2008 Prize of the Chairman of ECCJ

Finding of Waste by Energy Intensity Management and Energy Conservation Measures

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◎ **Keywords**: **Energy management system by equipment;**
Rationalization of fuel combustion
Rationalization in conversion of electricity into motive power and heat, etc.

◎ Outline of Theme

We have been doing the energy conservation activities by organizational units like a family where each division of production, maintenance and engineering worked together based on our environmental strategy called “Nissan Green Program 2010”. With the energy management we had been doing before, we could only know the use of energy which was supplied to each factory. So we introduced a system with which we could understand the production status and the energy amount used by each unit of equipment in real-time to find the operational waste and loss by managing the energy intensity. So we would like to present the case of our energy conservation activities achieved through finding the waste and loss.

◎ Implementation Period of the Said Example

April 2006 – August 2008

● Project Planning Period	April 2006 – March 2007	Total of 12 months
● Measures Implementation Period	March 2007 – February 2008	Total of 11 months
● Measures Effect Verification Period	October 2007 – August 2008	Total of 11 months

◎ Outline of the Business Establishment

- Items Produced　Passenger cars (Murano, Teana, X-Trail, etc.), commercial cars (AD vans)

- No. of Employees 4,600
- Type 1 designated energy management factory

◎ Process Flow of Target Facility (Coating Process)

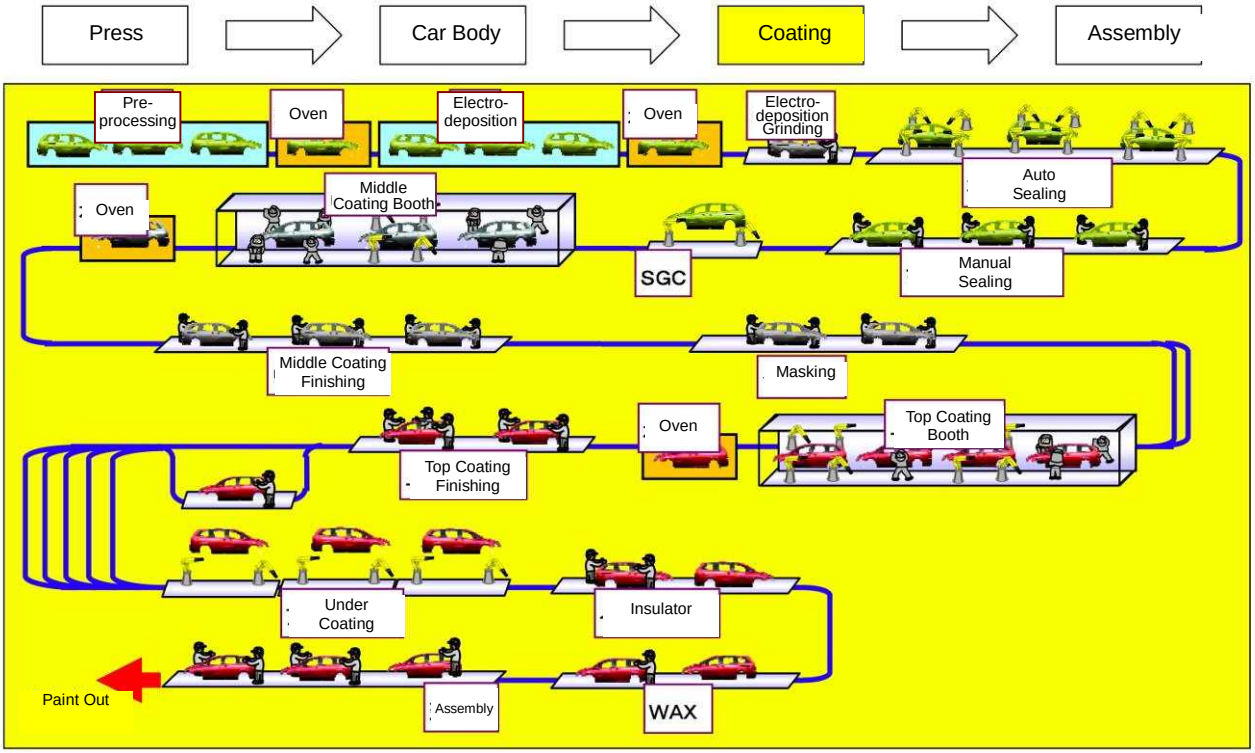

Fig. 1 Process of the Facility (Coating factory)

1. Reasons for Theme Selection

To start the energy conservation activities by operational management other than introduction of new equipment or improvement of technologies, it was necessary for us to visualize individual energy used by equipment, instead of knowing the energy amount used as a whole.

In doing so, we made the coating process which used much energy a model line of the energy conservation activities.

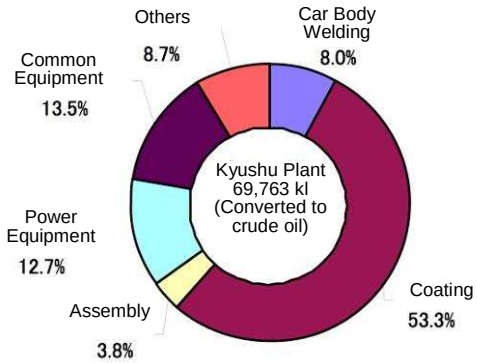

Fig. 2 Energy Amount Used by Process

(1) Understanding of Current Situation

Currently, the energy management division measures the energy amount used with various meters including power meters installed at the entrance to each factory.
The data is totaled once a month and the result is reported to the divisions using energy for factor analysis.

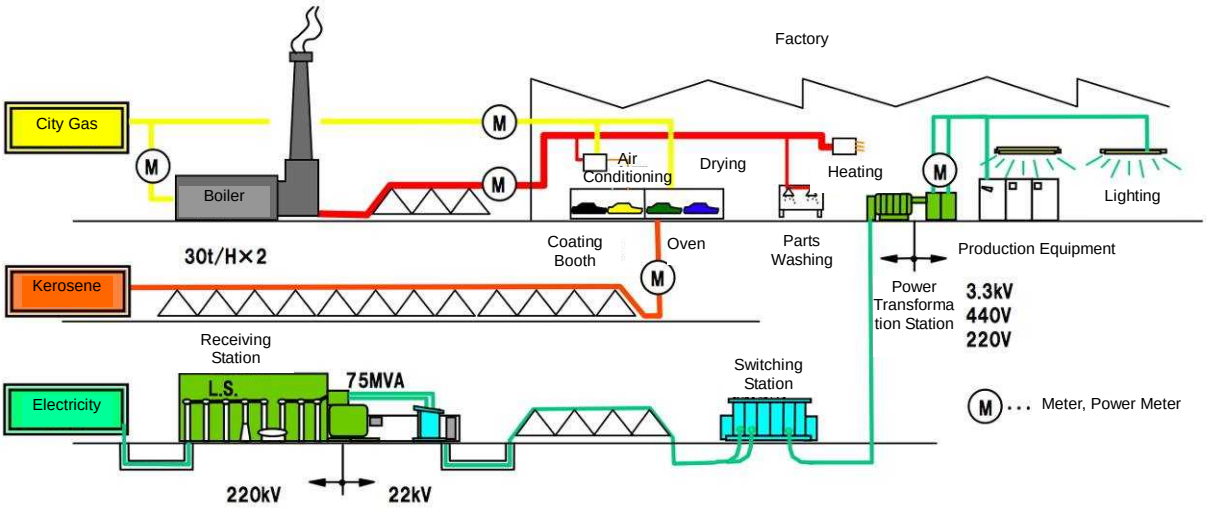

Fig. 3 Measurement Management for Energy Amount Used

(2) Analysis of Current Situation

(Problems of current situation)

- We cannot know which equipment or process is bad because we can only know the energy amount used by each factory.
- We can only judge the result because the factor analysis is done next month.

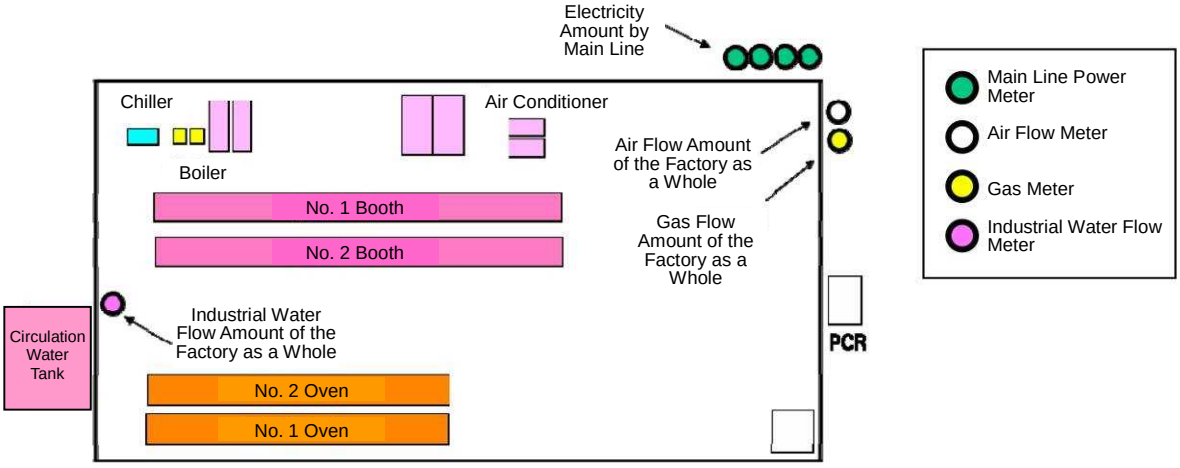

Fig. 4 Locations of Measurement Meters in the Coating Factory

2. Progress of Activities

(1) Problem Points and Their Investigation

We need to know the following two amounts from the current problems.

- Energy amount used by equipment
- Real-time energy amount used

The energy amount used changes according to the increase or decrease of production output. Therefore, we need to introduce a system which can manage the intensity comparing the energy amount used and the state of the production.

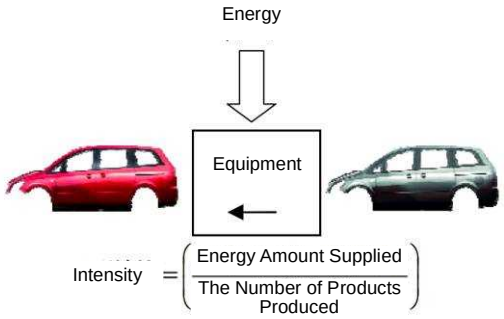

Fig. 5 Concept of Energy Intensity

(2) Implementation Structure

In addition to the family-like activities done by co-work of the divisions of production, maintenance and engineering, the energy conservation team consisting of professional members who know the equipment or control very well support the activities.

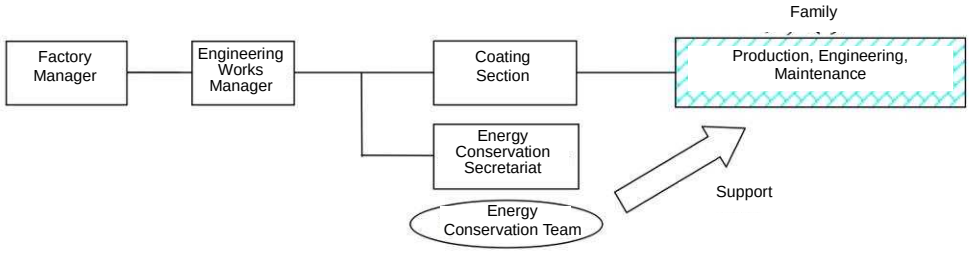

Fig. 6 Energy Conservation Activity Program Structure

(3) Target Settings

It is said that there is energy loss of 4% to 5% generated by operation in normal factories. Therefore, we set the target that required us to cut 3% of the energy amount used by the coating factory as a whole.

Reduction target : 2,133 t-CO_2

(4) Details of Measures

➢ Structure of energy management system

The data of the energy amount used and the number of products produced are collected for each process and for each type of equipment and they are put into the server, and monitored in real-time by the personal computers in the central control room of the production division.

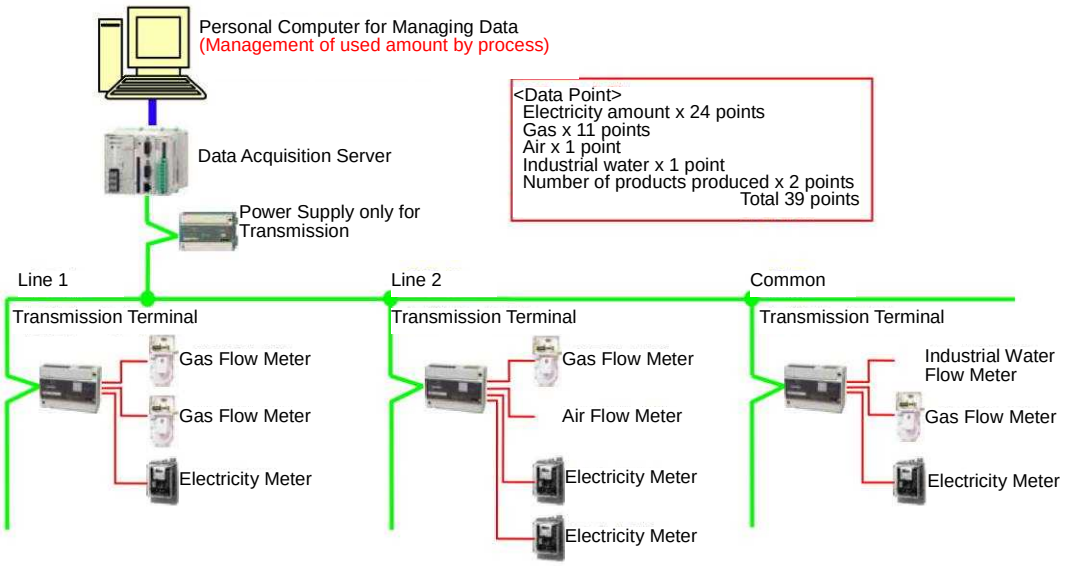

Fig. 7 Structure of Energy Management System

➢ Additional measurement points

Measurement instruments for acquiring data were newly added to equipment and production lines.

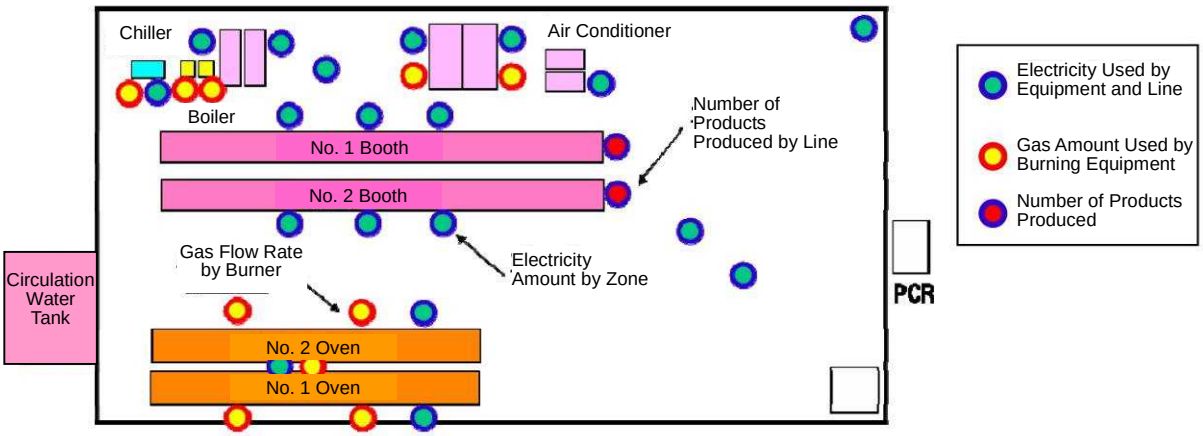

Fig. 8 Additional Placement of Measurement Instruments

➢ Management software

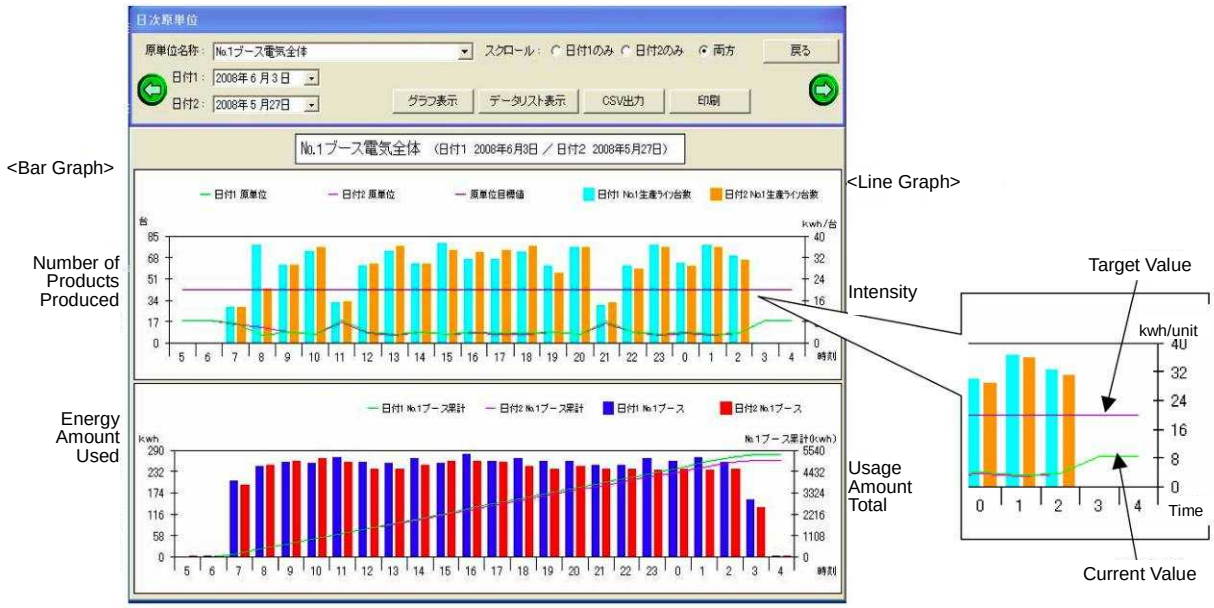

Fig. 9 Management Software Main Screen

(5) Effects achieved after Implementing Measures

By introducing the energy management system, it became possible to know the energy amount used by equipment in the coating factory.

As Fig. 10 shows, we came to know that the booth equipment accounted for about half of the total energy amount used, therefore, it was the key area of the energy conservation.

Meanwhile, as we became able to compare the number of products produced and the energy amount used in real-time, we realized that the energy used during non-productive hours such as break time or between shifts worsened the intensity, as Fig. 11 shows.

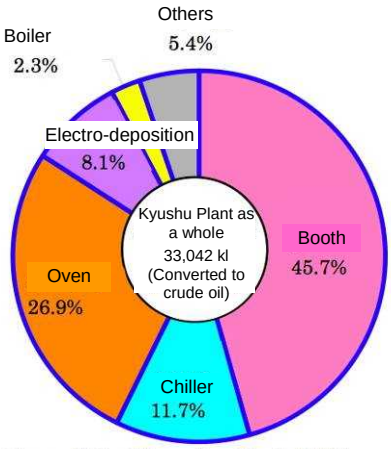

Fig. 10 Ratio of Energy Use in Coating Factory

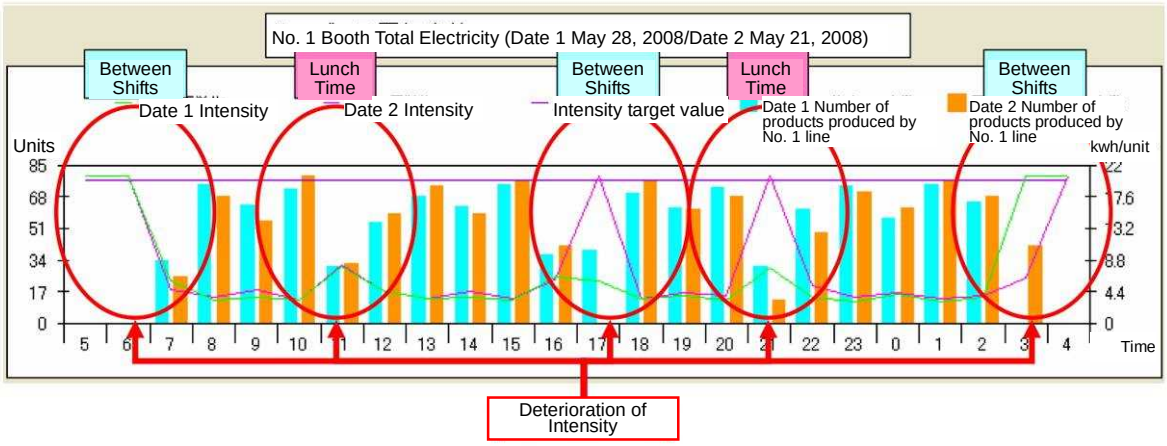

Fig. 11 Monitor Screen Comparing Energy Amount Used and Number of Products Produced

Booth equipment and associated equipment

The coating booth means the process for spraying the paint to car bodies. Environmentally friendly aquatic paint is used as the paint. But this aquatic paint is sensitive to temperature and humidity, so we need to control the temperature and humidity in the booth. Meanwhile, to spray the paint efficiently to car bodies, the inside of the booth must be kept at a constant down-flow with air.

- Control of temperature and humidity in the booth ・・・ Chiller, air conditioner
- Down-flow ・・・ Air supply fan, air discharge fan

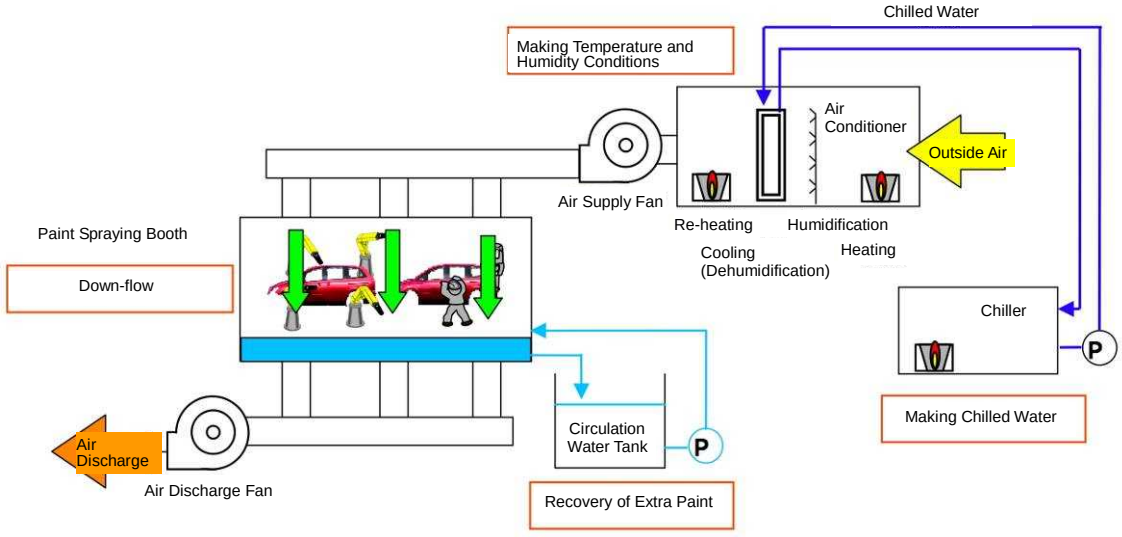

Fig. 12 Outline of Booth Equipment and Associated Equipment

➢ Energy conservation case study (1)・・・Review of control of booth air conditioning

With the automatic control method we had used before, there had been unnecessary

humidification, so there had been processes for cooling (dehumidification) and re-heating generating a great deal of energy loss. By changing the method to manual ON/OFF operation, the control was changed from the area shown by the broken lines in Fig. 13 to the area shown by the solid line, eliminating wasteful heating and cooling, thus, reducing energy. As the effects of the measures, we could reduce the city gas by 357,000 m^3N/year and CO_2 by 7t-CO_2/year.

- Energy conservation case study (2)・・・Review of air amount of the air supply/discharge fans

Although the air amount supplied and discharged had been balanced, both of the air supply fan and the air discharge fan had been operated with commercial frequency, so air amount more than necessary had been flowing using energy more than necessary.

To limit the excessive use of energy, we installed inverters to the air supply/discharge fans, lowered the frequency and cut the air amount. As a result, we could reduce the electricity amount consumed by the air supply/discharge fans. We also could reduce the amount of the city gas used by the air conditioner and the chiller used as the cold source. As the effects, we could reduce the electricity by 249 MWhh/year, the city gas by 76,700 m^3N/year and CO_2 emission by 273.7 t-CO_2/year.

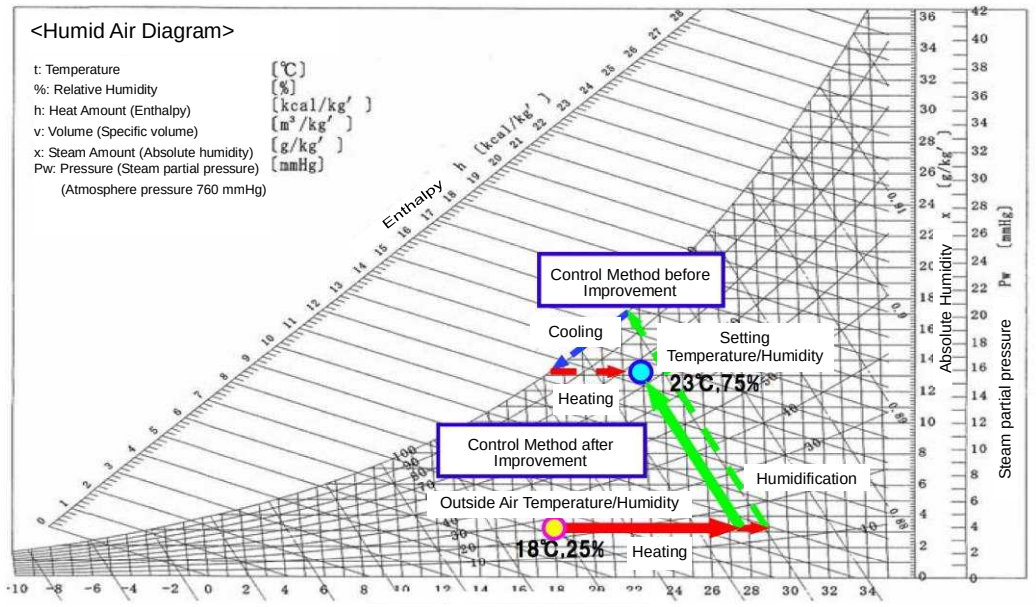

Fig. 13 Review of Control of Booth Air Conditioning

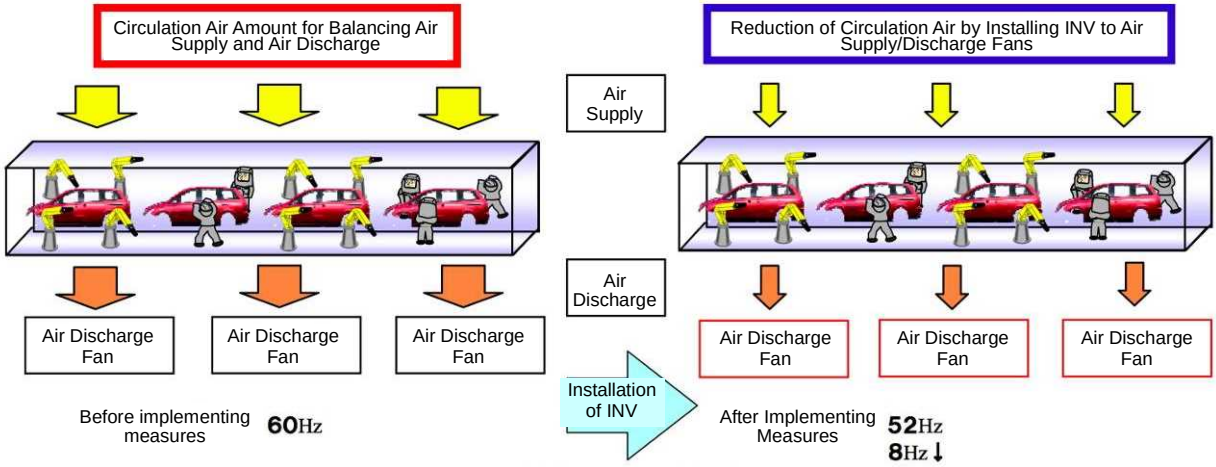

Fig. 14 Review of Air Amount of Air Supply/Discharge Fans

➢ Energy conservation case study (3)･･･Energy conservation mode for non-operative time zone

Fig. 16 shows the intensity graph of the electricity amount used by the booth's air conditioner. Before implementing the measures, the intensity had been bad during non-operative hours such as lunch time or between shifts.

From this, it was known that the booth's air conditioner had been using electricity even during the non-operative time. So we checked the booth's air conditioning equipment and identified the absolutely necessary equipment only which we couldn't do without. Then, as shown in Fig. 15, we added an energy conservation mode with which we could stop pumps or fans and supply air which was necessary for the minimum ventilation during the

non-operative time. By operating with the energy conservation mode during the non-operative time, we could stop the intensity from becoming worse as shown in the figure. As the results of these measures, we could reduce the electricity by 1,974 MWh/year, the city gas by 256,000 m_3N/year and the CO_2 emission by 1,341 t-CO_2/year.

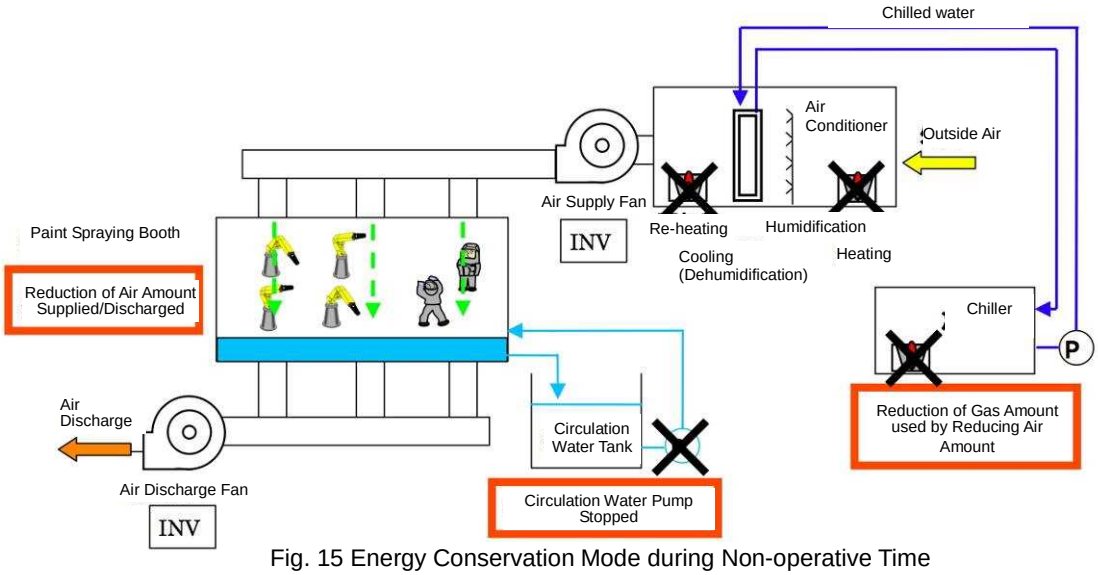

Fig. 15 Energy Conservation Mode during Non-operative Time

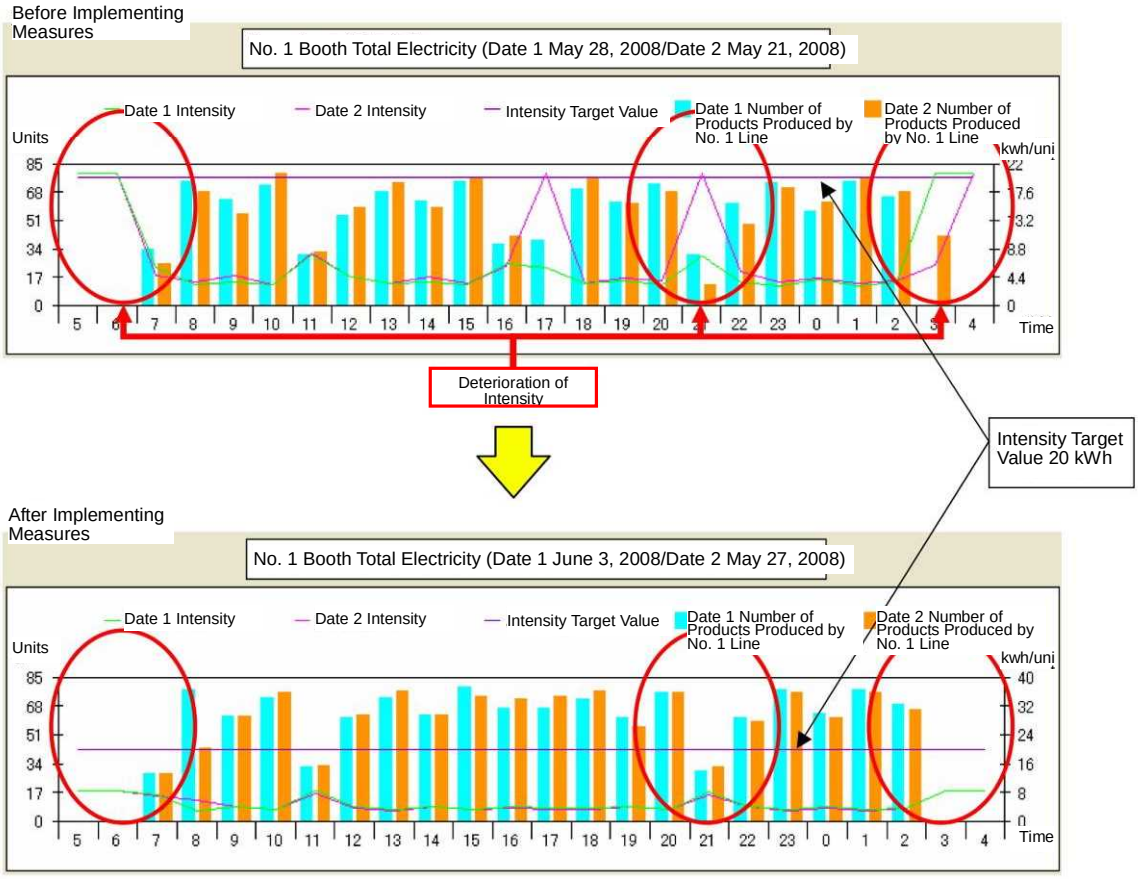

Fig. 16 Effects of Energy Conservation Mode

3. Summary

By visualizing the energy amount used by each unit of the equipment, we could find the waste in the operational management which we had not been able to find before and we could reduce the use of energy by 2,535 t-CO_2 (115% of the target value).

4. Future Plans

1) To establish intensity target for each factory

We will make theoretical intensity based on the index called energy intensity and set a target for the activities from now on.

2) To decrease intensity by doing benchmark activities

We will do the benchmark activities not only within Kyushu Plant but also together with other factories in and out of Japan. We will clarify the difference between factories and we will borrow the strength of other factories.

3) How to show energy intensity

We will disclose the information in a way that is easy for the management to understand.
We will expand the scope of our activity from that of limited people to that of the factory as a whole.