

2005 Prize of the Chairman of ECCJ

Energy Conservation by the Lowering Temperature as a Car Body Coating Condition

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Coating Section, Improvement Team

Keywords: Rationalization of heating, cooling and heat transfer (Air conditioning facilities, hot water supply facilities, etc.)

Outline of Theme

As energy conservation activities at a coating plant, we, as identified above, challenged the reduction of heat amount used by the coating booth by lowering the temperature as a car body coating condition.

We would like to introduce the activities in this case study.

Implementation Period of the said Example

April 2003 – February 2005

- Project Planning Period April 2003 – October 2003 Total of 7 months
- Measures Implementation Period November 2003 – February 2005 Total of 16 months
- Measures Effect Verification Period November 2003 – February 2005 Total of 16 months

Outline of the Business Establishment (Suzuki, Iwata Plant)

- Items Produced 4-wheeled vehicles
- No. of Employees 2,000
- Annual Energy Usage Amount (Actual results for fiscal year 2004)

A Heavy oil	1,818 kL
LPG	5,220 tons
Electricity	77,286 MWh

Process Flow of Target Facility

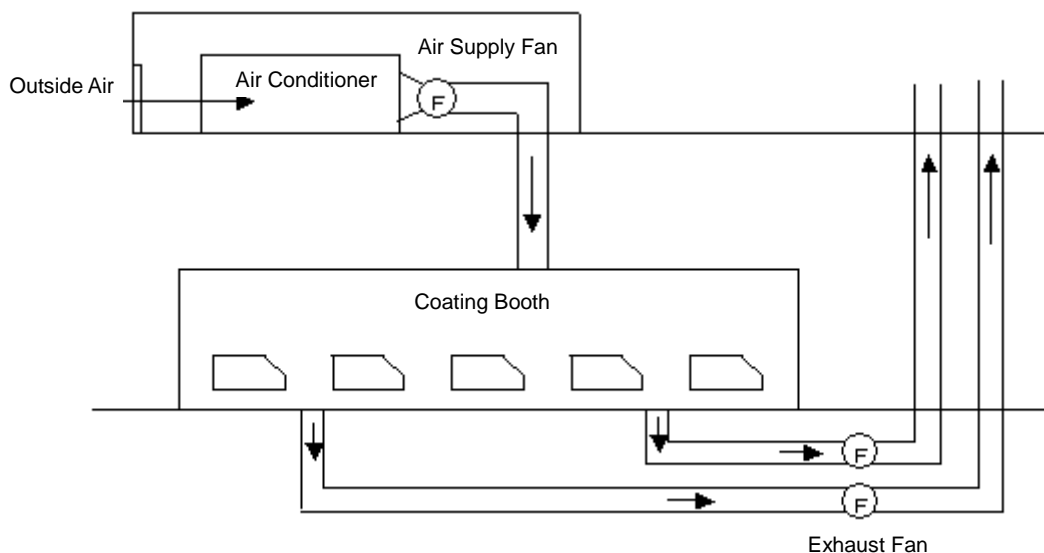


Fig. 1 Outline of the car Body Coating Booth

1. Reasons for Theme Selection

The coating factory consumes the most energy in the automobile assembling factories. Especially, the coating booth heats (heating and humidification) the air taken from outside throughout a year, because it needs to control the temperature and humidity in the booth to maintain the coating quality.

If we can reduce the heat amount for heating the air without worsening the coating quality, we can expect a large energy conservation effect, so we chose the “lowering the temperature as car body coating condition” as our theme and planned activities to realize the theme.

2. Understanding and Analysis of Current Situation

(1) Understanding of Current Situation

	Season	Temperature Condition	Humidity Condition
①	Winter (December to March, next year)	22±2℃	70~85%
②	Summer (June to September)	30±2℃	70~85%
③	Middle Season (October, November, April, May)	26±2℃	70~85%

Table 1 Temperature and Humidity Conditions of Coating Booth

(2) Analysis of Current Situation

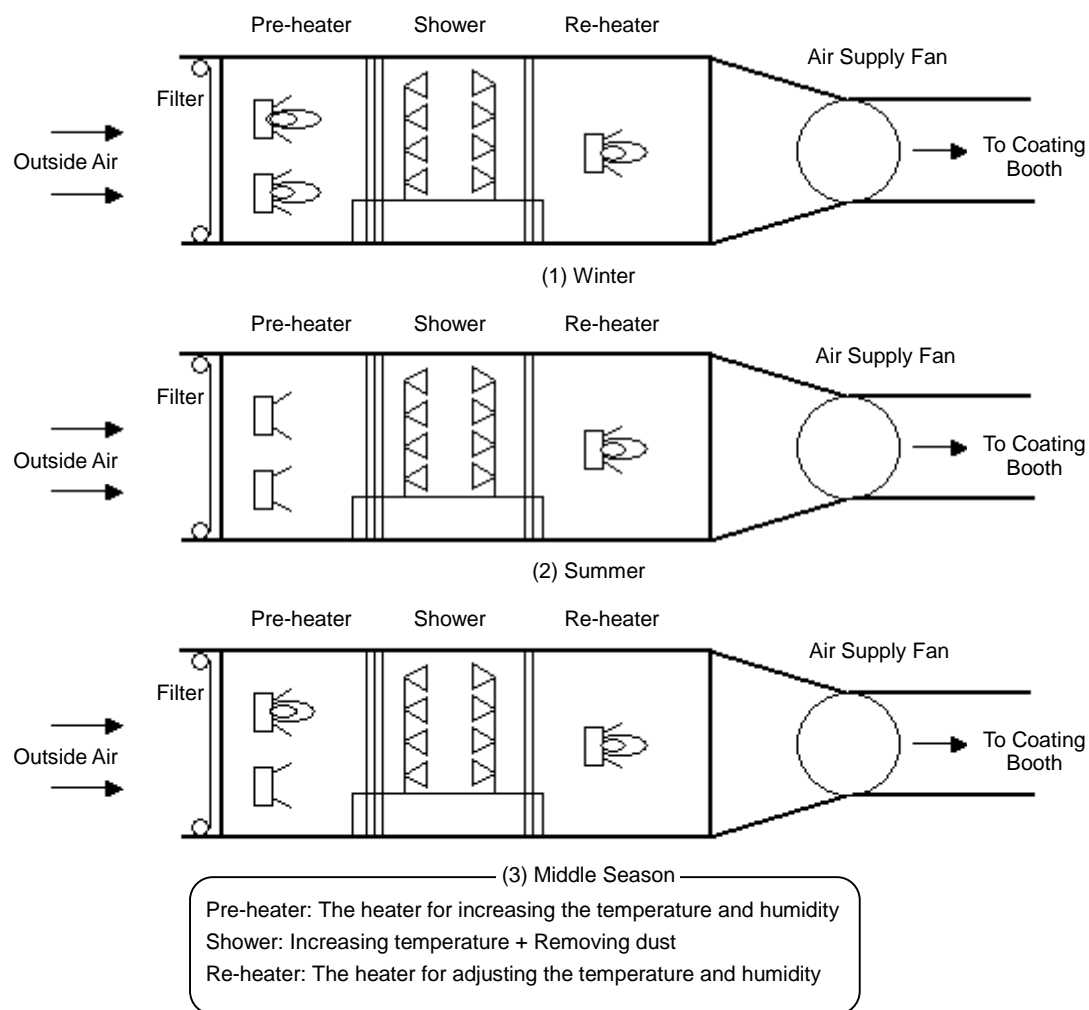


Fig. 2 Operation of Booth Air Conditioner before Improvement

3. Progress of Activities

(1) Implementation Structure

In order not to make the coating quality degraded by implementing the improvement, the implementation structure was made centering around the work place people who were always checking the quality and the staff members and the energy managers of the factory were put in the position to back up the activities.

Meanwhile, when changing the content of the paint or modifying the air conditioner, we did so having the cooperation of the manufacturers of the paint and equipment.

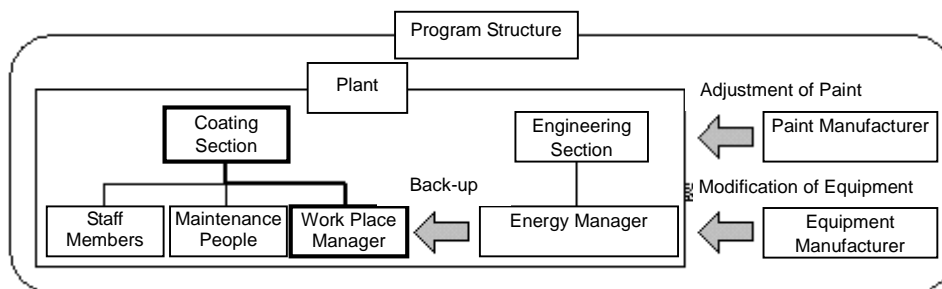


Fig. 3 Implementation Structure of Activities

(2) Target Settings

Based on the 30% cost reduction activities implemented by the plant as a whole, we set up a target aiming to “reduce LPG cost of a car by 30%” (base amount: Average in the period from November, 2002 to October, 2003).

(3) Problem Areas and Their Investigation

If we lower the temperature as a car body coating condition, the following problems are anticipated to happen. So we studied the measures for them.

	Problems	Measures
Paint	When the booth temperature goes down in the winter, the coating quality becomes degraded (paint sagging, less luster).	Solvent in the paint must be changed.
Air Conditioner	If the booth temperature is lowered in the summer and middle seasons, the humidity cannot be controlled well.	The air conditioner must be modified so that the humidity can be controlled even under the temperature lowered.

Table 2 Problems and Measures

(4) Activity Schedule

We implemented the activities according to the following schedule. Especially for the winter, we organized the activities in 2 steps to minimize the occurrence of quality problems.

		2003												2004												2005					
		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3						
	Preliminary Study	→																													
①	Winter	STEP 1 →												STEP 2 →																	
②	Summer																														
③	Middle Season																														

Table 3 Activity Schedule

4. Details of Measures

(1) Lowing the Booth Temperature in Winter

Booth temperature: $22\pm 2 \rightarrow 19\pm 2$ (STEP 1)
: $19\pm 2 \rightarrow 15\pm 1$ (STEP 2)

If the booth temperature is lowered in the winter, the volatilization speed of the thinner for diluting the paint becomes slow causing coating defect such as paint sagging, less luster, etc. So we changed the contents and composition of the thinner to cope with the lower temperature condition.

(Points of change)

- To make the thinner dry fast so that the coating N.V. (remaining volatilization ratio of paint) is kept same even if the booth temperature is lowered.
- To check that there is no sagging of the car body paint.

As the result of these measures, it became possible to lower the booth temperature and reduce the LPG burning amount of the pre-heater and re-heater.

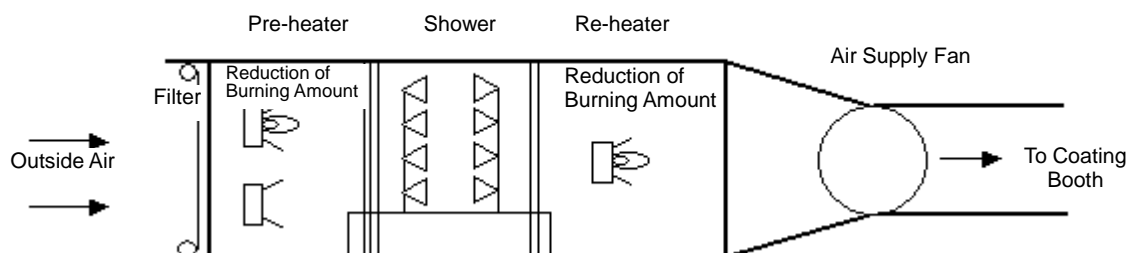


Fig. 4 Operation of Booth Air Conditioner after Improvement (Winter)

(2) Lowing the Booth Temperature in Summer

Booth temperature: $30\pm 2 \rightarrow 28\pm 2$

Before the improvement, the range of the air conditioner in which we could adjust the water amount was small, so we had to adjust the humidity increased by the showers (2 units) with the re-heater in the summer when the outside air becomes very humid. So we modified the air conditioner so that we could switch the number of the showers operated from 2 units to 1 unit. By doing this, we became able to contain the increase of the humidity caused by the shower (from 90% to 80%), stop the re-heater and, therefore, reduce the burning amount of LPG.

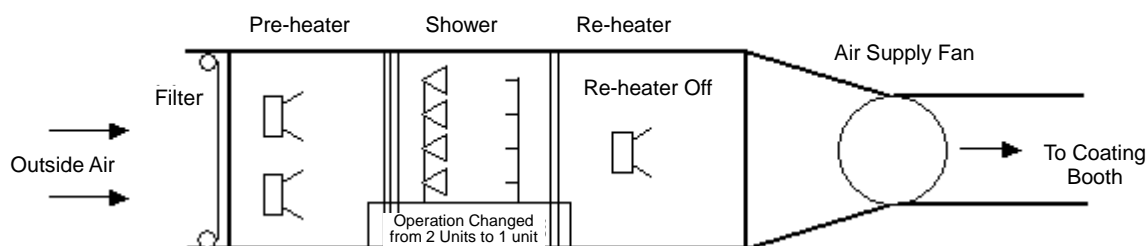


Fig. 5 Operation of Booth Air Conditioner after Improvement (Summer)

(3) Lowering the Booth Temperature in Middle Season

Booth temperature: $26 \pm 2 \rightarrow 25 \pm 2$

In the middle seasons (seasons between summer and winter), the pre-heater is used according to the drop of the outside air's temperature and humidity. The main purpose of the operation in this season is to increase the humidification by the showers.

So we tried to increase the humidity of the outside air by installing a humidifier in front of the air conditioner and extend the period in which the pre-heater is stopped.

Meanwhile, by lowering the humidity, we could make the size of the re-heater smaller (approx. 30%) and reduce the burning amount of LPG.

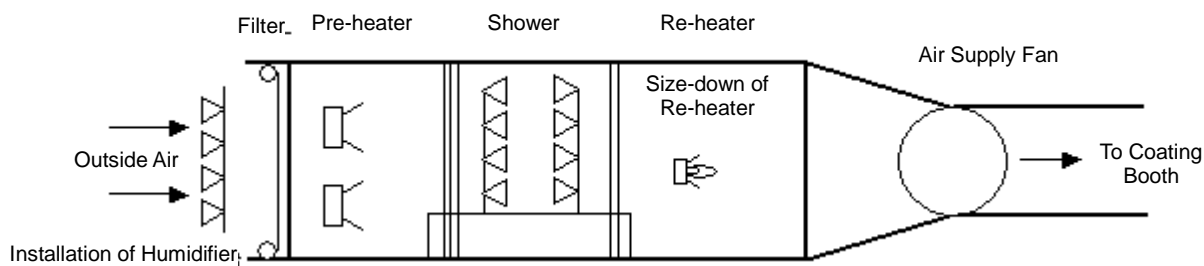


Fig. 6 Operation of Booth Air Conditioner after Improvement (Middle season)

5. Effect Achieved after Implementing Measures

With the foregoing improvements, we could reduce the use of LPG as follows:

STEP1: 33% reduction, STEP2: 40% reduction (both yearly average)

This was a great achievement against the 30% reduction per car as the target.

If we put this figure in the whole energy use of Iwata Plant, it is found that we reduced the use of LPG by 32% and the total use of energy (converted to crude oil) by 10%, greatly contributing to the energy conservation of the whole plant.

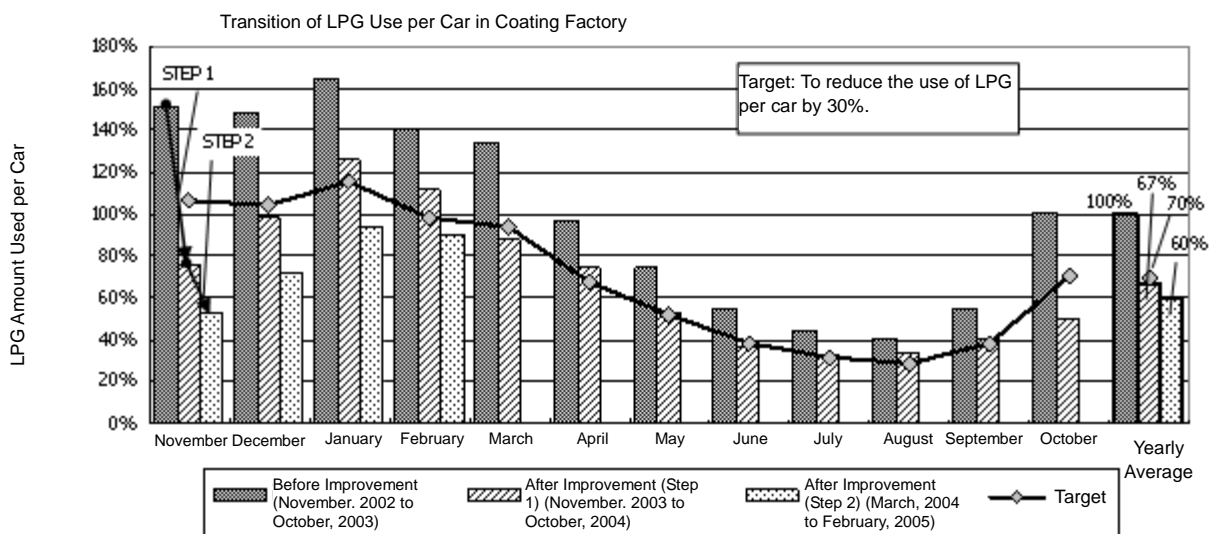


Fig. 7 Transition of LPG Cost

6. Summary

We implemented the foregoing activities under the initiative of the work place people, while being helped by the cooperation of the internal divisions concerned and the manufacturers of the paint and equipment, and we could make big achievements.

The fact that we challenged conventional ideas and achieved the target has become the role model of the activities hereafter.

Meanwhile, through these activities, we could obtain new knowledge on the paint and equipment and enhance the consciousness of energy conservation.

7. Feature Plans

- [1] To continue these activities and establish operation method for the booth air conditioner.
- [2] As the energy conservation hereafter, we will study the possibility of further lowering the temperature. We will also study new proposals and continue the energy conservation activities.