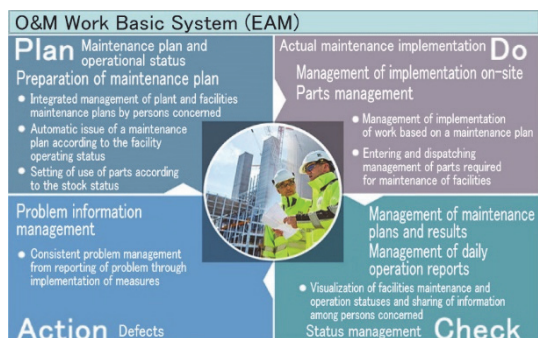


Construction and Application of O&M Work Basic System (EAM) for Power Generation Plants



DI Strategy & Planning Department,
Digital Innovation Headquarters,

Nagasaki Solution Business
Department, Steam Power Maintenance
Innovation Business Divisi, Energy
Systems,

Mitsubishi Heavy Industries, Ltd.

In the performance of Long Term Service Agreement (LTSAs) for Integrated Coal Gasification Combined Cycle (IGCC) plants, it has been required that the customer and Mitsubishi Heavy Industries Ltd. (MHI) should work together to perform appropriate Operation and Maintenance (O&M) work and smooth troubleshooting work on both sides to increase the plant operating rate.

To this end, it is necessary to share information on O&M-related plans and their implementation results between the customer and MHI so that both sides can perform O&M work together.

Furthermore, in order to smoothly perform O&M work in an IGCC plant which is comprised of a large number of facilities, it is also important to manage data for each facility.

In conventional power generation plants, however, paper- or Excel-based management of maintenance work and daily operation reports has been conducted.

In order to break away from such an analog management, we constructed the O&M Work Basic System (EAM : Enterprise Asset Management) that allows sharing of information on O&M work plans and their implementation results and integration of O&M work between the customer and MHI and management of maintenance plans, their implementation results, operating status, problems and troubleshooting status for each facility comprising the plant.

The features of this system and actual use examples are introduced.

1. Features of the O&M Work Basic System

The utilization of this system in O&M work allows “realization of a smooth Plan-Do-Check-Action (PDCA) cycle in plant O&M work” and “contribution to continual improvement of customer satisfaction based on accumulated O&M work information”.

1.1 Realization of a smooth PDCA cycle in plant O&M work

- System configuration based on the O&M work process

The customer’s O&M work process is investigated and organized and the O&M work process is reflected in the system. Therefore, the system can be utilized according to the work.

- Smooth PDCA cycle

The utilization of the system allows sophistication of the PDCA cycle and thorough management without omission or leakage, thereby improving the efficiency of the O&M work management. The merits of utilizing the system are shown in **Figure 1**.

- Facility-based data configuration

All data is configured so as to be linked to each other based on the facility. Therefore, work can be managed according to the status of the facility.

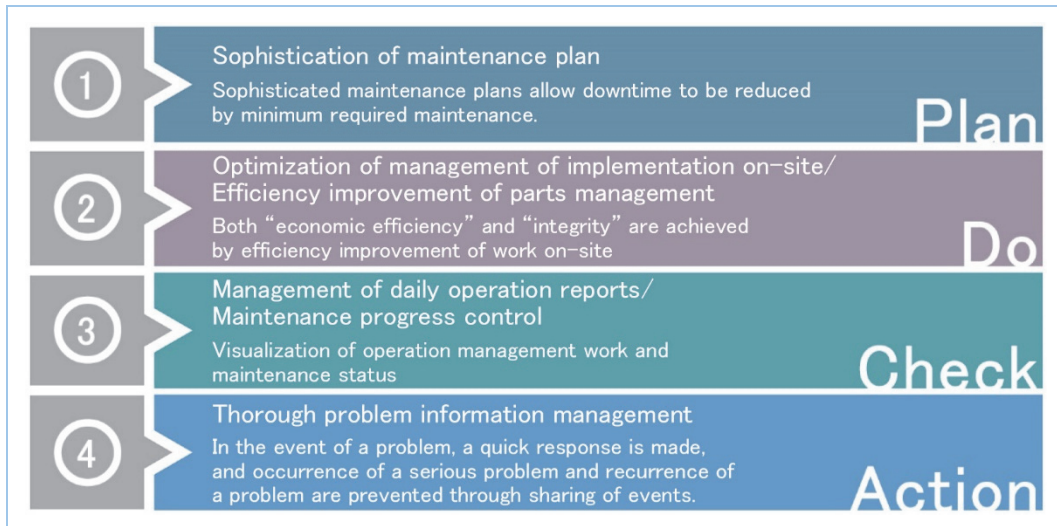


Figure 1 Merits of utilization of the O&M Work Basic System (EAM)

1.2 Contribution to continual improvement of customer satisfaction based on accumulated O&M work information

- Appropriate and continuous service by sharing of O&M information

The O&M work information accumulated in the system is shared, and it is possible to grasp the operation history and maintenance status of the plant and to provide continuous service according to the status based on the information.

- Support of introduction and operation of solutions

The customer’s system utilization status can be grasped and digital solutions for further efficiency improvement of O&M work can be proposed and provided. After the introduction of the system, continuous support can be provided by “System introduction/start-up workshop” - “Operation support”.

2. Functions

The functions are provided as a cloud service (Figure 2). Five work areas in O&M (maintenance plan, work management, operation management, parts management, problem management) are implemented as basic functions (Figure 3).

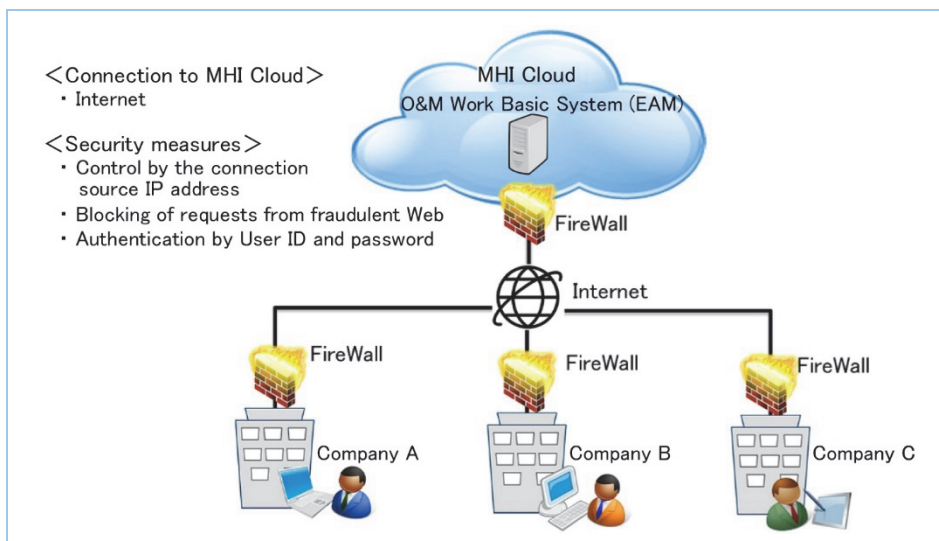


Figure 2 Outline of access from outside of the company

Work		Outline of function
1	Planning and management	Repair plans (annual), engineering work plans (monthly) and task plans for each work (weekly) are integrally prepared/managed.
2	Work management	Preparation of work schedule A daily work schedule is prepared based on the work plan and a request for implementation of the work is submitted. At the same time, a request for attendance, requests for isolation operation, etc., are made.
		Check and approval of work schedule The content of the work schedule from the work contractor is checked and approved, and implementation instructions are made.
		Actual implementation of work The approved content of the work schedule is checked on-site and the work is undertaken. The work progress and results are entered and if any problems occur, the content is reported.
3	Management of problems	If a problem is reported from an on-site terminal, responsibilities are assigned and a request for troubleshooting is made. Study of troubleshooting, planning of measures (engineering work planning) and their implementation/checking are consistently managed. A database of "work history" and "contents of problems and measures" for each facility is made.
4	Operation management	Operation takeover information is entered and shared, and if a problem occurs, the content is reported. The plant operation, the work schedule and status are visualized.
5	Parts management	Entering and dispatching, stock and usage of parts at a plant warehouse are managed.

Figure 3 Outline of the functions of the O&M Work Basic System (EAM)

3. Examples of detailed functions

Examples of the functions of the system are shown in Figures 4 and 5.

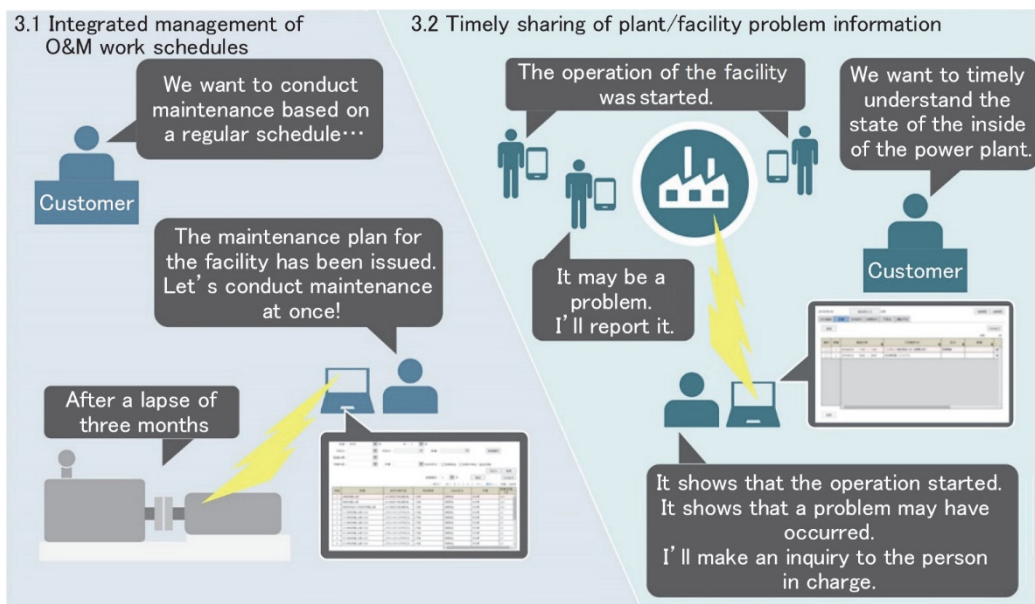


Figure 4 Examples (1) of the Functions of the O&M Work Basic System (EAM)

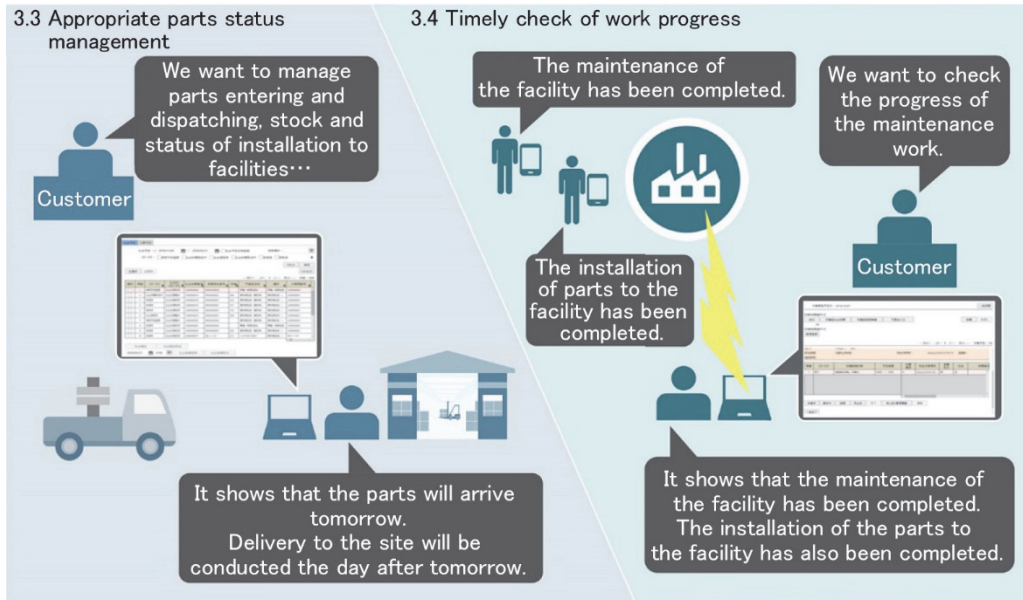


Figure 5 Examples (2) of the Functions of the O&M Work Basic System (EAM)

3.1 Integrated management of O&M work schedules

With the facility-based data configuration, work plans based on the predetermined schedules are automatically issued, allowing appropriate maintenance work without omission or leakage and contributing to extending the service life of the facility and increasing its operating rate.

3.2 Timely sharing of plant/facility problem information

If any problems occur during the work, the information can be immediately entered into the system from a tablet terminal or the like and the internal state of the power plant is timely shared among the persons concerned. Therefore, a quick response to the problem is possible, resulting in prevention of a drop of the operating rate.

3.3 Appropriate parts status management

The statuses of parts required for maintenance of facilities, such as entering and dispatching from warehouse, stock and installation to facilities, can be managed. Therefore, appropriate stock management is possible, resulting in prevention of forgetting to deliver.

Furthermore, parts management information of multiple plants can be linked. Therefore, it is possible to interchange parts between plants and assets can be optimized.

3.4 Timely check of work progress

Information about actual work results can be entered from a tablet terminal or the like on-site, and it becomes possible to timely check the work progress.

Furthermore, materials and photos concerning work procedures can be attached to plans and results, which help appropriately implement work and store work information.

4. Utilization examples at a plant into which the system was introduced

4.1 Factor analysis in the event of problems

Maintenance work plans, their implementation results and the operation history based on daily operation reports for a plant and facilities are managed. In the event of a problem, the information can be used to analyze the factors (clarification of omission of work, inadequate operation, etc.) (Figure 6).

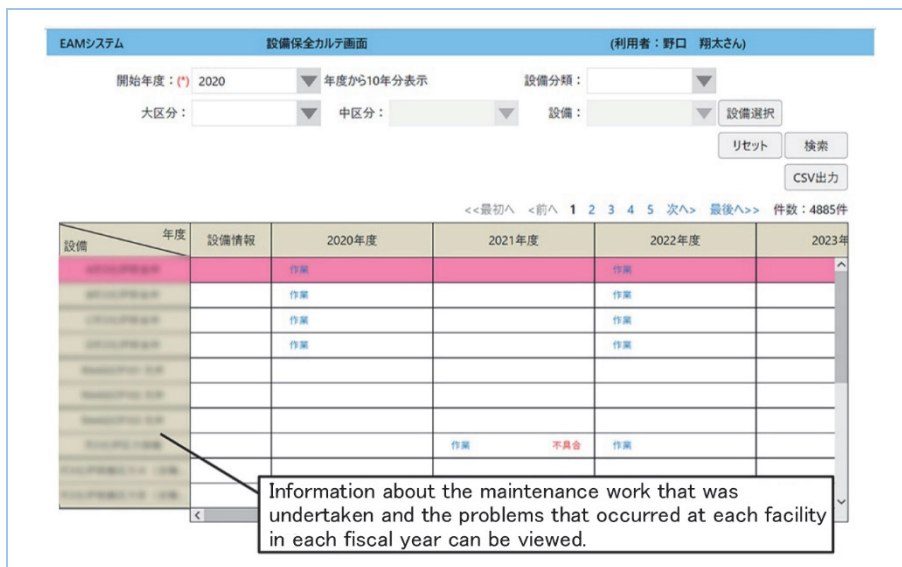


Figure 6 Facilities chart screen

4.2 Prevention of omission at the time of takeover of work

At the time of takeover of work, the daily operation report is used, in which the summary of the latest information of the power plant (operation history, problem information, etc.) is always displayed (Figure 7).

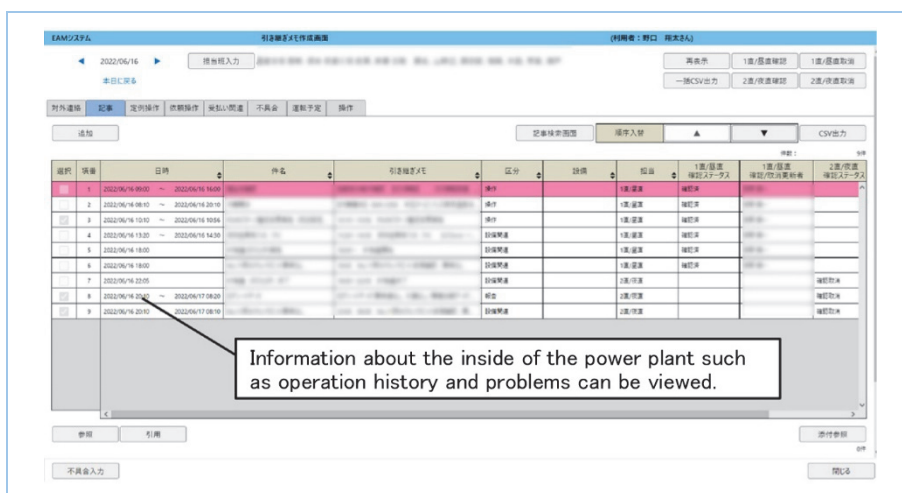


Figure 7 Daily operation report screen

4.3 Efficiency improvement of parts inventory-taking work

Conventionally, parts were visually checked at the time of inventory-taking. At present, for the parts inventory-taking work, the information about quantity of stock, delivery to outside of the warehouse and warehousing due date, etc., is extracted from the system (Figure 8).

EAMシステム 在庫確認画面 (利用者: 野口 翔太さん)

保管番号: ※前方一致検索 在庫確認日: ~

JV管理番号: 予備品選択 予備品名称:

保管先: 保管場所: ※部分一致検索

倉庫内予備品 ※倉庫内予備品に該当するステータスにチェックを入れる。 倉庫外予備品 ※倉庫外予備品に該当するステータスにチェックを入れる。

ステータス: 入庫予定 在庫 在庫 (補充待ち) 補充待ち 使用予定登録 払出依頼設定中 払出依頼承認済

払出依頼取消中 受渡済 受取済 使用済 修理中 破棄 消耗

リセット 検索

全選択 全解除 帳票出力 CSV出力

<<最初へ <前へ 1 2 3 4 5 次へ> 最後へ>> 件数: 954件

選択	項番	在庫確認日	ステータス	保管番号	検査	種別	保管場所	在庫確認結果
<input type="checkbox"/>	1	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	2	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	3	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	4	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	5	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	6	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	7	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	8	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	9	2022/03/16	在庫				予備品倉庫/層 2-2-16	
<input type="checkbox"/>	10	2022/03/18	在庫				予備品倉庫/層 2-2-17	

確認 在庫確認結果備考

破棄登録 派転登録 破棄/消耗履歴

The status of parts can be viewed.

Figure 8 Inventory check screen

5. Future development

Using the O&M Work Basic System (EAM) as the base, we will promote the further sophistication of the PDCA cycle of customers' O&M work (automatic issue of work schedules, identification of hazardous work, automation of parts management, etc.)

We will utilize the data accumulated in the system to study and provide services toward optimization of customers' plant maintenance and operation, thereby contributing to improving customer satisfaction.