MakBan and Tiwi Agile Project - Overhauling Days Reduction

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ABSTRACT

In 2009, the MakBan and Tiwi geothermal power plants were acquired by AP Renewables Inc. (APRI), a subsidiary of Aboitiz Power Corporation. APRI is one of the leading geothermal energy companies in the Philippines, delivering clean and renewable baseload power through its two facilities: Makban Geothermal Power Plant (MGP) with an installed capacity of 458 MW, and Tiwi Geothermal Power Plant (TGP) with 361 MW.

To maintain plant integrity, a comprehensive overhaul is conducted every three years. However, these overhauls often exceeded planned timelines—extending standard durations of 23, 28, and 48 days to actual averages of 26, 36, and 57 days, respectively.

To address this challenge, APRI adopted the Agile methodology. In 2021, the "OH Days Reduction" project became one of the company's three pioneering Scrum-Agile initiatives. The project's primary objective was to reduce overhaul durations from 26–36 days to 18 days, thereby maximizing power generation and improving plant availability.

Implemented using the Scrum framework—an iterative and adaptive approach to project management— the project was driven by a dedicated Scrum Team composed of a Scrum Master, a Product Owner, and Developers. Among the team's key accomplishments were the development of a Critical Spare List and Acquisition Plan for both MGP and TGP, and the successful implementation of High-Velocity Oil Flushing.

Over the course of three years (2021–2024), the "OH Days Reduction" project achieved an average reduction of 5.6 days in overhaul durations, contributing significantly to operational efficiency and reliability.

Keywords: *Plant Overhauling, Critical Spare, High-Velocity Oil Flushing, Scrum*

1. INTRODUCTION

Power plant overhauling is a comprehensive process of planned maintenance that involves inspection, servicing, and repair of plant equipment to ensure optimal performance and mitigate the risks of potential failures. It is a crucial aspect of power plant operation, contributing to safety, reliability, and efficiency. This process is essential in sustaining plant efficiency and extending the service life of key assets.



Figure 1: MakBan Geothermal Plant

At the MakBan geothermal power plant, the system and major equipment include the Turbine and Generator sets, Main Valves, Condensate System, Lubrication

Oil System, Cooling Towers, Main Steam System, Gas Extraction System, Cooling Water System, 480v, Medium, and High Voltage Transformers, Instrumentation Systems, and many more.

The overhauling of the turbine-generator and the oil flushing have been identified as the most critical activities impacting the APRI Plant turnaround schedule. The OH Days Reduction AGILE project focused on analyzing the activities that can impact the completion of turbine generator overhauling completion.

In order to ensure the integrity of the equipment, a comprehensive overhaul is conducted every 3 years. However, overhauling comes with a price; our 23-, 28-, and 48-days standard turnaround duration extends to 26, 36, and 57 days actual average duration. This results in a significant financial impact to the company— until the "AGILE way" was adopted. Eventually, Scrum was introduced at APRI and the top management recognized the necessity to include the project "OH Days Reduction" as part of the 3 pioneer Scrum-Agile Projects implemented in 2021.

This initiative was implemented to improve turnaround efficiency by reducing overhaul durations from 28 days to as few as 18 days. In turn, the project enhances power generation, increases plant availability, and minimizes financial impact through systematic process improvements and the adoption of Agile project management principles.

The project was implemented using the AGILE method, which is a flexible and iterative approach compared to the traditional project management. It employs the "Scrum" framework that helps people, teams, and organizations generate value through adaptive solutions for complex problems. The dedicated Scrum Team consists of a Scrum Master, Product Owner, and Developers.

2. METHODOLOGY/APPROACH

Scrum, which is a specific framework within the broader Agile methodology, was used in the project management of OH Days Reduction. Agile focuses on iterative development and flexibility, particularly in software development. It emphasizes collaboration, continuous feedback, and responding to change throughout the project lifecycle. Instead of rigid, linear processes, Agile uses short, iterative cycles called "sprints" to deliver working software incrementally.

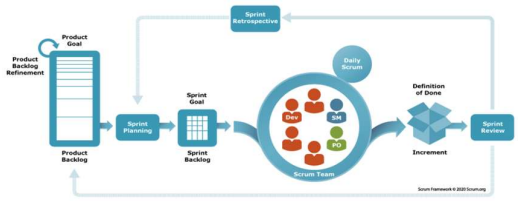


Figure 2: Scrum Framework

2.1 Scrum Team

The fundamental unit of Scrum is a small team of people, a Scrum Team. The Scrum Team consists of a Scrum Master, Product Owner, and Developers. Within a Scrum Team, there are no sub-teams or hierarchies, fostering collaboration and accountability, all of which are critical for managing time-sensitive maintenance operations. It is a cohesive unit of professionals focused on one objective at a time, the Product Goal. Scrum Teams are cross-functional, meaning the members have all the skills necessary to create value in each Sprint. They are also self-managing, meaning they internally decide who does what, when, and how.

2.2 Scrum Events

The Sprint is a container for all other events. Each event in Scrum is a formal opportunity to inspect and adapt Scrum artifacts. These events are specifically designed to enable the transparency required. Failure to operate any events as prescribed results in lost opportunities to inspect and adapt. Events are used in Scrum to create regularity and to minimize the need for meetings not defined in Scrum.

Optimally, all events are held at the same time and place to reduce complexity.

2.3 The Sprint

Sprints are the heartbeat of Scrum, where ideas are turned into value. They are fixed-length events of one month or less to create consistency. A new Sprint starts immediately after the conclusion of the previous Sprint. All the work necessary to achieve the Product Goal, including Sprint Planning, Daily Scrums, Sprint Review, and Sprint Retrospective, happens within Sprints.

● Sprint Planning: The team plans what work will be completed during the sprint.

● Daily Scrum: A short daily meeting where the team discusses progress and any impediments.

● Sprint Review: The team demonstrates the work completed during the sprint.

● Sprint Retrospective: The team reflects on the sprint and identifies areas for improvement.

2.4 Product Backlog

The Product Backlog is an emergent, ordered list of work items needed to improve the product. It is the single source of work undertaken by the Scrum Team. Product Backlog items that can be accomplished by the Scrum Team within one Sprint are deemed ready for selection in a Sprint Planning event. They usually acquire this degree of transparency after refining activities. Product Backlog refinement is the act of breaking down and further defining Product Backlog items into smaller, more precise items.

2.5 OH Days Reduction Project Implementation (2021-2024)

Outage Reduction is achieved by identifying which aspects have direct and indirect impact on the total outage duration. By using the scrum methodology, product backlogs have been identified to target on the following aspects: **Resources, Methods and Sustainability.**

Resources

Critical Spare Parts Availability

● Improvement on the availability of critical spares has a direct impact on the outage duration. During the outage, spares need to be readily available which will prevent outage extension because critical components can simply be replaced. Repair on critical components during outage will increase outage duration if the component is part of the outage critical path.

● Acquisition plan and on the critical spares was coordinated with the procurement team to ensure that delivery and availability of spares are lined up with the upcoming outages.

Method

Plant shutdown and startup procedure improvement

● Proper sequencing for plant shutdown is essential in ensuring that maintenance and/or corrective work can safely start. Similarly, proper plant startup procedure guarantees that the unit can be put back in service.

● Plant shutdown and startup procedure was reviewed with the operations team to standardize the procedure across similar units. Activities were reviewed to check if some tasks can be done in parallel to optimize the duration.

Oil Flushing Improvement

● Oil flushing is part of the critical path for standard turbine and generator overhauling. Historically, oil flushing can take up to 12 to 14 days which directly impact the total outage duration. By implementing both advanced oil flushing

and high velocity oil flushing, total oil flushing duration has been reduced to 3 days.

● Advanced oil flushing enables flushing of main oil supply and return lines through bypass and offline filtration which reduces oil flushing duration once turbine and generator units have been boxed up.

● The majority of the oil pipes for APRI units are already aging and have not been replaced since the plants have been constructed. High velocity oil flushing is the procedure of flushing the oil lines through injecting high velocity oil to remove dirt on the piping.

Turbine-Generator Overhauling Standard Scoping, Layout Plan and Overhead Crane Maintenance

● The turbine-generator overhauling is the critical path during standard overhauling which has a direct impact on the overall duration. Standardizing the scope ensures that the proper and correct procedure with the most optimized duration is implemented during plant overhauling. By standardizing the scope, long term service agreements have been formed with strategic partners to ensure repeatability, consistent quality and standard duration is met.

● Standardized equipment location layout and plan on the turbine floor have also been developed to ensure that all pulled-out components can be properly inspected and accounted for once the unit is for re-assembly. This also ensures that all work parties can have access and walkways so that the turbine-generator overhauling and other parallel works done on the turbine floor will not be stalled.

● Long term service agreement has also been developed on the plant overhead crane to ensure that it is reliable during overhauling since most of the critical path activities require lifting of critical components.

Sustainability

Turbine-Generator Overhauling Table of Organization

● A table of organization was established to ensure clear accountability and responsibilities of the working team. It also ensures that division of work is clear and there are no gray areas during work execution.

● Internal experts have been identified to ensure that competency, training and certification are sustained for the consistency of quality and results.

Best Practices and Lessons Learned Database

● The database was established to track and consolidate all best practices and lessons learned. This ensures that the spirit of agile methodology for continuous improvement is adopted in the outage management framework.

The OH Days Reduction initiative was implemented over three phases, each focusing on key backlog items to improve maintenance performance, particularly for turbine-generator overhauls and oil flushing procedures.

2.5 OH Days Reduction - 2021

In this part, the scrum team accomplished major sprint goals/product backlogs as follows:

● Improvement of the list and preparation of the Acquisition Plan and Budget for Plant Critical Spares

● Execution of Time and Motion Study for Turbine-Generator Overhauling (Critical Path Analysis)

● Improvement of the Turbine and Generator Overhaul Table of Organization

● Improvement of Turbine Cooling Down Schedule and Plant Start-up Procedures

● Development of a Procedure for Advanced Oil Flushing

2.6 OH Days Reduction (Refocused) - 2022

In this part, the scrum team accomplished major sprint goals/product backlogs as follows:

● Development of a Standard Clearance Reference for Generator

● Implementation of Advanced Oil Flushing

● Implementation of High-Velocity Oil Flushing

● Standardized equipment location layout/plan at turbine floor

Table 1: MGP Modular Units Historical Oil Flushing Duration After Overhauling

Oil Flushing Procedure	Actual Duration (Days)
Normal Oil Flushing after OH with manual pipe cleaning (accessible pipes)	12 – 14
Normal Oil Flushing after OH with parallel 3rd Party off line filtration	8 – 10
Normal Oil Flushing after OH with parallel 3rd Party off line filtration and advance Oil flushing OH	5 – 6
High Velocity Oil Flushing	3

2.6 OH Days Reduction (Revisited) - 2023

In this part, the scrum team accomplished the following major sprint goals/product backlogs:

● Development of a Database for Overhauling Best Practices and Lessons Learned

● Development of a Standardized Scope of Work for Long-Term Service Agreement (LTSA). These include the work scope for Plant Overhead Crane maintenance, Turbine-Generator overhaul, and Turbine Rotor servicing.

● Implementation of LTSA Contracts for Turbine overhauling and Plant Overhead Crane to secure long-term service reliability.

● Preparation of Work Instructions for in-house Turbine Diaphragm Repair

3. RESULTS AND DISCUSSIONS

Over the three-year implementation period (2021–2024), the "OH Days Reduction" project achieved a measurable improvement in maintenance efficiency. Specifically, the average overhaul duration was reduced by 5.6 days, contributing significantly to operational efficiency, equipment availability, and enhanced plant reliability.

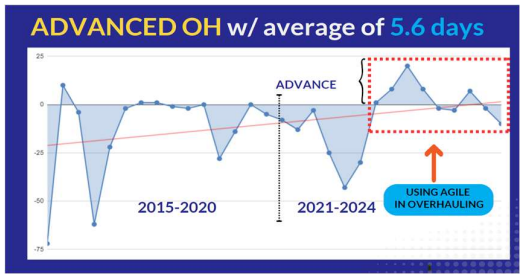


Figure 3: Overhauling duration before and after the OH Days Reduction project

Some of the key accomplishments of OH Days Reduction Agile projects are as follows:

● Improve the list and prepare the Acquisition Plan and Budget for Plant Critical Spares

● Improve the Turbine and Generator OH table of organization

● Improvement of Plant Shutdown and Start-up Procedure

● Implement Advanced Oil Flushing and High-Velocity Oil Flushing

● Standardize OH equipment location layout/plan on the turbine floor

● Develop a database for overhauling best practices and lessons learned

● Implement a long-term services agreement (LTSA) for Turbine and Plant Overhead Crane

● Develop a Standard Scope of Works for Turbine-Generator OH for LTSA

In recognition of these achievements, APRI Finance team forecasted an estimated cost savings of **millions of Philippine pesos** for the period 2024–2028 as a direct result of the project's initiatives. Furthermore, the OH Days Reduction project earned multiple organizational awards from Aboitiz in 2024:

● Agile Project Champion - 2024 Aboitiz Pecha Kucha Showcase

● Most Valuable Agile Project - 2024 APRI Inyovation Culmination Day

● Champion, Innovation-Agile Category - 1AP Team Awards (first win in APRI history)

4. SUMMARY AND CONCLUSIONS

Reduction of overhauling duration is a very challenging task, yet it yields very significant benefits for a power company in achieving operational and financial goals. The following conclusion can be drawn from this project:

Firstly, the AGILE method in project management is very valuable in solving major operational and technical problems in any industry when there is a need for immediate, useful results.

It is very important to develop a comprehensive list and acquisition plan of critical spares for turbine generator overhauling during long-term budgeting. Early identification and procurement of critical components can significantly reduce lead times and prevent schedule delays during turnaround activities.

Furthermore, to achieve advance completion of plant turn around, it is necessary to have a long-term agreement for equipment which can directly affect the critical path schedule.

Lastly, effective implementation of plant outage management guideline and upskilling of maintenance personnel will be helpful to achieve the desired reduction in standard overhauling duration.

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