



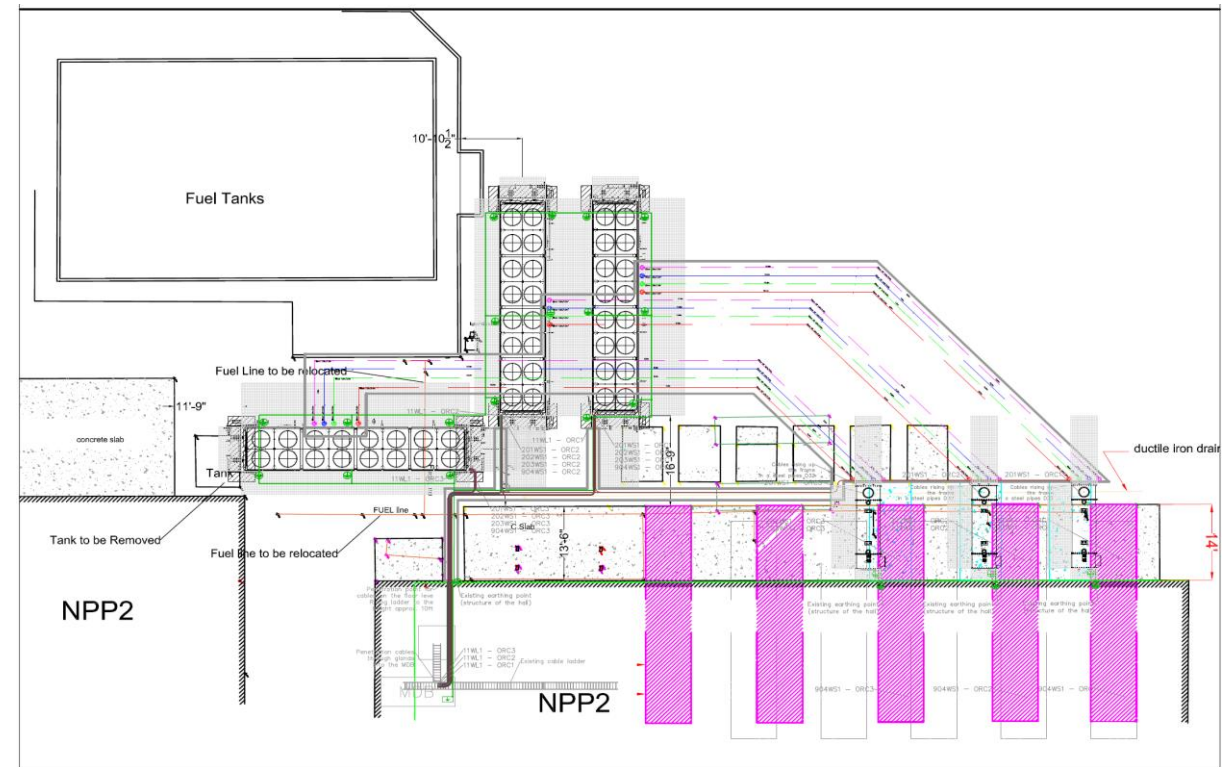
ELECTRATHERM ORC SOLUTIONS

- 30th PPA CONFERENCE –
SAIPAN NORTHERN
MARINAS
- SUCCESSFUL ORC
INSTALLATION POHNPEI
MICRONESIA

POHNPEI UTILITIES CORPORATION NANPOHNMAL POWER STATION ORC PROJECT

The project consists of three ElectraTherm Power+6500B+ ORC's that have been installed inside 40' shipping containers, to recover waste heat from the diesel generators, both engine exhaust and jacket water for generation of renewable energy.

These units have increased the efficiency of the existing diesel generators by producing about 200 kWe of additional power and with the replacement of the existing engine coolers it has provided enhanced cooling of the diesel engines also allowing increased output through reduced derating due to high ambient temperatures.



POHNPEI UTILITIES CORPORATION NANPOHNMAL POWER STATION ORC PROJECT



The project was funded by way of grant from the United States Department of Agriculture Rural Utilities Service High Energy Cost Programme and was undertaken in partnership between Pohnpei Utilities Corporation, ElectraTherm and B: Power.

B:Power are ElectraTherm's system integration partner who undertook the design, containerisation, supply and manufacture of balance of plant and onsite installation and commissioning.

TIMELINE – KEY DATES



The design concepts for the project were;

- Firstly, to provide an economic and efficient solution that met the requirements of the issued RFQ and the Phonpei Utilities Corporation.
- Secondly to provide a solution that minimised onsite installation work and provided protection to the installed equipment from adverse weather conditions.
- Thirdly to provide a system that will accommodate proposed replacement engines with minimum additional work
- Fourthly to provide an installation with high online availability, required minimum maintenance and is simple to operate, and
- Finally, to provide an installation that Phonpei Utilities Corporation is proud to own and operate as well as an installation that both ElectraTherm and B:Power are also proud to be associated with.

The design solutions provided were;

- Supply of ElectraTherm Power+6500B+ ORC's using combined waste heat from the diesel generator exhaust and jacket water cooling system.
- Supply of latest technology dry cooler that provides cooling for both the ORC and Diesel Generator which continues to provide engine cooling should the ORC be offline.
- Supply of high-performance exhaust gas heat exchanger using patented technology to maximise heat recovery from the diesel generator exhaust system.
- Containerisation of ORC and associated balance of plant including electrical cabinet and control system to provide protection against adverse weather conditions.
- Placement of dry cooler mounted on roof of container to minimise footprint of the total system.



The advantages of the containerisation of equipment included;

- The installation of equipment and systems in a controlled clean environment enhancing the quality of the installation.
- Simplified resolution of unforeseen installation clashes between electrical, piping and equipment.
- Enabled testing of installed electrical and piping systems prior to shipment.
- Simplified requirements for shipping to site.
- Minimised handling requirements on delivery to site.

OFFSITE MANUFACTURE





Delivery of the project equipment to Pohnpei occurred July 2021 but due to Corvid 19 restrictions access to site, to enable installation to commence, was not provided until August 2022.

The B:Power installation team consisted of six personnel, who together with local staff and the support of the PUC under the leadership of Nixon Anson, undertook the installation of the equipment.

The advantages of containerisation quickly became evident with onsite activities limited to placement of containers in final locations, placement of dry coolers onto the container roofs, installation of Exhaust Gas Heat Exchangers and the installation of interconnecting pipework.

One of the big challenges faced by the B:Power crew was adjustment to the local climate conditions with excavation work being at times compared to swimming lessons.

B:Power crew worked closely with PUC operations personnel to minimise any disruption to the day-to-day operation of the power station particularly during connection of the heat exchangers to the engine exhaust systems requiring pre planned shutdown of the engines.

On behalf of ElectraTherm and B:Power we would like to acknowledge the leadership and support of the Pohnpei Utilities Corporation in making this project a success and in particular Nixon Anson who has been the driving force behind this project since the first presentation in 2017 until today and his faith in our organisation to deliver.

We also thank the staff of PUC who supported the installation team and Lukas during commissioning and made their stay on Pohnpei both enjoyable and successful.

Importance of Good Data – Starts with Heat Balance Information for Operating Engines

- Initial assessments can be prepared from engine data sheets
- For final solution necessary to measure the actual heat available under normal operating conditions
 - Can be prepared by the utility
 - Alternative visit by an experienced ORC Systems technician to undertake all necessary measurements with the added advantage that a site assessment for the installation of ORC and balance of plant can be done at the same time.
- Noted that a program for the collation of current engine installation for the various utilities has been commenced by the PPA Secretariat.

Discussion between System Supplier - Utility Management and Operating Personnel to establish project expectations

- Potential output against measured waste heat by;
 - Individual Engine
 - Power Station
- Operating hours
- Operating Sequence for Multiple Engine Installation
- Integration of ORC System within Existing Plant
- Training and Maintenance
- Funding and Financial Return

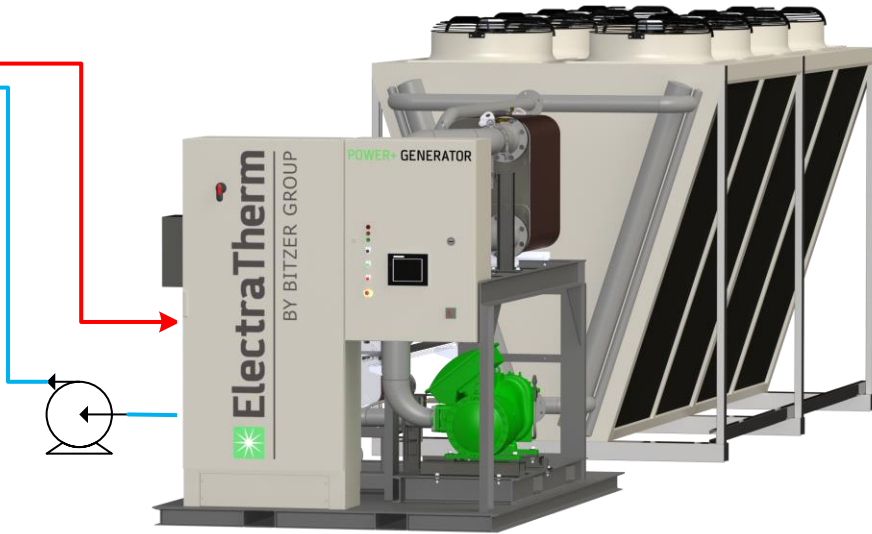
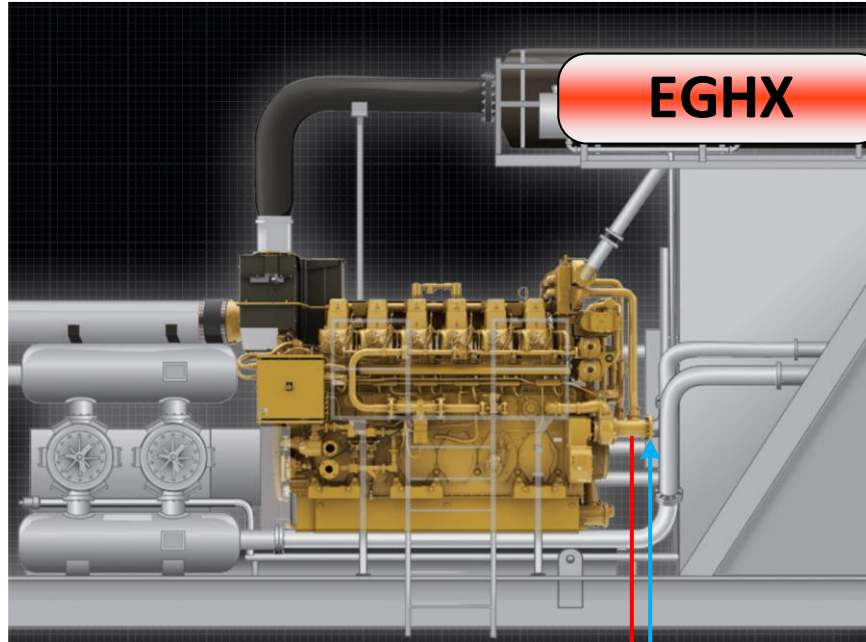
Basis of Contract

- Proposal prepared by System Supplier based on measured heat source and expectation discussions.
- Agreed Scope of Work
- Agreed set of terms and conditions
- Project Timeline
- Project Payment Schedule
- Definition of completion against milestones and overall contract.

OPPORTUNITIES FOR THE PACIFIC

DIVERSE AND FLEXIBLE

STATIONARY ENGINES - ENERGY EFFICIENCY



Issue: Energy Inefficiency due to non use of waste heat.

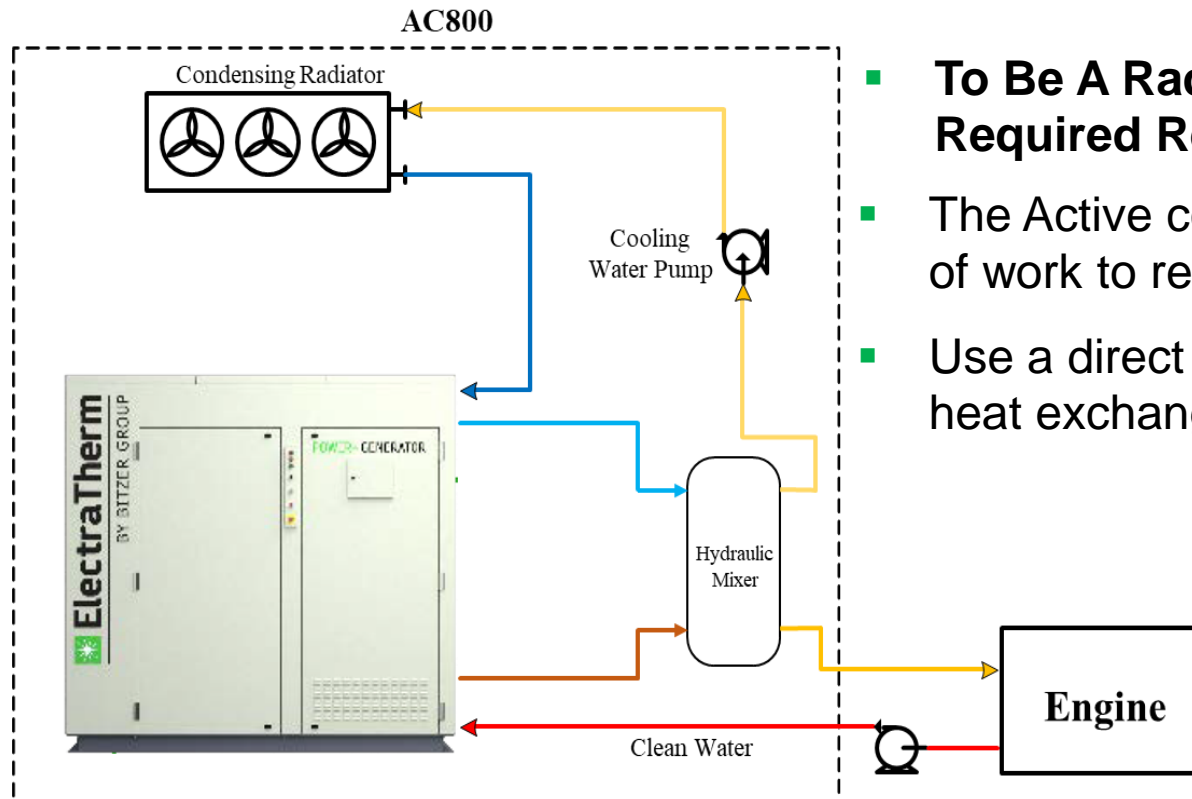
Solution: Energy Efficiency - Installation of **Power+ Generator** to use waste heat from engine exhaust and **Active Cooler** for Engine Cooling. Result saving in operating costs and improved energy efficiency.

Simple solution for immediate action

NEXT GENERATION ENGINE COOLING

AC800 OVERVIEW – RETURN TEMPERATURE CONTROL

Traditional Engine Cooling Systems require either direct mechanical or electrical energy to provide the necessary rejection of heat. As the engine operator you are paying to create the waste heat (fuel cost) and you are paying again to reject that heat (power consuming radiator). The Active Cooler replaces the cost for rejecting the heat and can provide additional power for your customers



- **To Be A Radiator Replacement the AC800 Must Maintain the Required Return Temperature!**
- The Active cooler design aims to include and supply the entire scope of work to replace traditional power consuming radiator cooling.
- Use a direct contact method of heat transfer instead of traditional heat exchanger





Power Generation/Useful Heat – Power+6500B+/Power Module

- Heat From Biomass/Biogas Fueled Boilers
- ORC as Heat Balancing Unit allowing Boiler to operate 100%
- CHP Capability Meeting Downstream Requirements
- Bottoming Plants





Waste Heat Power Generation

– Power+6500B⁺/Power Module

- Waste Heat From Incineration/ Pyrolysis Plants
- CHP Capability Meeting Downstream Requirements
- Bottoming Plants



Turning Thermal Energy Into Geothermal Electricity

- **Geothermal is Abundant and Renewable**
 - Millions of existing wellbores
- **Geothermal is Baseload**
 - Wind and solar are intermittent and require carbon-intense batteries for reliability
- **Geothermal is Distributed and Dispatchable**
 - Geothermal Systems can be scaled from 10 kW to 100+ MW distributed systems
- **Geothermal is Cost-Effective**
 - Reusing existing infrastructure and wellbores reduces capital intensity and eliminates new surface disturbance
- **Partnering with Specialist Companies** – working with Transitional Energy to repurpose existing oil well infrastructure

** Photo courtesy of Transitional Energy*

**The use of ElectraTherm ORC Solutions
for the conversion of waste heat resources
into high value electricity
is only limited**

By The Bounds of Your Imagination



Thank you!

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