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YAP RENEWABLE ENERGY DEVELOPMENT PROJECT

IPS Connect Conference, Hawaii 2018

James Mason– Oct 2018

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PRESENTER – JAMES MASON

- International Business Development Manager with Entura
- Entura were awarded the Design and Construction Supervision (DSC) contract on 29th April 2014
- My role in this project was Project Director
- Implementing Agency – Yap State Public Service Corporation (YSPSC)-Faustino Yangmog and Victor Nabeyan
- Funding Agency - ADB - Mike Trainor

Yap State Public Service Corporation

ADB ASIAN DEVELOPMENT BANK

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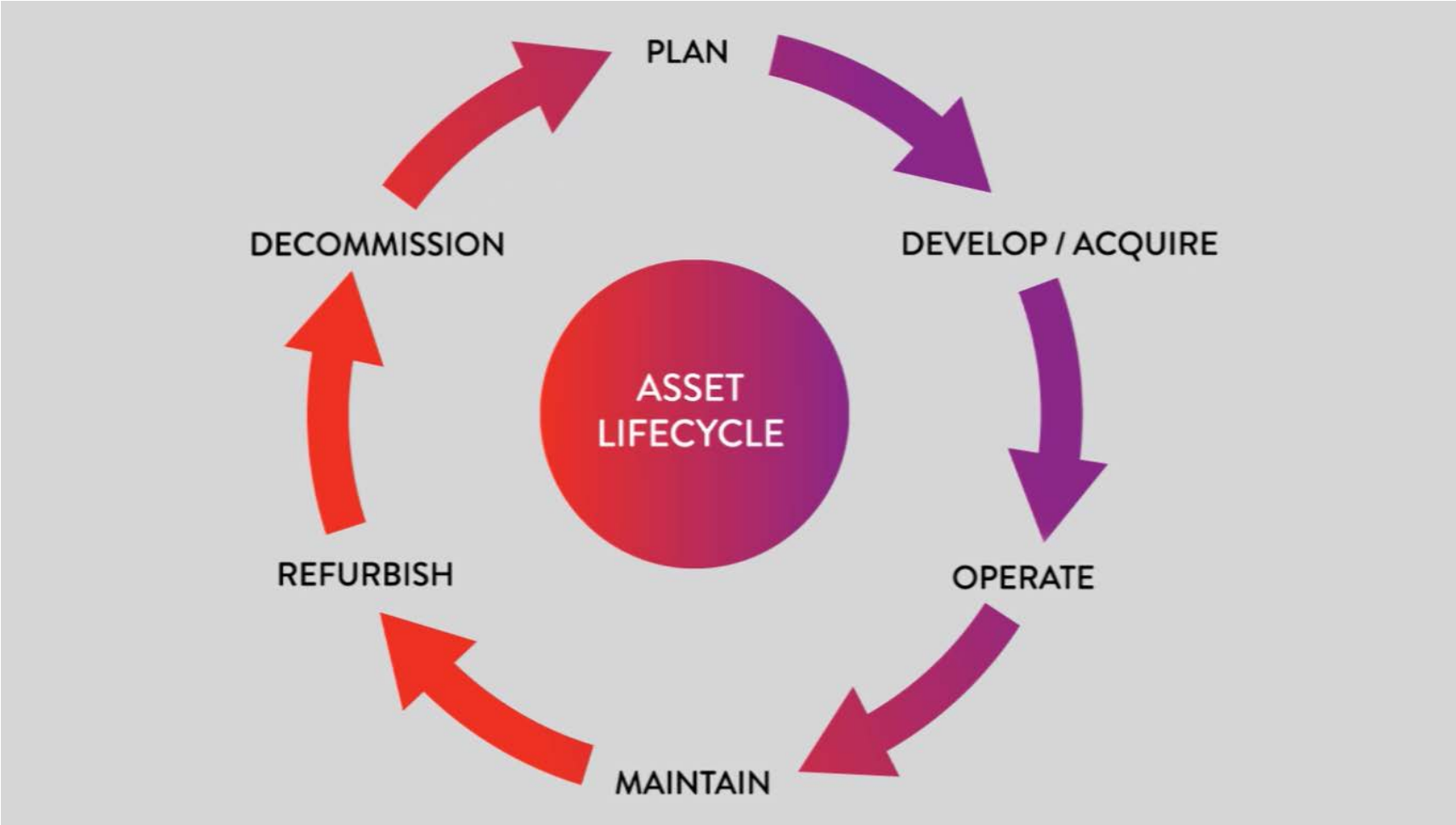
AGENDA

- Introduce Entura
- Present an overview of one of our recently completed projects in the pacific
- Discuss the outcomes
- Next Steps

ABOUT ENTURA

- One of the world's most experienced specialist power and water consulting firms
- Part of the Hydro Tasmania group - backed by more than 100 years of creating energy and maintaining power and water assets
- Services covering every aspect of major power and water projects, from strategy, planning, design and construction through to operation, maintenance, risk management and training
- Over 250 staff; expanding business opportunities nationally and internationally
- Broad range of clients across the Asia-Pacific region including:
  - all levels of government
  - electricity and water utilities
  - developers
  - funding agencies (World Bank, ADB)

SOLUTIONS ACROSS THE WHOLE LIFECYCLE



HYBRID RENEWABLES

As the world increasingly embraces renewable electricity generation, and transitions away from costly or emissions-intensive technologies, the need is growing for hybrid renewable energy assets that combine multiple forms of generation and storage.

Our services include:

- renewable energy roadmaps, conception and master planning
- feasibility studies and concept designs
- power systems and grid connection studies
- due diligence assessments
- tender and bid responses
- planning and environmental approvals
- front-end engineering design including power systems modelling, integration design and control design and interface specification
- detailed designs, technical specification, procurement and factory testing
- control code and HMI (operator screen) design and preparation
- owner's engineer role
- project management of site works including construction, installation, pre-commissioning, unit commissioning, system integration commissioning and initial operation
- asset management plans
- operator training
- remote system support
- web dashboards and app development for mobile devices

PLANNING A RENEWABLE ENERGY JOURNEY IN THE PACIFIC

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STAGE 1: PLANNING

- POWER SYSTEM AND RENEWABLE RESOURCE INVESTIGATION
- DEFINE POWER SYSTEM GOALS AND STRATEGY FOR THE JOURNEY

STAGE 2: INTRODUCTION OF RENEWABLES

- UP TO 15% RENEWABLES
- SMALL-SCALE RENEWABLES
- MINOR CHANGES TO SYSTEM OPERATION

STAGE 3: EXPANSION OF RENEWABLES AND INTRODUCTION OF ENABLERS

- UP TO 35% RENEWABLES
- INTEGRATE LARGE-SCALE RENEWABLES
- INTRODUCE ENABLING TECHNOLOGIES
- CHANGES TO OPERATIONAL PHILOSOPHY TO PRIORITISE RENEWABLES

STAGE 4: EXPANSION OF RENEWABLES AND ENABLERS

- UP TO 70% RENEWABLES
- INTEGRATE LARGE-SCALE ENABLERS AND COMPLEX CONTROL SYSTEMS
- MAJOR CHANGES TO UTILITY OPERATION AND MAINTENANCE PROCEDURES

STAGE 5: APPROACHING 100% RENEWABLES

- ADD 'LAST MILE' ENABLERS
- ASSET MANAGEMENT JOURNEY BEGINS

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YAP RENEWABLES ENERGY DEVELOPMENT PROJECT

Yap State in Partnership with ADB and FSM

YAP - A TRADITIONAL ISLAND OF STONE MONEY

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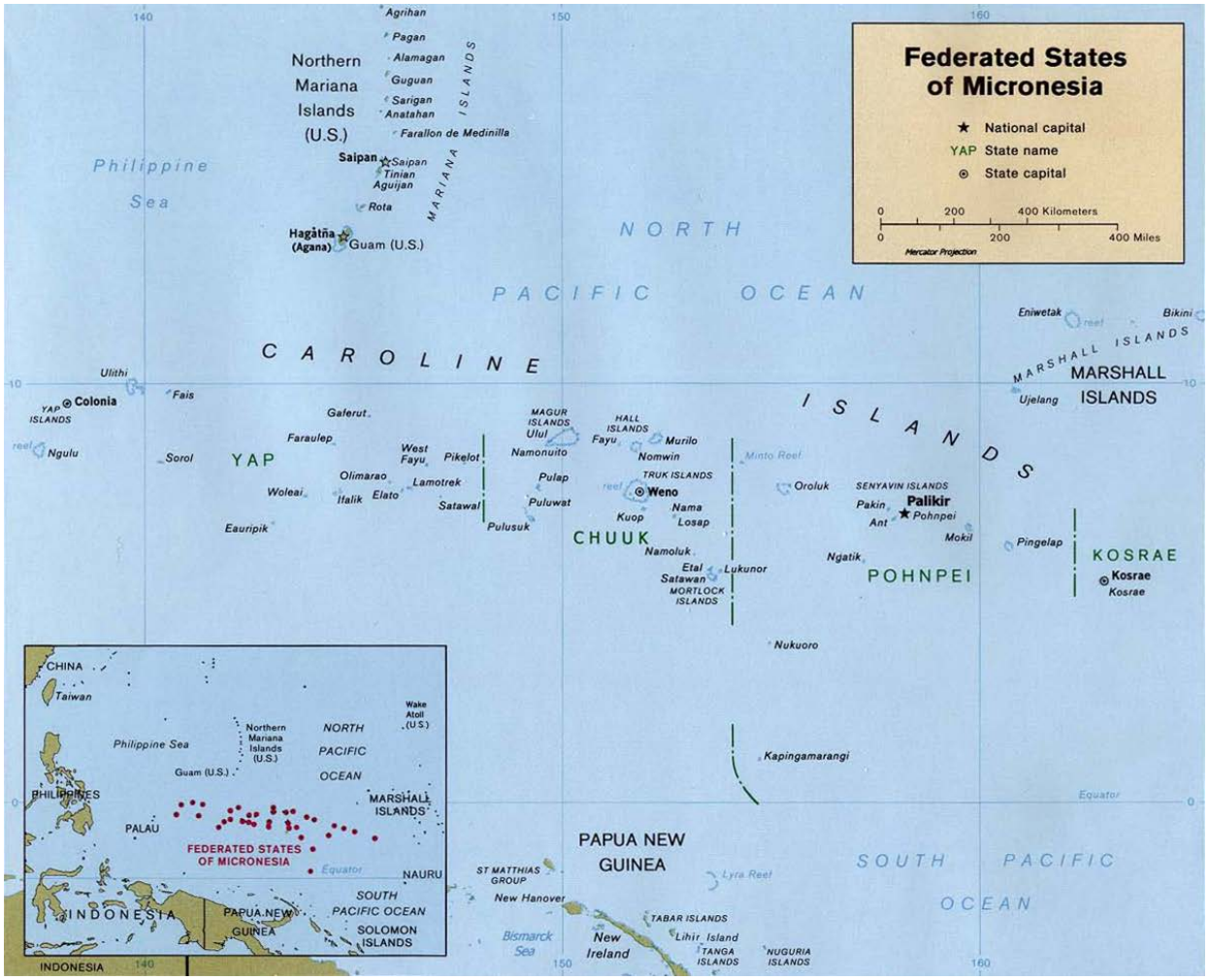
YAP LOCATED IN THE CAROLINE ISLANDS



YAP STATE ENERGY ACTION PLAN

The National Objective for Energy is

- To promote the sustainable socio-economic development of FSM through the provision and utilization of cost-effective, safe, reliable and sustainable energy services.

Yap State's Energy Action Plans

- To become less dependent on imported sources of energy by having an increased share of renewable energy sources
  - 30% of energy coming from renewable sources by 2020
  - 50% of energy coming from renewable sources by 2030

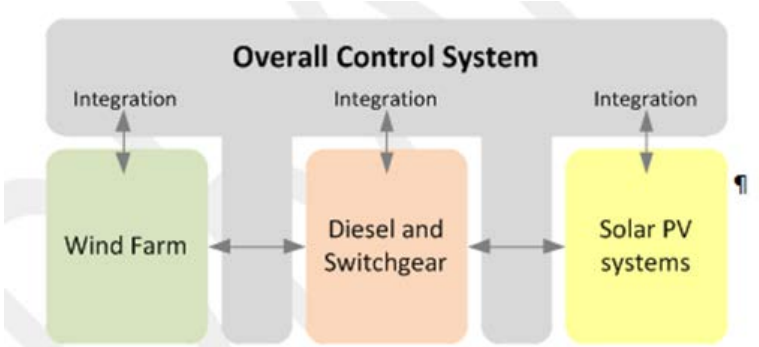
BACKGROUND

- Yap is an island of the Federated States of Micronesia, in the Western Pacific Ocean. Around 10 000 people live on the island.
- The current power station houses four diesel generators with a very limited amount of renewable energy distributed throughout the power system.
- Entura was engaged by Yap State Public Service Corporation (YSPSC) as the design and supervision consultant for the Yap Renewable Energy Development Project (YREDP), which aims to reduce long-term energy costs and increase self-sufficiency and energy security through an energy-efficient, high-penetration renewable energy power system.

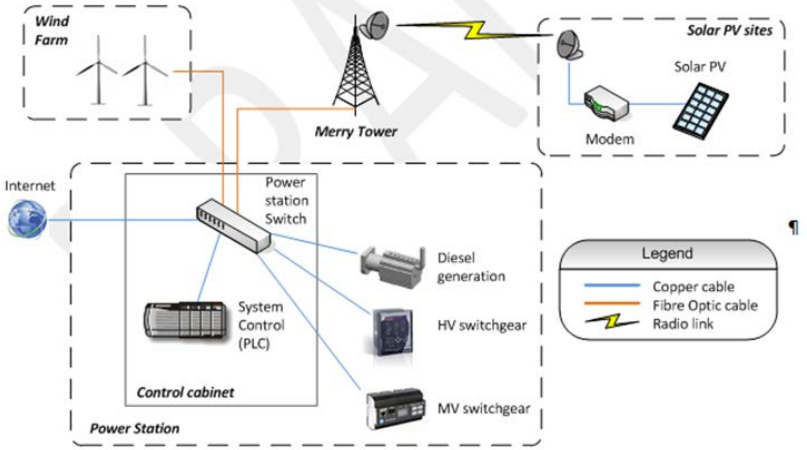
PROJECT METRICS

YREDP - $US11M

- 2 * 1800kW high Speed Diesels
- 1 * 800 KW high Speed Diesel
- 3 * 275 kW wtg = 825 kW
- 300 kw Solar PV on 11 government owned blds
- Automated Integration and Control System
- Communication System



Figure°1.1:·Relationship·between·all·four·YREDP·project·components¶



Figure°2.1:·Future·Yap·power·system·control·network·(simplified)¶

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SOLUTION

- Entura determined the most appropriate hybrid diesel/renewable energy remote area power system. Entura undertook all the necessary assessments, network modelling and investigations to design and specify an integrated renewable energy system to meet the 2.2 MW load, using 825kW of wind generation, 500 kW of grid-connected solar energy and three high-speed, responsive diesel generators.
- The overall architecture of Yap's integrated high-penetration renewable energy system, combined with an innovative automated integration and control system, balances and maintains the security of the energy supply, and also maximises the amount of renewable energy used on the island.

OBJECTIVE

- Once completed, the project aims to enable Yap to experience up to 70 per cent instantaneous renewable penetration when conditions allow.
- The project will provide access to clean, secure modern energy generation, fostering Yap's social and economic development, and reducing the reliance on generation from diesel.
- One of the project highlights is that Yap power system is now placed on the right track for easier future integration of additional renewable energy generation, which will further reduce diesel generation, lower emissions, and help the Federal States of Micronesia to reach its energy action targets.

A MODERN FULLY INTEGRATED HYBRID RE POWER SYSTEM

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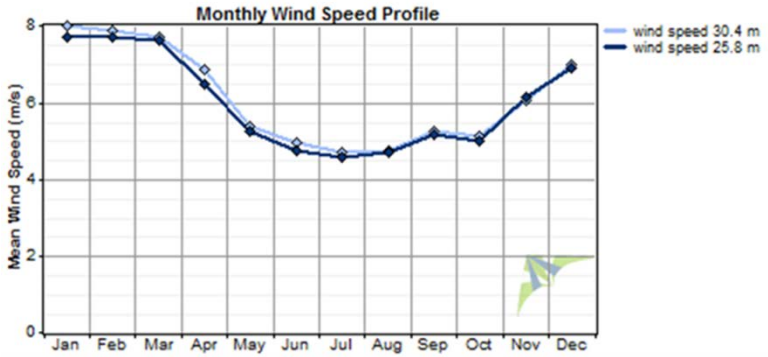
SUMMARY OF RESULTS ACHIEVED TO DATE

- *Since the commissioning, no outage has been attributed to the introduction of the renewable energy facilities, Wind & Solar.*
- *The weather conditions were not favourable to produce important renewable energy. A few windy conditions, with a lot of variability of RE have shown that the supervision and control system is performing as expected, curtailing RE if necessary to keep stability and diesel generator(s) under minimum load.*
- *The Dynamic Spinning Reserve plays its role and we can observe the small peak generator coming on line when necessary.*

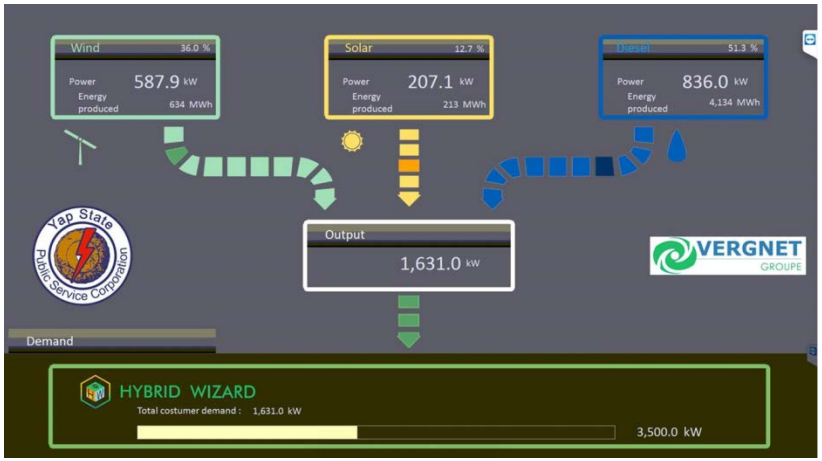
IS THE SYSTEM PERFORMING TO EXPECTATIONS

- The system reached 60% of RE penetration (without any energy storage).
- Under particular conditions, the small peak generator connects & disconnects quite often, this will be reduced with the introduction of an Energy Storage System (next stage).
- The full RE potential will be observed during the trade winds season. At present, the rainy season shows limited RE production in few occasions.



AVERAGE DIESEL DISPLACEMENT

- So far, the wind farm has produced 602 MWh
- The solar farms (ABD project only, PEC excluded) have produced 264 MWh since their installation.
- Approximate Diesel Displacement so far:
  - 866,167 kWh = 61,869 US Gall.
- Against a target of 113,600 gallons diesel/annum @ savings of $500,000 annually



NEXT STEPS

- Under a separate engagement, Entura is investigating the feasibility of including even more diversified, distributed, variable renewable energy generation to be incorporated into this system which includes up to 1MW of more ground-mounted solar, an additional 300 kW of floating solar, an additional 550kW from wind, batteries and the potential for a waste-to-energy system or flywheel as currently planned under the 2018 Energy Sector Masterplan.
- The project has put Yap well on track to realise its ultimate goal of operating with zero diesel, and to realise the significant associated benefits in terms of reduced costs, greater quality and security of power for the community, and increased sustainability through reduced emissions.

CONTACTS

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