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*Operational Excellence of Hydro Power Plant With "G-Action Mobile"**

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Abstract
The Gunung Wugul Mini Hydro Electric Power Plant (MHEPP) is a run of river power plant with a Commercial Operation Date (COD) of December 3, 2021, by PT PLN UP2D Central Java-Special Region of Yogyakarta. The application of corporate culture and regulations to run the operations of the Generating Unit such as asset management, Occupational Health and Safety Management System (SMK3) and Security Management System (SMP) require a high level of effort. Socialization and implementation related to the management of the Generating Unit must be carried out to the lowest level for the realization of good management. Focusing on Operational Excellence built on Shingo House Method, where elements of organizational leadership focus on the application of principles, systems, and tools to build superior performance factors by making continuous improvements. The implementation of G-Action Mobile optimizes digital technology and supports the company's program, namely digital transformation for control operations, maintenance, security, and Occupational Health and Safety (OHS) activities more effectively. The G-Action Mobile application can encourage the acceleration of the implementation of corporate culture within the Gunung Wugul MHEPP so that the achievement of a capability factor of 67.16% of the 33.60% target, the issuance of a Zero Accident decree, and the implementation of a security management system that is tight enough to support environmental conditions that can improve unit performance with conditions comfortable and safe.

Keywords: *Operational Excellence, Generating Unit, G-Action Mobile.*

Abstrak
Pembangkit Listrik Tenaga Mini Hidro (PLTMH) Gunung Wugul merupakan pembangkit listrik aliran sungai dengan Tanggal Operasi Komersial (COD) 3 Desember 2021 oleh PT PLN UP2D Jawa Tengah-Daerah Istimewa Yogyakarta. Penerapan budaya dan peraturan perusahaan untuk menjalankan operasional Unit Pembangkit seperti pengelolaan aset, Sistem Manajemen Keselamatan dan Kesehatan Kerja (SMK3) dan Sistem Manajemen Pengamanan (SMP) memerlukan upaya yang tinggi. Sosialisasi dan implementasi terkait pengelolaan Unit Pembangkit harus dilakukan sampai ke tingkat yang paling bawah demi terwujudnya pengelolaan yang baik. Berfokus pada *Operational Excellence* yang dibangun dengan Metode *Shingo House*, elemen kepemimpinan organisasi berfokus pada penerapan prinsip, sistem, dan alat untuk membangun faktor kinerja yang unggul dengan melakukan perbaikan terus-menerus. Implementasi G-Action Mobile mengoptimalkan teknologi digital dan mendukung program perusahaan yaitu transformasi digital untuk pengendalian operasi, pemeliharaan, keamanan, dan kegiatan Kesehatan dan Keselamatan Kerja (K3) secara lebih efektif. Aplikasi G-Action Mobile dapat mendorong percepatan implementasi budaya perusahaan di lingkungan PLTMH Gunung Wugul hingga tercapainya faktor kapabilitas sebesar 67,16% dari target 33,60%, terbitnya SK Zero Accident, dan implementasi sistem manajemen keamanan yang cukup ketat untuk mendukung kondisi lingkungan yang dapat meningkatkan kinerja unit dengan kondisi nyaman dan aman.

Kata kunci: *Keunggulan Operasional, Unit Pembangkit, G-Action Mobile.*

1. INTRODUCTION

A. Operational Excellence

A new paradigm is used by world-class organizations that are aware of limited resources and increasing business risks, so every investment that will be made needs to be carefully planned, tested for feasibility, and managed effectively and efficiently in its implementation carried out. strict and integrated monitoring on an ongoing basis so that any obstacles that arise can be immediately overcome and used as learning material for carrying out a continuous improvement process.

The Shingo House is a model approach to building operation excellence. Shingo House provides a summary and categorization of the principles and supporting concepts from the results of the basic principles approach to building operational excellence in stages references to 4 dimensions. At each stage, there is a guiding principle as a reference for behavior and a supporting concept as a reference to add insight. Every employee must practice the behavior on the left side and master the concepts on the right side. Each guiding principle and supporting concept is divided into four dimensions that support the success of operational excellence. Each dimension is interrelated in the form of stages to build operation excellence (Ksmon, 2013).

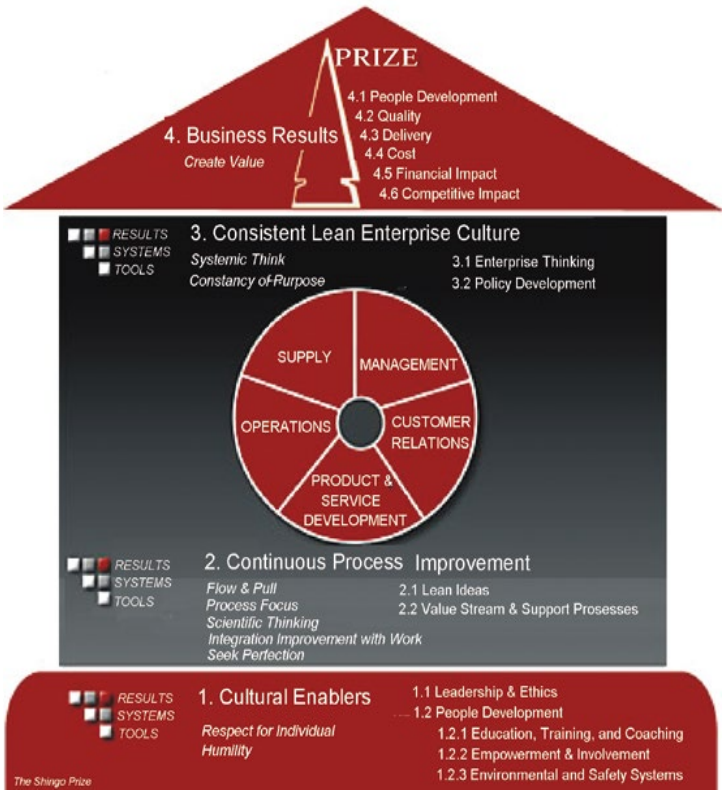

Figure 1. Shingo House Model Chart (Ksmon, Umar. 2013)

The dimensions that support the success of operational excellence at Shingo House are:

1) Culture Enabler
   Culture enablers make people in the organization linked with transformational change, and the development of understanding and a goal is to build a culture for operational excellence.
2) Continous Process Improvement
   Continuous Process Improvement is an activity that makes continuous improvements in terms of business processes and systems and procedures to meet customer needs.
3) Enterprise Alignment
   Develop a management system that's in accordance with work processes and behavior with principles and provides directions that are simple, compressive, workable, and standard. Operational excellence is the definition of successful strategy building when business strategies are in tune with the appropriate principles.
4) Result
   Good results are due to following established principles. Good results correspond to good behavior.

B. Digital Transformation

Industry in the 4.0 era confronts companies with various business challenges. Moving dynamically, following the flow of change, is the key to maintaining the sustainability of the changing business. So, as one of the industry players in a very strategic sector, namely the electricity sector. Indonesia Power is also moving dynamically by digitizing business processes. Digital transformation is also a vehicle that brings Indonesia Power closer to its dream. To become a trusted power generation company that illuminates all corners of the country.

The Internet of Things (IoT) paradigm promises to make "things" including consumer electronic devices or home appliances, such as medical devices, fridge, cameras, and sensors, part of the Internet environment. This paradigm opens the doors to new innovations that will build novel type of interactions among things and humans, and enables the realization of smart cities, infrastructures, and services for enhancing the quality of life and utilization of resources. IoT as an emerging paradigm supports integration, transfer, and analytics of data generated by smart devices (Buyya et al., 2016). IoT is used to support plant operations at the Gunung Wugul MHEPP.

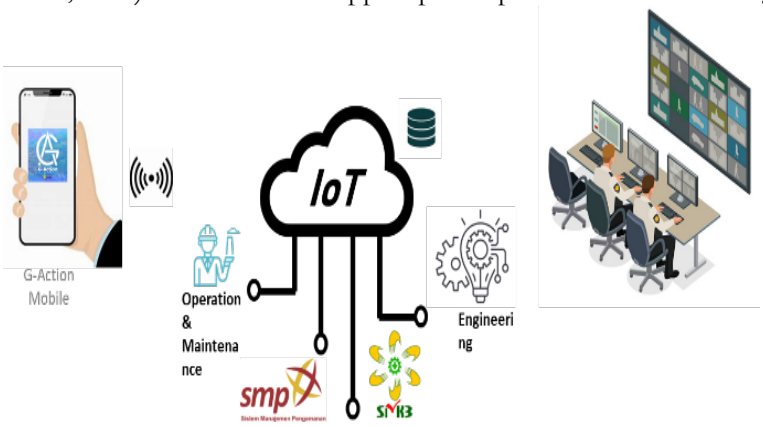

Figure 2. G-Action Mobile IoT Concept

Regarding data taken from outside networks, it is limited to patrol data carried out by security, and videos related to safety briefings can be accessed on YouTube so that the data presented is open source. The operating data presented in the G-Action mobile application is not data that will affect the operation of the generator, the data is data that we send to the Operations Control Center (PPO) and the PLN Distribution Control Center (DCC). Access data security has three levels of security, the first is to have a database link, the second must have the password from the link, and the third is the registered G-Action user and password.

2. BACKGROUND CONCEPT

One of the efforts to improve performance in the generating unit is through the "G-Action mobile" which is a means of developing human resources and power plant management systems. So this application can have a significant impact on the development of generating units to be more effective and efficient.

G-Action is a mobile application that makes every operational activity of the generating unit effective, be it operation and maintenance systems, asset management, security management systems, and occupational health safety management systems that are integrated with an IoT-based database, so that all operational costs become more efficient.

A. Basic Concept of Culture Enabler

The commitment of the Gunung Wugul MHEPP to carry out work following the principles of Operational Excellence which is built with the concept of cultural enabler in building applications that includes the operational activities of the Generating Unit.

1) Ensuring a safe environment
   Ensure that the work environment provides security, protects health, and ensures occupational safety. The condition of the work environment is reck accompanied by leadership that commits to the community and the environment.
2) Develop people
   The human resources development process is a primary concern for the organization and supports the development of corporate culture. Organizations have the ability to form "New Experts" who can drive future improvements.

B. Asset Management

Promote the company's growth rate which is expected to be faster and more competitive than the company focuses on operations and maintenance activities, with the goal of Operational Excellence. The development and implementation of the generator asset management system must be able to increase efficiency and effectiveness along provide added value to the primary business processes, namely the operation and maintenance of the power plant. The following is the menu for the G-Action Mobile application related to asset management which can be seen in Figure 3.

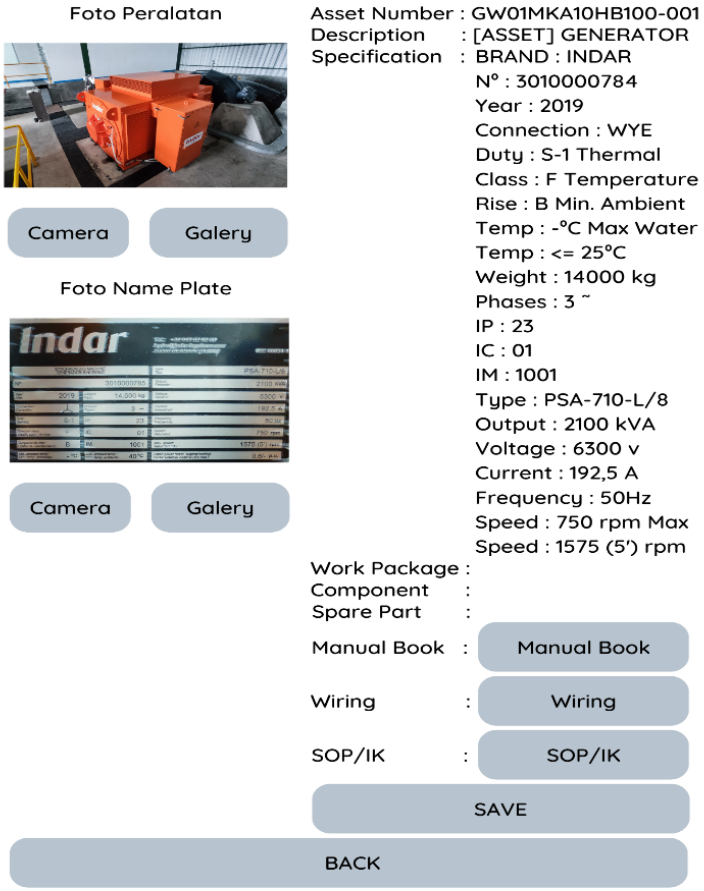

Figure 3. Management Asset Menu

C. Operation and Maintenance Excellence

The priority of the Operation and Maintenance Excellence strategy is the establishment of "smart operation maintenance", namely the management of operation and maintenance activities for generating machines handled by information technology-based companies in facilitating the analysis of operating performance, the availability and accuracy of operating data as well as the availability of equipment history and ease of supply processes. integrated chain starting from the supply and distribution of fuel. The scope of operation and maintenance excellence includes:

1) Performance system
   The performance system regulates indicators in the implementation of operation and maintenance excellence.
2) Process system
   The processing system regulates the aspects of operation and maintenance excellence which consists of planning, implementing, and evaluating the business process stages starting from the provision of primary energy/fuel and the operation of power plant installations and maintenance.
3) People system
   The people system regulates the organizational structure, number, and competence of human resources that support the transformation process of Operation and Maintenance Excellence. In operation and maintenance activities, the G-Action Mobile application can encourage activity effectiveness to the unit reliability, and performance targets can be reached. Figure 4 is the G-Action Mobile application menu related to Operation and Maintenance.

Figure 4. Observing and Recording Opera ting Parameters

4) Security Management System

Security Management System is part of the overall management which includes organizational structure, planning, responsibilities, implementation, procedures, processes, and resources needed for the development of implementation, achievement, review, and maintenance of security policies in the context of controlling risks related to business activities, to create a safe, efficient and productive environment. To ensure that the system can be applied consistently and carried out according to its objectives, required management of the system(Yudhistira et al., 2017). In controlling security and ensuring a safe environment, two organizational systems must support, namely, the *SMP* procedure and the *SMK3* procedure which has a standardized flow. In the *SMP*, controlling and monitoring security patrol activities, reception of guests, incoming/outgoing items, and reporting of shifts must be recorded in the G-Action, so that the effectiveness and conduciveness of the work environment can be achieved.

Figure 5. G-Action Security Management System Menu

D. SMK3

Based on Law Number 13 of 2003 article 87 paragraph 1 concerning Manpower, it is stated that "Every company is obliged to implement an occupational health and safety management system that is integrated with the company's management system" (Noviastuti et al., 2018). The implementation of *SMK3* comprehensively and consistently is carried out in the Gunung Wugul MHEPP environment to maintain occupational safety and health

and improve the performance of the generating unit. The implementation of *SMK3* is carried out thoroughly with OHS signs and utilizes the Human Safety Environment (HSE) room to provide safety induction instructions. The safety factor is very important to support the smooth operation of the generating unit. The HSE menu facility in the G-Action application helps make it easier for HSE personnel to guide safety induction and control of OHS implementation in the Gunung Wugul MHEPP environment.

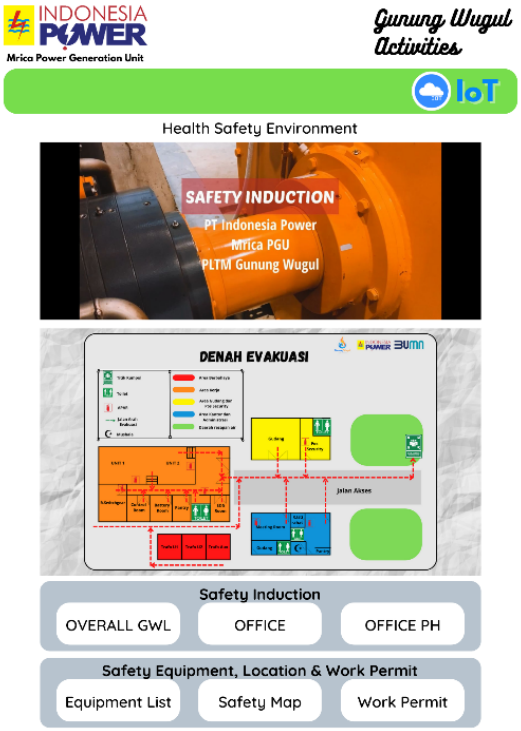

Figure 6. G-Action SMK3/HSE Menu

3. RESEARCH METHODOLOGY

A. Methodology

Optimizing digital technology to accelerate implementation and conducting operational excellence studies based on a Continuous Process Improvement methodology which is carried out consistently for the implementation of corporate culture and regulations. Direct observation is needed to see the effectiveness of activities in the field. The methodology used from the basic concept of Continuous Process Improvement includes:

1) Stabilize process
   Invent stability in the running process. Stability is the basis for making improvements as the basis for problem identification and continuous development.
2) Process standardization
   The process is carried out to a certain standard to reduce the need for supervision and reduce management costs.
3) Prioritize direct observation
   Direct observation is very influential on the scientific mindset. Data obtained from direct observation is very important to understand the process/phenomenon being studied. Direct observation reduces misperceptions, past assumptions, instincts, and inaccurate standards.
4) Focus on values flow
   An understanding of the entire values flow will assist in the required process improvements.
5) Keep it simple and visualized
   Make sure that everything is kept simple and has a clear visual image to ensure the availability of information to run the process.
6) Identify and eliminate waste
   Identifying and eliminating waste is the main goal of continuous process improvement. Waste is the main factor impeding the flow of value.

7) No further deviation
   If a deviation occurs, all processes are stopped and immediately corrected so that it does not happen continuously. The system that is built must be able to overcome various obstacles and take action as soon as possible.
8) Integration of improvement with work
   Quantify process conditions and always pursuing better future conditions. People show concern in order to realize the mission of improvement.

With the concept of a study based on Continuous Process Improvement, it is hoped that performance improvements can be measured and make improvement quickly. This methodology is carried out to improve and control the process, so that the data collection process is more focused on the goals to be achieved.

B. Data Retrieval

The implementation process can be seen directly in the G-Action Mobile application database and unit performance data sent by the Mrica Power Generation Unit (PGU) performance and operations division. Technology utilization of digital IoT makes it easier for us to access applications and data anywhere and anytime. The data resulting from the implementation to reach operational excellence are as follows:

1) Application database for evaluation needs
   Operational division evaluation report
2) Record of energy transactions/Production reports
   Performance review report (ALCO)
3) Zero Accident Decree

4. RESULT AND EVALUATION

After implementing the G-Action mobile for supporting facilities for the operation of the Gunung Wugul MHEPP, a significant performance was obtained in implementing corporate culture and regulations, so that the performance of the Generating Unit became more, more effective, and maximal. The data resulting from the implementation of digital transformation through the G-Action application at the Gunung Wugul MHEPP are as follows:

A. Gunung Wugul MHEPP Electricity Production Report

Table 1. Electricity Production Table up to August 2022

No	Monthly Production Target (kWH)	Number of Days	Monthly Production Target (kWH) Following the Day	Realisasi Produksi Bulanan (kWH)	CF (%)
1	864,000	31	892,800	1,823,760	79.07%
2	864,000	28	806,400	1,733,640	83.22%
3	864,000	31	892,800	1,745,400	75.68%
4	864,000	30	864,000	1,776,540	79.59%
5	864,000	31	892,800	1,518,660	65.85%
6	648,000	30	648,000	1,327,560	59.48%
7	684,000	31	706,800	1,173,420	50.88%
8	360,000	31	372,000	1,043,280	45.23%
9	432,000	30	432,000		
10	612,000	31	632,400		
11	720,000	30	720,000		
12	864,000	31	892,800		
	Total		8,752,800	12,142,260	

The electricity production report data is obtainable from the Record of energy transactions carried out from January - August 2022. The data below shows the achievement of operating performance surpassing the target.

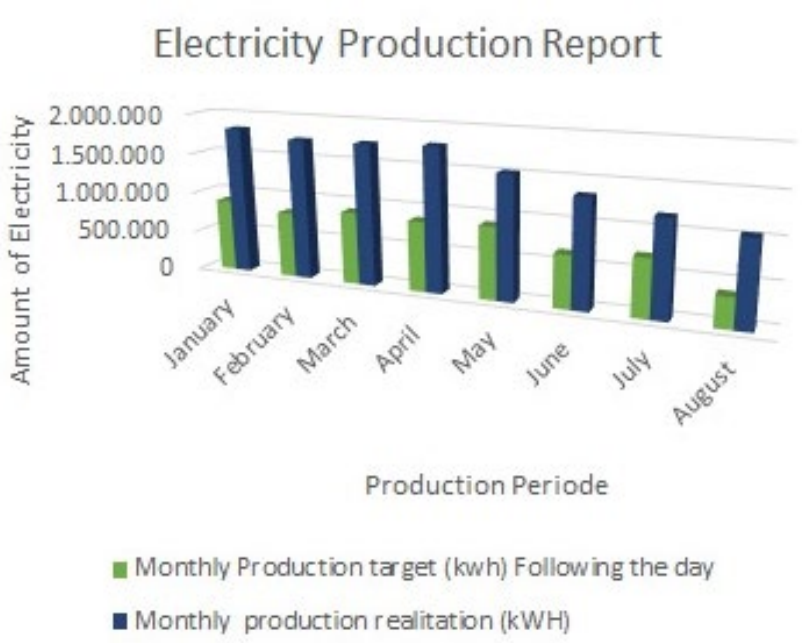

Figure 7. Production Achievement Chart

B. Mrica PGU ALCO and Operation Evaluation Report

The unit performance report (ALCO) submitted by the performance division and the operations evaluation report submitted by the operations division became the basis for the results of the implementation of this study. The following is the performance data of Mrica PGU, especially the Gunung Wugul MHEPP Sub Unit which is commonly abbreviated as GWL.

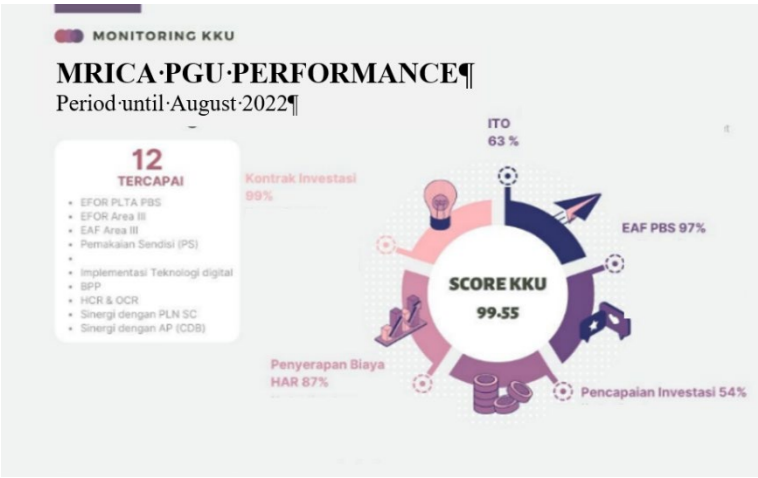

Figure 8. Summary Mrica PGU ALCO

The details of the summary of the operational performance of the Gunung Wugul MHEPP until August 2022 are as follows:

1) EAF Grid and Embedded

Equivalent Availability Factor (EAF) is the readiness factor of the generating unit. Following the Mrica PGU management contract in 2022, where the EAF Grid target is 87.21%, and the EAF Embedded target is 98.48%. So in the Figure 9 can be concluded that the EAF Grid and Embedded Gunung Wugul MHEPP targets have a value above the goal. The planning for the readiness of the generating unit is carried out by considering the unit parameters reported by the operator in the G-Action Mobile application.

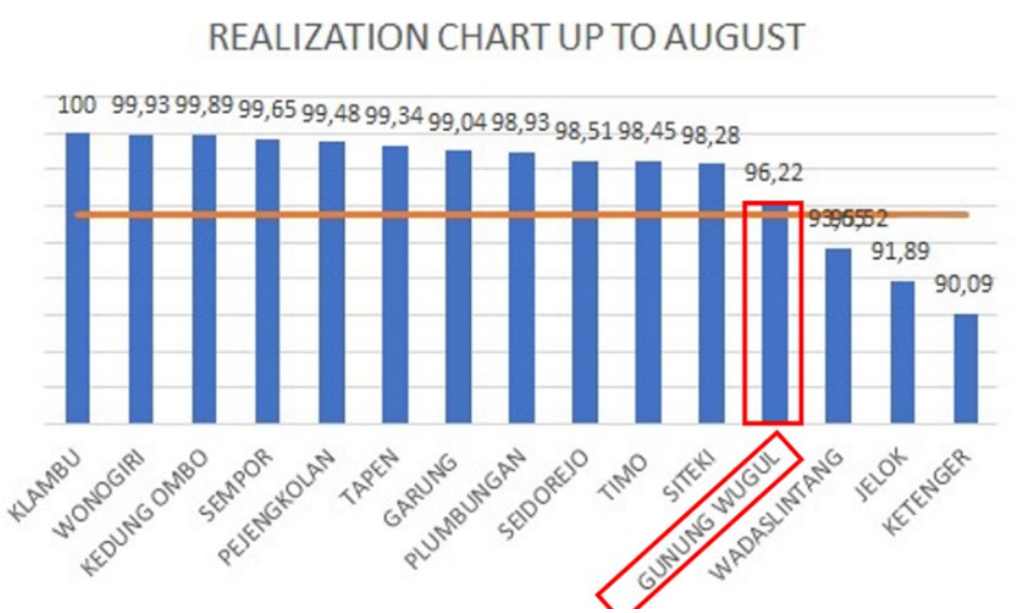

Figure 9. Mrica PGU EAF Grid and EAF Embedded

2) Capability Factor Monthly Operation Evaluation

The Capability Factor (CF) is a comparison that measures the actual generation of a power plant compared to the maximum amount it can generate in a certain period without any interruption. The following is the CF achievement of the Gunung Wugul MHEPP which reached 67.16% of the 33.60% target, This target was surpassed because the G-Action Mobile application helps in the monitoring process of unit parameters is carried out regularly wherever and whenever, then continuous improvement can be carried out immediately so that production results increase.

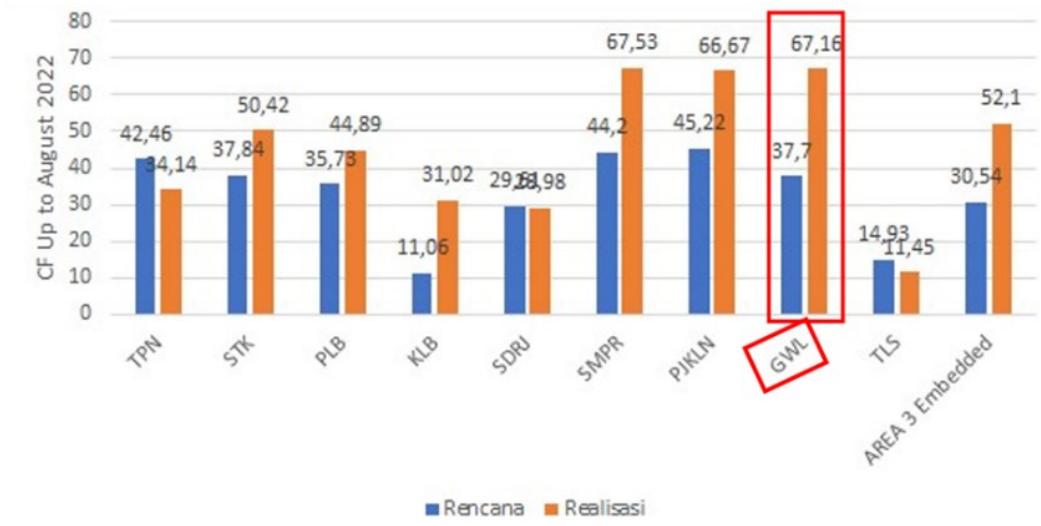

Figure 10. Mrica PGU Capability Factor

3) Determination of IP's Zero Accident Award

The determination of the Zero Accident Decree is evidence of the implementation of *SMK3* to support operational excellence. "Board of Directors Number: 009K/010/IP/2022".

The results of this study concluded the effectiveness of the G-Action Mobile application to support the operational excellence goal of the Gunung Wugul MHEPP with the achievement of a Capability Factor of 67.16% of the 33.60% target and other operating performance above the target. In addition to supporting the operation and maintenance process, the G-Action application is also effective in building an OHS culture with the issuance of the Zero Accident Decree so that the SMK3 culture can run well.

The development of the G-Action mobile application is carried out continuously to improve features and this application will be implemented in all Mrica PGU Sub Units.

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