# "EMS-Package LITE" Energy Optimization Package for Power Generation Facilities

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**ABSTRACT**

The energy consumption at steelworks fluctuates significantly depending on the state of production. It is important to monitor the demand for energy (both purchased and by-product) at all times and adequately control the supply and demand to stabilize power supply, lower power consumption, and reduce greenhouse gas emissions. For steelworks outside Japan, we have developed an energy optimization package for power generation facilities, "EMS-Package LITE," that can be installed and operated at low cost. It can inexpensively offer the system that calculate an optimal operation model from minimal input information and previous plant operation data, allowing on-site plant operators to operate a plant on the basis of the data calculated using the operation model.

## 1. Introduction

The energy required for production at steelworks is not fixed, but rather varies significantly according to the production situation. In addition to purchased energy, such as gas, oxygen and electric power, various kinds of energy are used, such as the by-product gas and by-product energy sources such as steam and electric power generated by production facilities.

A steelworks' energy management department constantly monitors and accurately controls these fluctuating energy demands to ensure a stable supply of energy. In addition, the department plays an important role in reducing energy consumption and greenhouse gas emissions by balancing and optimally controlling the supply and demand of complexly intertwined purchased and by-product energies.

In 2011, Fuji Electric launched its "Steel EMS

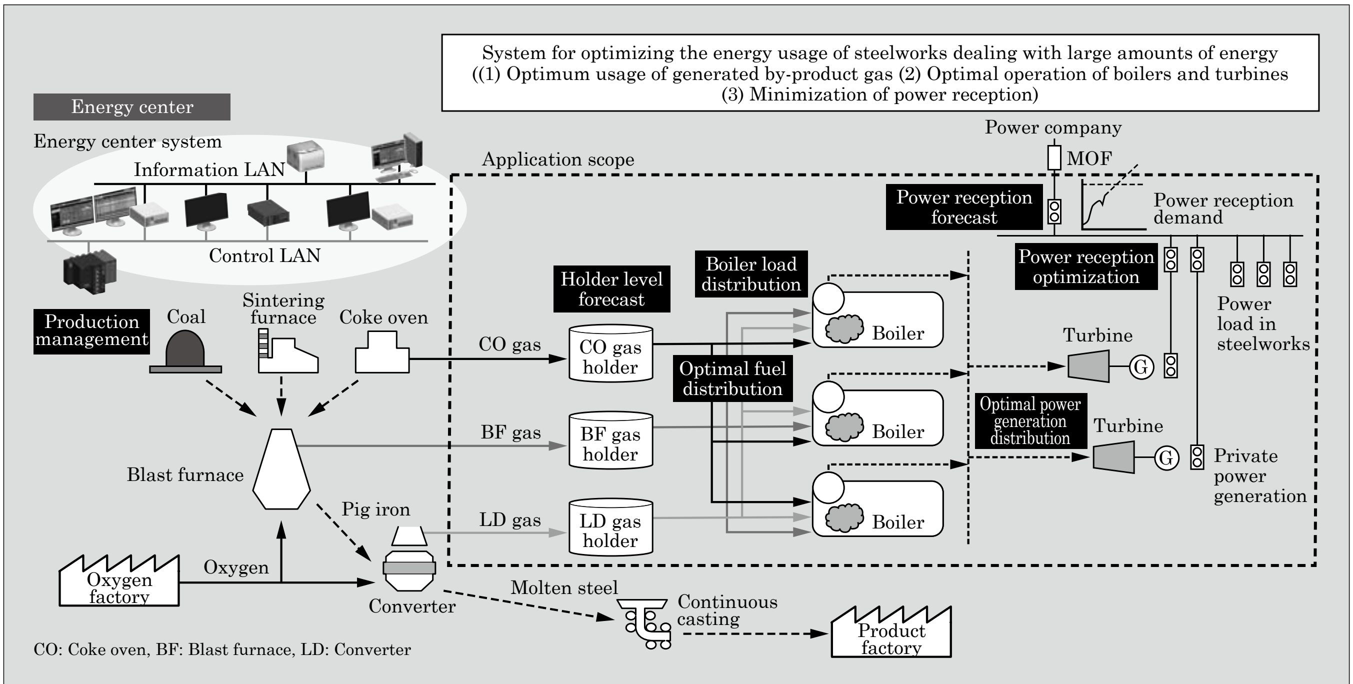


Fig.1 Scope of applicable facilities for "EMS-Package LITE" (power generation facilities)

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Package"(1). It has captured an overwhelming 90% or more of the market share at Japanese steelworks. It uses elaborate forecasting models and plant models to forecast the demand of multiple types of energy, create optimal operation plans and perform automatic control based on such plans.

Especially for overseas steelworks, we have recently developed "EMS-Package LITE" as an energy optimization package for power generation facilities that can be installed and operated at low cost.

## 2. Overview of "EMS-Package LITE"

Electric power is essential for operating the facilities of steelworks. In addition to purchasing electricity from a power company, there are cases where power is supplied by power generation facilities using by-product gas (blast furnace gas, converter gas, coke oven gas) in the steelworks.

This package outputs optimal operation plans in 30-minute intervals for a period of 24 hours based on the past operation data of the plant, as well as a minimum amount of other input data such as information of plant facilities, facility characteristics and production plans. Based on these optimal operation plans, cost reductions can be achieved by adopting procedures for on-site operators to follow. Figure 1 shows the scope of applicable facilities for EMS-Package LITE, and Figure 2, an overall view of the system. Table 1 shows the target specifications for the cost and energy savings effect of EMS-Package LITE.

Table 1 Target specifications for the cost and energy savings effect of "EMS-Package LITE"

| Item | EMS-Package LITE* | Steel EMS Package |
|---|---|---|
| Cost (%) | 14 | 100 |
| Energy-saving effect (%) | 20 to 50 | 100 |
| Applicable energy | Power | Power, gas, steam |

*Calculated at Steel EMS Package ratio of 100%



## 3. Main Features

### 3.1 Modeling (automatically generated information sheets and models)

This feature makes it easy for customers to perform modeling. Simply following the specified format, users first input into the information sheets in Excel*1 format concerning the number of boilers and turbines used for power generation at the steelworks, facility characteristic data, facility connection information, and cost information. Entering actual past operation data then, the models are automatically generated. Six kinds of optimal models are generated for each purpose, including those for energy savings and cost minimization. Figure 3 shows the workflow up to the generation of the optimal model.

### 3.2 Visualization (offline)

Visualization (offline) function converts actual past data into energy costs for each of the models and plots them on the models. This function allows users to visualize the room for energy savings. Figure 4 shows an example of visualizing purchased power costs. The

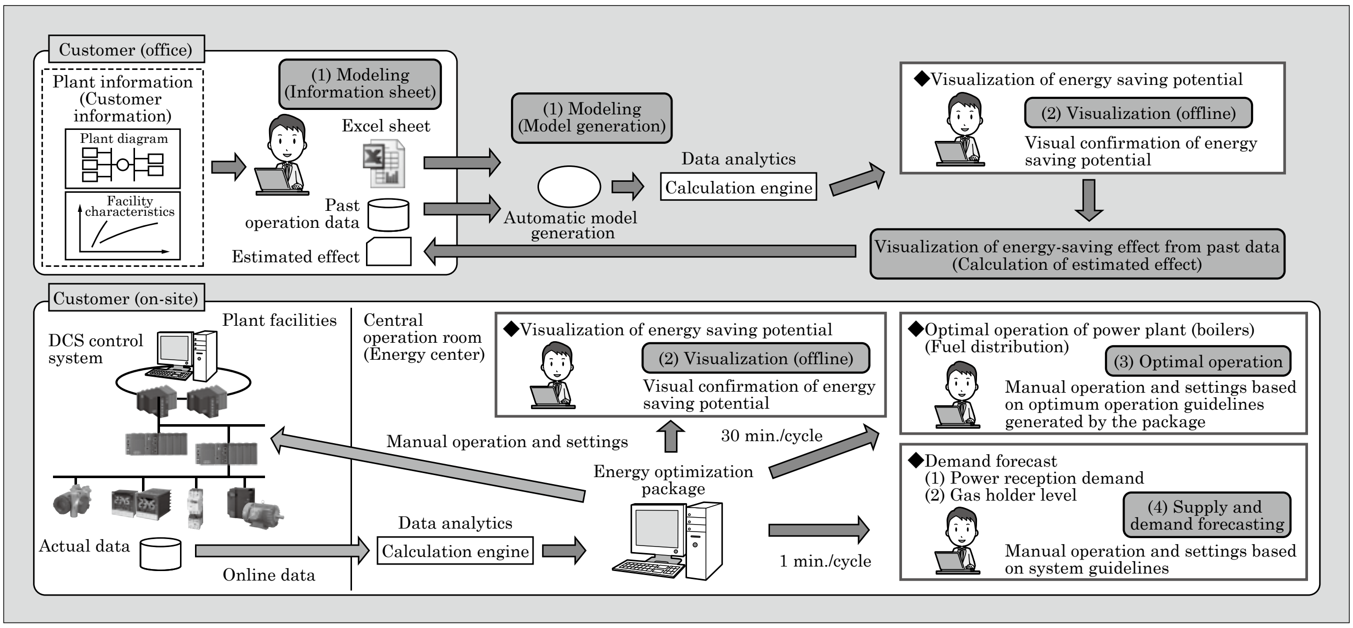


Fig.2 Overall image of "EMS-Package LITE"

*1: Excel is a trademark or registered trademark of Microsoft Corporation.

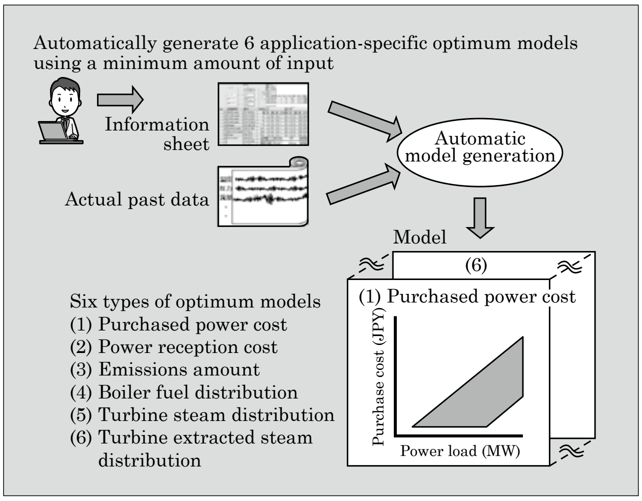


Fig.3 Workflow up to the generation of the optimal model

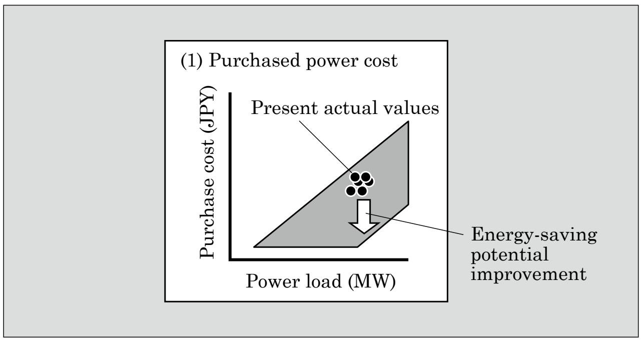


Fig.4 Example of visualizing purchased power costs

white arrow in the figure shows the room for energy savings.

### 3.3 Optimal operation and visualization (online)

In optimal operation, plant data (actual data) is collected online and used to create optimal operation plans (energy distribution) for the power plant in 30-minute intervals for a period of 24 hours via an optimal calculation engine. By following the optimal operation plans, on-site operators can achieve energy savings.

In addition, if there is a change in operation, the center operator can recalculate it on the spot to enable optimal operation based on the most recent operation. Furthermore, even though the optimal operation plan is calculated automatically based on the optimal model and actual data, the operation plan and energy balance of the facilities can also be changed as needed. Visualization (online) enables users to visually confirm the conditions of energy-saving operation since it simultaneously displays the actual state collected in real time via the OPC interface and the forecast energy-saving state after initiating optimal operation. Figure 5 shows the optimal operation work flow.

### 3.4 Supply and demand forecasting

The amount of generated energy and usage can be forecast for continuous production facilities (such as blast furnaces and coke ovens) based on changes in the out-of-operation plans, actual performance and the intensity of each of the facilities (boilers, turbines). Furthermore, the amount of generated energy and usage can be forecast for batch production facilities (converters) based on changes in the production plans, actual performance and the steelmaking intensity.

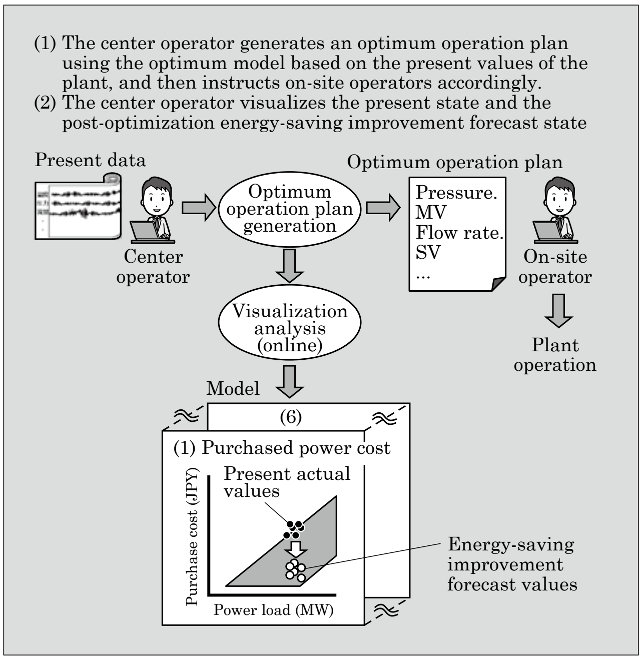


Fig.5 Optimal operation workflow

(1) Power demand monitoring

The center operators constantly monitor the amount of power received, and if the forecast amount of power received is likely to exceed the contract value, they will ask the on-site operators of the power generation facilities to change the amount of power generation. Figure 6 shows an example of the demand monitoring screen.

(2) Gas holder monitoring

The center operator constantly monitors the forecast gas holder level, and if the gas holder level is


Fig.6 Supply and demand forecast (demand monitoring screen)

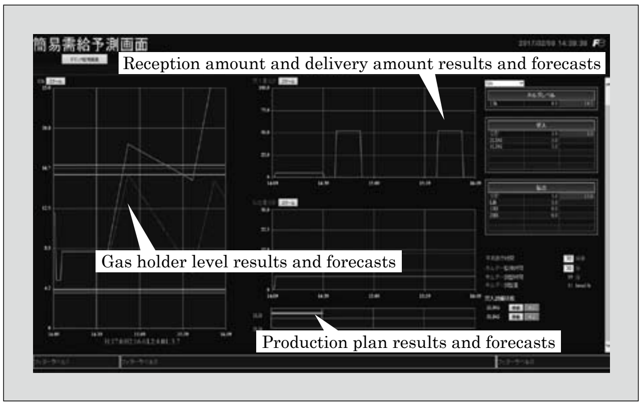


Fig.7 Supply and demand forecast (gas holder monitoring screen)

likely to exceed the upper or lower limit, the operator asks the on-site operators of the power generation facilities to change the fuel of the power plant. Figure 7 shows an example of the gas holder monitoring screen.

## 4. Evaluation

This package was designed to achieve an energy-saving effect equivalent to approximately 20% to 50% that resulted by Steel EMS Package. When field verification was carried out in an actual plant, the estimated result of the energy-saving effect was about 30%, thereby achieving our target. In addition, we were also able to achieve our cost target (see Table 2).

Table 2 "EMS-Package LITE" results

| Item | EMS-Package LITE* | Steel EMS Package |
|---|---|---|
| Cost (%) | 14 | 100 |
| Energy-saving effect (%) | 30 | 100 |
| Applicable energy | Electric power | Power, gas, steam |

*Calculated at Steel EMS Package ratio of 100%

## 5. Postscript

In this paper, we introduced "EMS-Package LITE" energy optimization package for power generation facilities.

Fuji Electric has utilized its many years of experience in the operation of energy centers at steelworks to achieve energy savings through optimization based on state-of-the-art control and software technologies. The adoption and proliferation of EMS-Package LITE is expected as a low cost solution to achieve energy-saving operation of steelworks in overseas countries, such as India and China, contributing to energy savings and reduction of greenhouse gas emissions worldwide.

### References

(1) Narumi, K. et al. "Steel EMS Package" Optimizing Energy Management at Steelworks. FUJI ELECTRIC REVIEW. 2013, vol.59, no.3, p.165-169.

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