COUNTRIES**
2nd Seminar in Federated States of Micronesia
~About the results of the five-year project~

Thursday, July 6th 2023
Pohnpei, Kosrae time 13:00 – 15:30 (Maximum extension until 16:00)
Yap, Chuuk time 12:00 – 14:30 (Maximum extension until 15:00)
Venue: Zoom meeting

【Program】

13:00 ~ 13:05 (Pohnpei, Kosrae), 12:00 ~ 12:05 (Yap, Chuuk)

Opening Remarks (Acting Secretary, DRD, FSM, Mr. Florian Yatilman)

13:05 ~ 14:00 (Pohnpei, Kosrae), 12:05 ~ 13:00 (Yap, Chuuk)

- ① Project Summary (JICA, Chief Advisor, Mr. Tadayuki Ogawa)
- ② Capacity Assessment report (JICA Expert Team leader, Mr. Luis Kakefuku)

14:00 ~ 15:15 (Pohnpei, Kosrae), 13:00 ~ 14:15 (Yap, Chuuk)

Keynote speech

- ① 「Experience, knowledge, and expertise in maintenance and management of diesel power plants gained through the project (Chuuk)」
(CPUC, Generation Manager, Mr. Dennis Triana)
(15minutes)
- ② 「Experience, knowledge, and expertise in maintenance and management of diesel power plants gained through the project (Kosrae)」
(KUA, Operations Manager, Mr. Robert Taualupe)
(15minutes)
- ③ 「Experience, knowledge, and expertise in renewable energy installation planning and maintenance gained through the project (Yap)」
(YSPSC, Engineering Manager, Mr. John A. Chieng, or Mr. Jacob Choay)
(15minutes)
- ④ 「Experience, knowledge, and expertise in renewable energy installation planning and maintenance gained through the project (Pohnpei)」
(PUC, Manager, Renewable Energy Mr. Sidney Kilmete)
(15minutes)

15:15 ~ 15:30 (Pohnpei, Kosrae), 14:15 ~ 14:30 (Yap, Chuuk)

Closing remarks (JICA Micronesia, Resident Representative Mr. Kunihiro Yamauchi)

Participants list (project team members)

No.	Organization	Position	Name
1	Department of Resources and Development	Acting Secretary	Mr. Florian Yatilman
2	Department of Resources and Development	Assistant Secretary	Mr. Faustino Yarofaisug
3	Yap State Public Service Corporation	General Manager	Mr. Victor Nabeyan
4	Yap State Public Service Corporation	Engineering Manager	Mr. John A. Chieng
5	Yap State Public Service Corporation	Power Plant Manager	Mr. Cristopher Igem
6	Chuuk Public Utility Corporation	CEO	Mr. Kembo Mida
7	Chuuk Public Utility Corporation	Generation Manager	Mr. Dennis Tariana
8	Chuuk Public Utility Corporation	Head of power distribution	Mr. Albert Francis
9	Pohnpei Utilities Corporation	General Manager	Mr. Nixon T. Anson
10	Pohnpei Utilities Corporation	General Manager	Mr. Dackson Solomon
11	Pohnpei Utilities Corporation	RE Manager	Mr. Sidney Kilmeter
12	Kosrae Utilities Authority	General Manager	Mr. Fred Skilling
13	Kosrae Utilities Authority	Operations Manager	Mr. Robert Tualupe
14	Kosrae Utilities Authority	Electrical engineer	Mr. Gerardo Protacio
15	JICA Micronesia Office	Resident Representative	Mr. Kunihiro Yamauchi
16	JICA Micronesia Office	Project Formulation Advisor	Mr. Toshikazu Nonaka
17	JICA	Chief Advisor	Mr. Tadayuki Ogawa
18	JICA Head Office		Mr. Naohiro Ojima
19	JICA	JICA Expert	Mr. Luis Kakefuku
20	JICA	JICA Expert	Mr. Masanori Shimabuku
21	JICA	JICA Expert	Mr. Hirokazu Nakamura
22	JICA	JICA Expert	Mr. Hideyasu Hokama
23	JICA	JICA Expert	Mr. Takahisa Watanabe

Participants list (Invitees)

No.	Organization	Position	Name

Many Pacific island countries rely heavily on imported fuel for their main electric energy source and reducing fuel costs has been one of their greatest issues for improving energy security.

Incurring these circumstances, these countries are actively aiming to promote the development of renewable energy. However, in development of renewable energy, which has unstable output, it is indispensable to take into consideration the stability of the power system to which it will be integrate. The fuel consumption of diesel generators which are the main power source that will respond to output fluctuations, and the financial status of power source to ensure a stable energy supply and sustainable implementation structure and moreover, lead to reduced fuel consumption. In addition, to improving the diesel power plants and small hydroelectric power plants, solar generation equipment and micro-grids, JICA has provided a wide range of assistance to the power sectors of Pacific Islands Countries including assisting in establishing development plans and human resources development through trainings.

Diesel generating plants always an important role in power plants as well as in industries and commercial installations to meet the continuous and emergency standby power requirements. A good knowledge of operations principles, layout requirements, associated components and maintenance practices for diesel power plants helps the career development of many technicians and engineers in today's world. The training provided by JICA with the experts instructors leading the technical staff, a proper way to provide thorough knowledge and increase skills for the operation and maintenance of the diesel power plant.

Those who work for power plants must constantly recognize the mission of the electric power business, encourage business with close attention and a strong sense of responsibility, and strive to maintain and improve business performance. Those who are engaged in power plant operation should pay close attention to his daily health, keep their minds calm and be careful during operation. Each operator should always be familiar with the system, function, characteristics, operation condition etc. of the facility and deal with calm even in case of accident or other urgent need. Always try self-development such as acquisition of knowledge and improvement of technology, so that if disaster occurs should try to be able to take appropriate measure. Operators should be aware of the following matters according to the instruction of the operation manager. Operating procedures should be performed according to each method and operation manual. Keeping in mind that "safety is given priority to everything", all the coworkers who work on the site should try to achieve the safety policy in accordance with each safety action guideline.

Operators should operate the power plant according to the direction of the generation manager. Always aware that generation manager is responsible for prevention of disasters, strive to improve knowledge. In the case of a disaster, operation manager shall instruct the operator calmly and take immediate action to attend appropriate measures. Generation manager must positively discover unsafe conditions of facilities and unsafe acts of operators and take appropriate guidance and measures. Precautions before the power plant operation and precautions at the end of operation.

Maintenance is one key to diesel generator set reliability

Preventive maintenance Because of the durability of diesel engines, most maintenance is preventive in nature. Regular engine exercise, it is generally a good idea to establish and adhere to a schedule of maintenance and service based on the specific power application and the severity of the environment. The best way to keep track of maintenance intervals is to use the running time meter on the generator set to keep an accurate log of all service performed. This log will also be important for warranty support.

General inspection When the generator set is running, operators need to be alert for mechanical problems that could create unsafe or hazardous conditions.

Proper diesel generator maintenance is key to ensuring that your equipment keeps running for years to come and these key points are essential.

10 Basic Essential steps for proper diesel generator maintenance

1. Routine General Inspection diesel generator maintenance
2. Lubrication Service is essential for diesel generator maintenance
3. Cooling System as part of maintenance of your generator
4. Check the Fuel System during maintenance of your generator
5. Test Batteries during maintenance of your generator
6. Routine diesel generator maintenance exercise
7. For Diesel generator maintenance cleanliness is key
8. Exhaust system inspection for a diesel generator maintenance check
9. Servicing the air cleaner
10. Washing the engine breathers

Conclusion:

Preventive maintenance for diesel engine generators plays a critical role in maximizing reliability, minimizing repairs and reducing long-term costs. By following generally recognized diesel maintenance procedures and specific manufacturer recommendations for your application, you'll be assured that your diesel power system will start and run when you need it most.

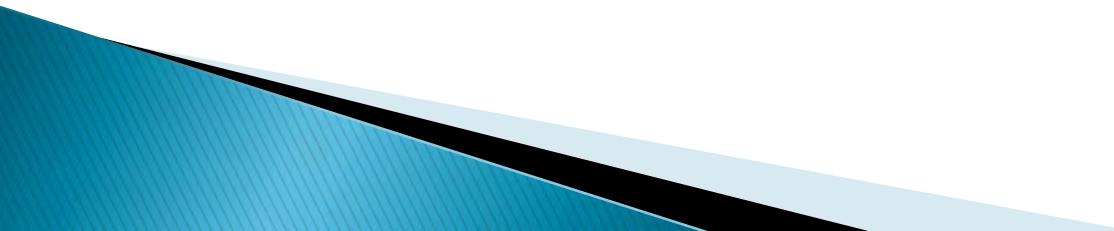
End.

Kosrae Utilities Authority FSM

**Experience, Knowledge and Expertise in
Maintenance and Management of Diesel
Power Plants gained through the project**

This training on Diesel Power Plant Operation and Maintenance was a very successful and helpful which enhance the knowledge, skills and attitudes in operating a diesel power plant including tending, maintaining and repairing diesel engine and alternator.

This falls on Three Competencies:

1. Basic Competencies
 2. Common Competencies
 3. Core Competencies
- 

Basic Competencies

This covers the knowledge, skills and attitude required to lead in the dissemination and discussion of ideas, information and issues in the workplace.

Four Elements:

1. Lead workplace communication
 - Communicate information about workplace processes
 - Lead workplace discussions
2. Develop and Practice Negotiation skills
 - plan negotiations
 - participate in negotiations
3. Solve Problems Related to Work Activities
 - identify the problem
 - determine fundamental causes of the problem
 - determine corrective action
 - provide recommendations
4. Use Mathematical Concepts and Techniques
 - identify mathematical tools and techniques to solve problem
 - apply mathematical procedure/solution
 - analyze results

Common Competencies

This covers the knowledge, skills and attitudes in indentifying handling and using measuring instruments.

Three Elements:

1. Selecting measuring instruments
 - object or component to be measure is identify
 - correct specifications are obtained from relevant source
 - appropriate measuring instrument is selected according to job requirements
2. Carry out measurements and calculation
 - measuring tools are selected in line with job requirements
 - accurate measurements are obtained in according with the job requirements
3. Maintain measuring instruments
 - measuring instruments are kept free from corrosion
 - measuring instruments are kept cleaned before and after

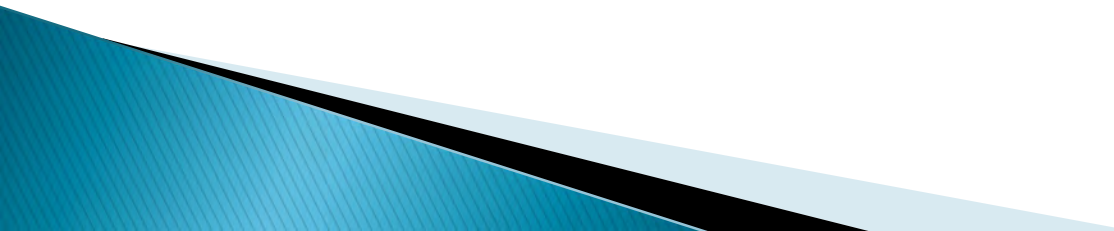
Core Competencies

This unit covers the required performance in executing the preparation and tending of diesel and its auxiliary equipment.

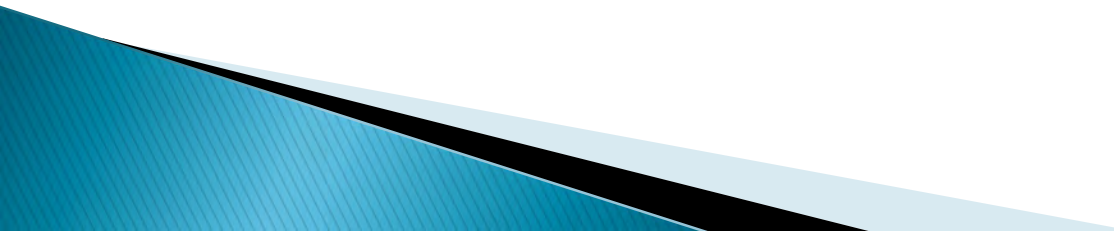
Three Elements:

1. Perform pre-operation check of diesel engine and auxiliary equipment
 - walk-around check
 - result are kept recorded
2. Perform operation check
 - engine running condition is monitored for normal operation base on indicating parameters
 - routine check is performed during operation in accordance to checklist
 - unit abnormalities are recorded and reported
3. Perform post-operation procedure
 - shutdown procedure is coordinated with control operator in accordance with policy
 - daily operation is recorded and reported

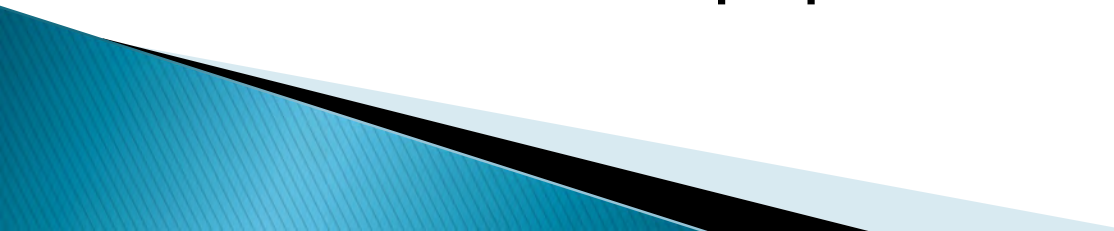
Safety

1. Safety first to be observed at all times by all persons engaged in works on power station, or electrical supply facilities. Its objectives are to ensure
 - the safety of each individual
 - the safety of his workmates
 - the safety of the public and the environment
 - the safety of the power generation equipment and property
 2. Safety equipment and personal protection
 3. Periodic inspection standard of safety equipment
 4. Electric shock
 5. Short circuit
 6. Ground fault
 7. Approach limit
 8. Electric insulation
- 

Basic Principle of Diesel Engine

1. Basic knowledge of diesel engine in Terms and Unit,
and main related formula
 2. Operating principle of diesel engines
 - two type of configuration in IC engine – 4 stroke
and two stroke
 3. Structure of diesel engine in two types– Vertical–type and Horizontal–type
- 

Operating of Diesel Power Plant

1. Operators precaution
 - operation procedures
 - safety precaution, operator's safety precaution etc
 2. Efficient operation
 - patrol inspections and load allocation
 3. Periodic inspection of Mechanical
 - total overhaul inspection
 - periodic inspection manual
 4. Periodic inspection of Electrical and Instrument equipment
- 

Trouble Shooting

Troubleshooting is a form of problem solving applied to repair failed, processes on a machine or a system. It is a logical systematic search for the source of a problem in order to solve it.

For example:

1. When the alarm device operates on high water temperature, over current trip, generator breaker trip etc.
2. Using the basic number and name of the automatic control device to identify which circuit cause the problem
eg: 52G is for generator circuit breaker
If this circuit breaker trip we use the number 52G to identify that circuit in the wiring or schematic diagram to trace what circuit causing this trip and it could be a over current relay, high water temperature etc.

Overhauling

An engine overhauling can bring your engine back to life. It is the process of deconstruction the current engine and having new internal pieces placed. This involves new cylinders, valves, springs and more.

There are two types: one for repair and one for periodic inspection carried out based on the instructional manual.

Therefore it is important to carefully read engine's instruction manual, maintenance manual etc. before disassembly.

Overhauling is base on manufacture recommendation and running hours of the engine

Fuel Consumption

Measurement of the fuel consumption rate helps to know the efficient operation of the engine and not wasting fuel.

$$\text{Fuel Efficiency} = \frac{\text{generated power (kWh)}}{\text{fuel consumption (gals)}} \quad (\text{kWh/gal})$$

$$\text{eg. kWh generated (1 hr)} = 650$$

$$\text{fuel consumption (gals)} = 350$$

$$\text{Fuel efficiency of engine} = \frac{650}{350}$$

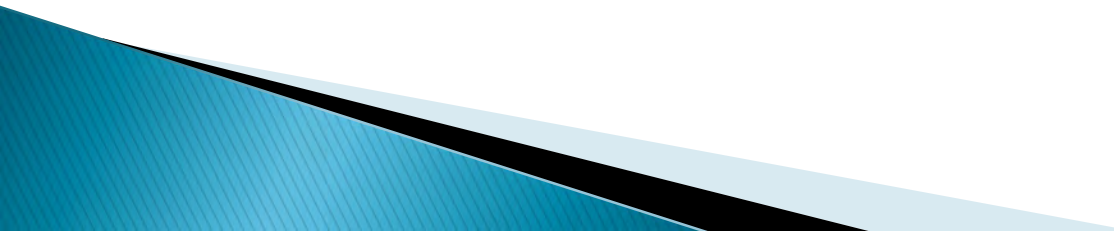
$$= 14.29 \text{ kWh/gal}$$

$$= 14.29 \text{ kWh/gal}$$

Conclusion

This training project help in preparing for our top overhaul of our Daihatsu engine which we are preparing for now.

Thank you



Experience and Knowledge Gained

**INTRODUCTION OF HYBRID POWER GENERATION
SYSTEM IN PACIFIC ISLAND COUNTRIES**

Yap State Public Service Corporation



Agenda



- Introduction
- Example
- Troubleshooting
- Solution
- Performance Ratio Log
- Additional Content
- Summary

Introduction



JICA has provided us the essentials to keep our system efficient. They have also provided valuable tools that are widely used within our organization to troubleshoot faults. We'll be presenting an example of how we have used some of these important tools.

Example

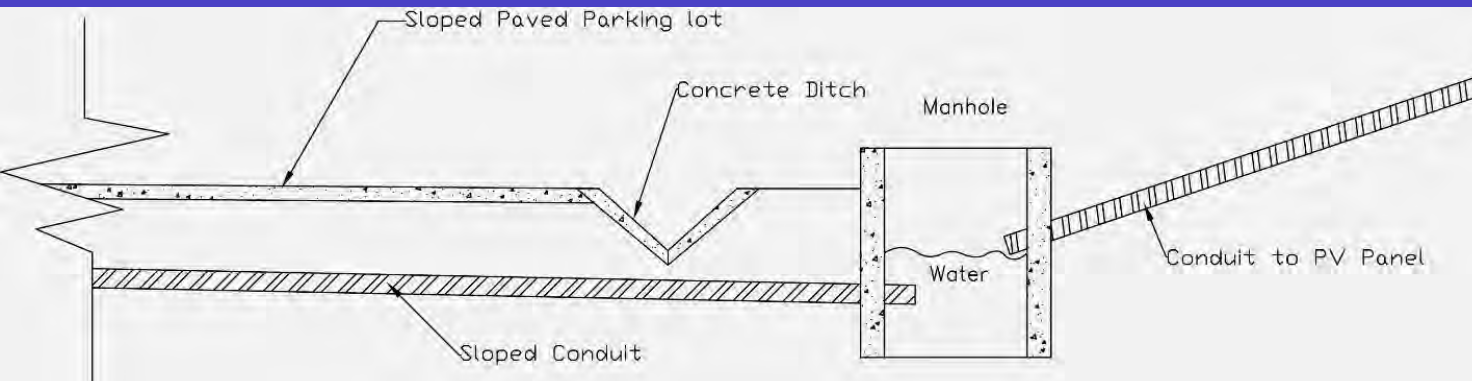
One of our system was displaying ground fault error

Matrice 200 Infrared drone pictures



Troubleshooting

Using the JICA provided insulation tester, Jacob Choay found that a DC cable (negative side, insulation resistance result: 0.010 Mega ohms) has an abnormal insulation value when compared to the other pair (positive side, insulation resistance result: 727 Mega ohms). This negative cable connects the PEC inverters to the PV array. After further evaluation, we established that one manhole has been trapping in water. After a period of around 7 years, the water has broken through the insulation and is in contact with cables causing a ground fault.



Confined Water Area

Solution

Working alongside our consultant Vincent Bouet, we decided to order and replace this cable. The new cable will be installed avoiding manhole and conduit especially around water prone areas so that water will naturally drain through the sand and the soil around the cable.



Performance Ratio Log

Waiting for the cable order, new cable installed on December 10, 2022.

Item	Date	2022												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rated Capacity of PV system(kW)		200	200	200	200	200	200	200	200	200	200	200	200	
Monthly Total Power Generation by PV system (kWh)		20479	19405	22535	13491	17500	13014	11054	10412	10894	9670	10000	14088	14378.50
Monthly Average Solar Radiation (kWh/m2/day)		4.170581	4.710857	5.080258	4.650462	4.548387	4.744	4.62271	4.323871	4.6752	4.001032	4.3488	4.088889	4.50
Number of days per month		31	28	31	30	31	30	31	31	30	31	30	31	
Theoretical maximum energy yield(kWh/month)		25,858	26,381	31,498	27,903	28,200	28,464	28,661	26,808	28,051	24,806	26,093	25,351	
Performance Ratio(%)		79.1	73.5	71.5	48.3	62	45.7	38.5	38.8	38.8	38.9	38.3	55.5	52.41

Item	Date	2023												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rated Capacity of PV system(kW)		200	200	200	200	200	200	200	200	200	200	200	200	
Monthly Total Power Generation by PV system (kWh)		17368	19628	24444	21416									20714.00
Monthly Average Solar Radiation (kWh/m2/day)		3.816	4.831714	5.377548	5.0288									4.76
Number of days per month		31	28	31	30	31	30	31	31	30	31	30	31	
Theoretical maximum energy yield(kWh/month)		23,659	27,058	33,341	30,173	0	0	0	0	0	0	0	0	
Performance Ratio(%)		73.4	72.5	73.3	70.9	0	0	0	0	0	0	0	0	72.53

Additional content

JICA has also provided a very useful tool known as the I-V Curve tester. This tool is regularly used especially in the outer islands.

IV Curve Tester Examples

- This tool has been used in 5 major outer island PV plants that has gone through strong winds.
- Fedrai, Asor, Mogmog, Falalop and Fais - Typhoon Maysak March 26, 2015.
- Satawal PV panels - Typhoon Mawar May 19, 2023.
- Knowing the condition on these PV panels has enabled us to order and replace these faulty PV panels.

Summary

With JICA's training throughout the past 5 years, we have gained useful knowledge in the fields of solar plant. We want to thank JICA and Enetech for taking the time to support us with our solar plants.



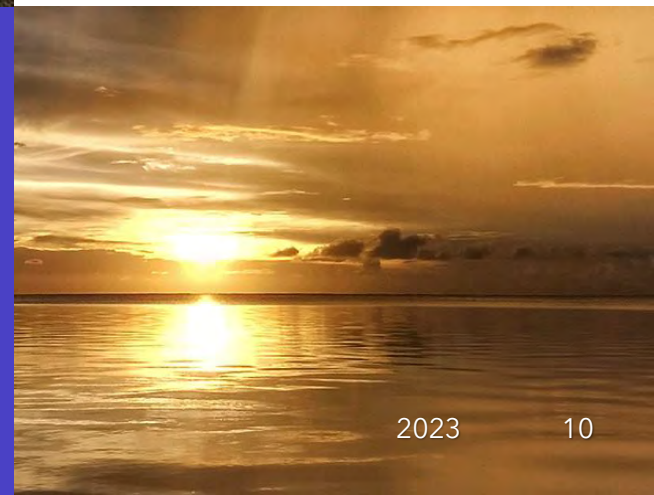


RE Team
John Chieng
Jacob Choay
Charles Laman

www.yspsc.org



Thank you!



POHNPEI UTILITIES CORPORATION

SIDNEY KILMETE

PUC RE MANAGER

Experience, Knowledge and expertise in renewable energy installation planning & maintenance gained through the project.

EXPERIENCE

- Regional Training (Fiji-EFL Training Center)
 - Have the opportunity to confirm the knowledge acquired during the past training and exchange our views and opinion with other participant through group discussion.
 - Encaged in group practical work (troubleshooting PV arrays, diagnostic string fault using cell line checker, IV curve tester & Insulation Resistance tester).
 - Visit to NCC center in Nadi, Fiji and witnessed how EFL control and operate their grid system using SCADA system.
 - Learned new solar PV testing equipment (IV-curve tester, Cell line checker, Insulation resistance tester).

RE TRAINING IN YAP-JULY 22, 2019

OBJECTIVE: TO ENHANCE CAPACITY OF COUNTERPART UTILITIES IN RENEWABLE ENERGY IMPLEMENTATION/OPERATION & MAINTENANCE (O/M).

- Understand Yap energy goal: Highest possible RE penetration; Maintain power system stability & reliability.
- Visit to 825kW (retractable windfarm)... and understand their Power Management tool “Hybrid Wizard”
 - Ave Load: 1,500kW (Wind 825kW, Solar 508.5kW, DEG 2ea x 1860kW; 1 ea x 830kW)
- In class lecture
 - Theory
 - Develop inspection record sheet
- Practical – conduct solar array test using IV-curve tester.

KNOWLEDGE

- Most Important topics covered:
 - Integration of RE
 - 1. Variability of RE (Solar & Wind) generation system (Short & Long fluctuation range)
 - 2. Possible impact on the grid operation by integrating RE generation system
 - 3. Introduction to HOMER
 - Operation & Maintenance
 - PV facility Inspection: I) Visual & Periodic check
 - Testing & troubleshooting PV arrays
 - Using IV-curve tester; use to check the performance of PV module.
 - String line tracer: use to check the pv modules for short or break
 - Cleaning schedule of PV panels
 - Inspection record
 - Inspection Plan (Daily, Monthly & Yearly)
 - Performance Ratio calculation sheet

TRAINING CONTENT

- Basic knowledge of hybrid power generation system (HPGS) technology
- Explanation of PR
- Basic knowledge on preparation & updating of RE integration manual
- PV maintenance
- PV facility Inspection
- O&M of PV system
- Inspection checksheet
- Learned use of measurement equipment (string tracer, Cell line checker, insulation resistance tester, Infrared)

EXPERTISE IN RE INSTALLATION, PLANNING & INSTALLATION

- Testing & commissioning of Palikir 180kW solar plants – Dec 2012
- Encaged in planning & installation of 200kW PEC fund project installed on top of Nett Elem. School roof – August 2014
- Installation, testing & commissioning of 600kW solar installed by Vergnet, funded by UAE.
- Installation, testing, commissioning of 274kWp solar by Clay Energy
- Installation, testing & commissioning of 2MW solar plant by KSEL.

IN SUMMARY

- The training overall is very good and very well organized
- By completing this training course;
 - PUC solar technicians are be able to trouble shoot and identify problems in any solar plant in Pohnpei by way of using special testing equipment provided by JICA.
 - We are able to understand the effect of high RE penetration to grid.What are the solutions so solve?
 - Types of solar PV modules
 - Types of Inverters

THANK YOU VERY MUCH FOR LISTENING &
PATIENCE

