

Electric energy
Best practice
Brief introduction



High efficiency air-cooled heat pumps (the front four were installed)

Industrial vehicle manufacturer
TOYOTA INDUSTRIES CORPORATION
Toyota L&F company
Takahama Factory

Introduction of high efficiency air-cooled heat pumps for the paint booth air conditioning system, which reduces CO₂ emissions by creation of steam-less system.

A total review of the entire air conditioning system was deliberated with the purpose of renewing the air-cooled chiller for cooling that had been running as the cold source for paint booth air conditioning, as well as realization of the steam-less system. CO₂ emissions were greatly reduced with the use of high efficiency air-cooled source heat pumps.

The decisive factor

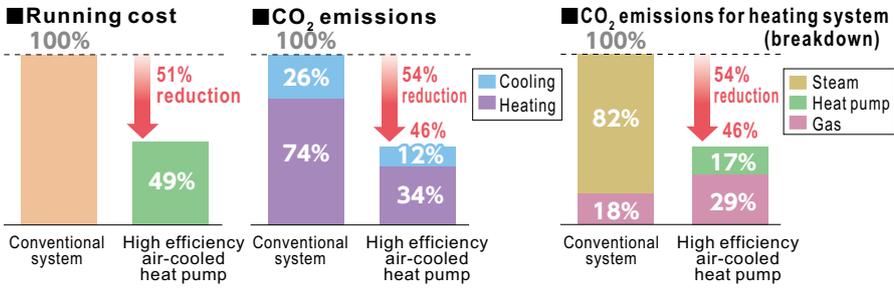
Realization of Steam-less heating and efficient cooling system
Installation of the high efficiency air-cooled heat pump and water mist humidifier, made it possible to have the paint booth air conditioning be steam-less. This meant that highly efficient energy saving operation for both cooling and heating could be expected, which became the decisive factor.

Advantages

Reduction of the running cost
Compared to the conventional system that used an air-cooled chiller for cooling plus steam as the heat source, the running cost went down 51%.

Reduction of the CO₂ emissions
Compared to the conventional system, the annual decrease of CO₂ is expected to be 54%. In particular, switching the heat source from steam to hot water made by heat pump has contributed to significant CO₂ reduction.

- Conditions for calculating CO₂ emissions
- ◎Electric Power...0.371kg-CO₂/kWh(*1)
- ◎City gas...2.157kg-CO₂/Nm³(*1)
- *1 Japan Federation of Economic Organizations



Highly efficient
Compared with gas combustion heat pump is 1.5 to 3 times more effective while heating, and also it can create cold heat more efficiently than gas absorption chiller while heating. In addition, with less machinery it has a space-saving design such as the pump being built into the body, which made it possible to reduce heat radiation loss when piping.

Improves operability
With the conventional system, the heating and cooling had to be switched by hand at the turn of every season, but automatic switching has led to the improvement of work efficiency.

*1 Japan Federation of Economic Organizations



Engine powered forklift

With an area covering 338,000m², or eight times that of Tokyo Dome, Toyota Industries Corporation's Toyota L&F company Takahama factory built in 1970 is the world's largest logistic equipment factory.

Everything from the design and production of industrial vehicles and logistic systems equipment to the supply of aftermarket products is handled here consistently. Most notably, the national forklift share has maintained 48 consecutive years at first place. Under the motto "the customer comes first", the factory provides reliable products with the highest level of quality through full build-to-order manufacturing.



Company Profile

Company name
Toyota Industries Corporation Toyota L&F company Takahama factory

Location
2-1-1 Toyota-cho, Takahama City, Aichi Prefecture

Phone
+81-566-53-7007

<http://www.toyota-lf.com>

*Graph figures courtesy of Toyota Industries Corporation

A fundamental review for a steam-less paint booth air conditioning system

At the Takahama factory, the production system had used steam from cogeneration, but the steam pipes that went through the entire factory reached a length of some 9.5 kilometers and the issues were considerable heat radiation loss and low steam utilization efficiency, at 50%. From the fact that cogeneration is aging as well, efforts are being made to reduce the use of steam that does not have high energy utilization efficiency.

Toyota Industries Corporation
Director
Toyota L&F company
Takahama factory Manager
Mr. Keiichi Fukunaga



Production Engineering Department
General Manager
Mr. Hideki Igawa

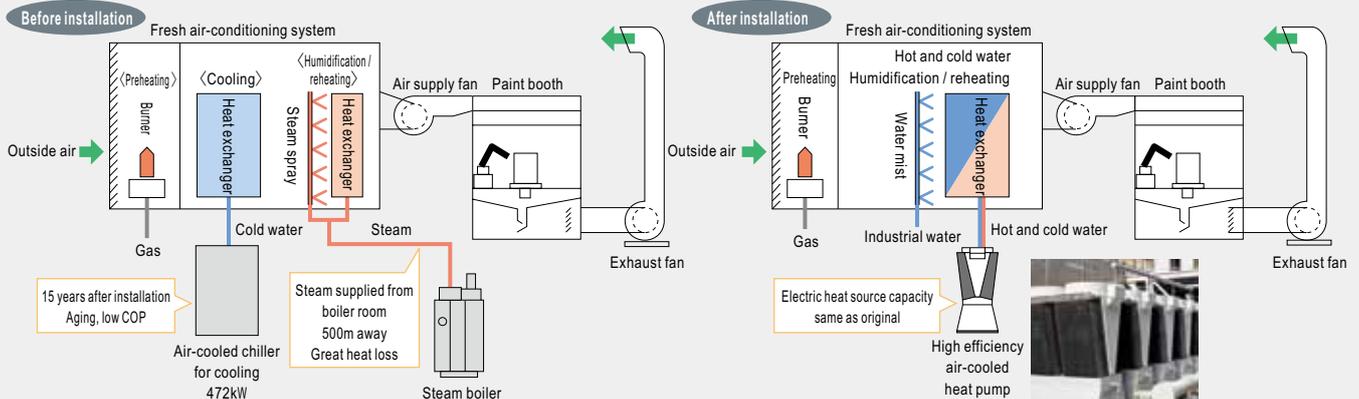
With the paint booth air conditioning too, steam had been used as the heat source and was supplied from the boiler room 500 meters away. The decision of the fundamental review of the heat system was carried out since the air-cooled chiller for cooling has reached renewal timing.

It was the event sponsored by Chubu Electric Power Co., Ltd. which provided them the problem-solving tips. The attention was given to cool and heat switchable air source heat pump.



Outer view of fresh air conditioner

System flowchart



[information obtained September 2014]

Looking back, General Manager Igawa says, "We decided to use heat pump because we not only expected great energy savings with its high efficiency, but it also could contribute significantly to the reduction of CO₂ emissions."

As for the selection, a heat pump with the same capacity (volume) as the existing chiller for cooling was chosen.

Temporary decline in capacity from lack of heating during the winter or defrosting will be backed up with the use of a pre-heating burner.

In total, it was possible to build a highly efficient and stable system with very little additional fuel needed. Also, there was no need to facilitate new heat sources, which significantly controlled investment spending, which became another drawing factor.

An optimum air conditioning system for painting was built, realizing significant energy saving throughout the year

In the past, a similar heat pump was installed in the base paint booth that did not require humidifying, and this was successful. This time, since the installation was in the coat paint booth, which demands strict humidity control, there was a necessity for further trial and error.

Conventional air conditioning in the coat paint booth used the air-cooled chiller for cooling and steam as a heat source. For heating, after preheating with a gas burner the steam was used to reheat and humidify. For cooling, cold water made with the air-cooled chiller for cooling was used.

Since the heat pump was installed, water mist has been used in place of steam. The heat pump is used for chilling and reheating by supplying cold or hot water. By combining heat pump and water mist realization of humidity control and the steam less system was made.

"Promoting energy saving greatly depends on how much the facilities can be downsized and the use of energy lessened.

Because the heat pump is a space-saving design with a built-in pump, it can be placed nearby reducing radiated heat loss. As for efficiency, heating has been improved 1.5 to 3 times, and cooling twice compared to the conventional system. Installation of the space-saving heat pump was perfect for this factory," says Koichi Kato



Production Engineering Dept.
Management and Environment Group
Mr. Koichi Kato

General Manager Hideki Igawa states, "You might think that installing a heat pump is expensive, but there is positively cost and effect, including running cost and maintenance, as a whole. In addition, there is great benefit in that it significantly cuts CO₂ emissions."

Contributing to both environmental protection and economic development under the "Global Environment Declaration".

All of Toyota L&F company, is aggressively involved in the three themes, "prevention of global warming," "Improvement of resource productivity," and "reduction of environmental risk".

"With the installation of the heat pump for starters, as well as the use of solar energy generation, the Takahama factory has become a pioneer of energy saving efforts in the group company.

We aim to complete steam-free throughout the factory by 2020 and plan to conduct various initiatives such air conditioning using waste heat from the paint drying furnace" says Takahama factory Manager Keiichi Fukunaga.