

The Study on How to Optimize Energy Saving Technology on Central Air-Conditioning for Existing Buildings

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Abstract—Firstly, the thesis defines what are the meanings, categories and features of energy saving technology optimization on central air-conditioning. Secondly, it analyses on how to optimize energy saving technology on central air-conditioning for existing buildings in China. Finally, this proposes four measures to be implemented on how to promote energy saving technology on central air-conditioning for existing building.

Index Terms—Optimize energy saving technology, central air-conditioning, existing buildings

I. INTRODUCTION

Energy saving and environmental protection are hot topics in contemporary study [1]. Central air-conditioning is one of the most common technologies being used in our daily life, it brings us good and comfortable life but then this also has great challenges to energy saving and environmental protection. Energy saving becomes a serious issue on central air-conditioning. Based on the point of view on energy saving, one needs to work on the sources; and multiple types of energy is being promoted by many countries' policies. For example, countries work on solar energy or natural gas, city gas, electricity from left hot water, industrial left hot water, methane, etc. as the direction on non conventional electricity source of supply. However, other this, to work on the improvement of the current usage and setting new targets can also achieve such objectives. And this is also the mainstream on energy saving on central air-conditioning.

II. CONTENT

A. Introduction on the Optimization of Energy Saving Technology on Central Air-Conditioning for Existing Buildings

1) Meanings

The optimization on the existing buildings central air-conditioning energy saving technologies has been debugged continuously among various systems. This is especially on devices between the facilities system and the

automatic control system; the systems between all equipments as well as equipments and the serving objects in order to achieve the best match. Technology optimization is through scientific management methods, there is no need to extra investment but can achieve the purpose of energy conservation; this is known as energy-saving management. Compared with the transformation of energy conservation, energy efficiency goals can be achieved through scientific management methods, a minimal investment but with good effect.

2) Categories

There are two methods on the optimization on the existing buildings central air-conditioning energy saving technologies [2]: First, load tracking type dynamic runtime management refers to the adjustment of the operating strategy based on building load changes, on fresh air as demand control, number of refrigerators controlled of control and night ventilation, etc.; Second, the cost of track-type dynamic runtime management, refers to the adjustment of the operating strategy according to changes in energy prices. Also this is to control air conditioning running under the peak and valley price difference, and maximize the use of its own.

3) Features

There are six advantages on optimization of energy saving on central air-conditioning when compared with the energy saving technological transformation. First, this does not need to invest additional technological transformation costs, reduce the barrier on the additional costs of existing buildings needed to put into the renovation funds by the owners or occupants. Second, this does not need to have the new technology selection decisions assessment. This can avoid existing buildings multiple stakeholders discuss on what technical advice aground the energy conservation efforts. Third, this does not need technological innovation and investment in financing as well as the time for discussion. You can edge to optimize the implementation side. Fourth, the use of optimization techniques to energy saving is easy to implement, unlike saving technological transformation requires owners' or tenants' support, and awareness. The implementation can simply run by the property company. Fifth, the use of optimization techniques and energy conservation, if property management companies are positive on this, this can immediately see the quick effect. Sixth, the optimized use of technology must require property company technicians and their optimization. This helps to improve both the overall construction equipment operation and management level. Of course, compared with the adoption of new technologies there have two disadvantages. First, the use

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of energy saving of optimization techniques, dynamic implementation plan must be developed in accordance with the characteristics and needs of both the construction equipment operation. This requires higher personnel skill from the management of existing buildings of the property company. Second, because of higher personnel skill, costs of the management of existing buildings management of property companies are higher.

B. The Most Representative Optimization Energy Saving Technology on Central Air-Conditioning

The strategy on optimizing operation of the air conditioning system is to ensure that the standard at the end of the output [3]. That is, under the premise of ensuring the comfort of indoor environment, to reduce the energy consumption of air conditioning systems, through the application of measures to improve operational efficiency and reduce the loading of the fresh air.

1) Reduction of the loading of fresh air

In central air-conditioning system, the fresh air's portion is at around 20-30%. To reduce fresh air's energy consumption the collection of the discharged cool air is an effective measure [4]. In order to satisfy the fresh air's minimum requirement, under the comfort condition on the indoor environment requirement, and different requirements from the serving objects, this needs a reasonable estimation of the fresh air volume. According to the characteristics of the air-conditioning system, this can leverage different seasonal fresh air to reduce the temperature in order to achieve the energy saving objective.

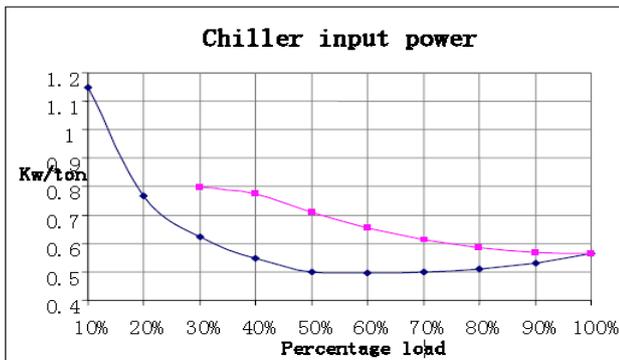


Fig. 1. Percentage load

2) Increase the cooling recycling efficiency

It has been a long time people use 7-12 °C as the central air-conditioning system standard refrigeration conditions. When the end side does not need too much cooling, electromagnetic valves will shut down automatically. The indoor temperature will be regulated under the control of the "volume adjuster". However, the central air conditioning's "quality adjuster" monitors the indoor temperature by controlling the temperature of chilled water. During the transition of season, one can try to reduce the demand coldness from the end side, by raising the indoor temperature for 2 °C. Under the change condition on the cooling procedure, this can raise the chilling water's temperature. Such method can inhibit or reduce the excessive consumption of cold while improving the efficiency of the refrigeration

cycle.

TABLE I: CONVERSION RATIO BETWEEN THE ENERGY AND HEAT LOAD

| LOAD | Cop | IPLV kw/ton | kw/ton | COP | Cop % | Efficiency % |
|------|-------|-------------|--------|----------|---------|--------------|
| 100% | 6.223 | 0.565 | 0.565 | 6.223009 | 100.00% | 0.00% |
| 90% | 6.190 | 0.529 | 0.568 | 6.190141 | 99.47% | 0.53% |
| 80% | 6.000 | 0.509 | 0.586 | 6 | 96.42% | 3.58% |
| 70% | 5.745 | 0.5 | 0.612 | 5.745098 | 92.32% | 7.68% |
| 60% | 5.384 | 0.496 | 0.653 | 5.38438 | 86.52% | 13.48% |
| 50% | 4.952 | 0.501 | 0.71 | 4.952113 | 79.58% | 20.42% |
| 40% | 4.543 | 0.549 | 0.774 | 4.542636 | 73.00% | 27.00% |
| 30% | 4.401 | 0.622 | 0.799 | 4.400501 | 70.71% | 29.29% |
| 20% | | 0.768 | | | | |
| 10% | | 1.148 | | | | |

3) To increase the cooling volume's usage efficiency

Fresh air system should be changed to variable air volume control for the full air central air conditioning system. During the air-conditioning, the use of fresh air should be the lowest to ensure air quality. And during the transitional season, the use of outdoor fresh air to reduce the indoor temperature can reduce the air-conditioning's power consumption. To take advantage of the air within the large public buildings for the equipment room cooling, the leftover cold air reduces the use of air-conditioning.

4) The use of leftover cool air

Storage air conditioning system runs on every night. An hour before turn off the machine, the central air-conditioning system can use the leftover cool air volume (8 °C - 18 °C) to provide cooling for the end side continually in order to achieve energy saving.

5) The use of the idled cooling tower

The use of the idled cooling tower to increase the area of the cooling service, this can reduce the temperature and increase the circulation efficiency; and at the end, reduce the power consumption of the central air-conditioning system.

6) The use of Ice Storage Technology on energy saving

Electricity cannot be stored, many countries use the price differences scheme to balance the demand of electricity during day time or middle of the night. When the price difference is at or above 3:1, by using ice storage technology can achieve the objective of energy saving. The use of such technology, in general, can save up more than 10% of the electricity cost. Specifically, this uses the low electricity cost at night to form and store ice; then at day time, during the peak electricity cost, without switching on the main machine, by melting the ice, this can achieve the cooling effect. Alternatively, this can raise the water temperature of the chilled water, and can switch on more cooling system. This can ensure the chilled water's temperature will not exceed a set level and consequently, the achievement on the less use of electricity during the peak period. In fact, this also reduces the wastage on the energy use on the pumps and also the use of electricity of the central air-conditioning system. China has introduced this ice storage technology since the nineties. Currently there are more than several hundred companies are

using this technology and some of them have their own developed technology.

C. To Ensure the Measures on Optimization of Central Air-Conditioning Technology

1) To mobilize the proactive use of the optimization of central air-conditioning technology on existing property companies

Presently, different countries' governments and relevant departments have developed mandatory energy requirements on energy saving [5]. However, for the different phases on existing buildings, owing to the promotion of this involved owners, property companies, technological changes and funding; with limited support from the owners and also the constraint of fund, this needs to rely on property companies to proactively optimize such energy saving technology. Therefore, to mobilize the property company enthusiasm on existing buildings' energy saving is the way to go.

2) Property companies established an independent energy saving unit

Property companies have not only needed energy-saving initiatives, they also need to establish an independent energy saving working group [6]. This group's function is to formulate energy efficiency goals and the proposal; to ensure the scientific side, the rationale and operability of these objectives and proposals. They must be timely follow up on each energy saving projects and their implementation. They also need to understand the usage of electricity and costs with a good analysis and causes, so as to formulate necessary measures monthly. On the progress of energy saving works, this group needs to manage the different phases and propose new measures and requirements on time. They also need to sum up and adjust any technical problems or opinions raised by users.

3) Enforce the professional training on the skill of property companies' personnel

The optimization on the technology of energy saving requires higher management and professional level from the property company. They need to ensure the training on their technical personnel so that they can formulate objectives,

proposals and also resolve problems. At the end, the energy saving works can be achieved.

4) Formulate relevant measures

To ensure the implementation of the energy saving objectives and proposal, one has to follow up, gather and adjust all measures on each phases. This needs to adopt a reasonable scientific energy saving technology.

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