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Energy cost saving evaluation of VSD installation in compressor rack of refrigeration system for the retail and wholesale building

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Abstract

Buildings generate the highest portion of energy consumption in most countries. It includes major contribution in climate change. Therefore, energy conservation in building is important to get higher energy standard of the country. In most regions of the world, heating and cooling loads represent the largest building-sector energy end-use. This research focuses on an evaluation of VSD installation in refrigeration system for the retail and wholesale building. The total building area of the existing experiential site is 10,000 sq.m. with 7,000 sq.m. sale area. The research data is derived from actual energy consumption and actual load measurement. The method is comparison between conventional compressor and VSD compressor in refrigeration system. We finally find that the energy of VSD compressor was not saved for the whole day. The compressor with VSD is more efficient than the one without VSD compressor during day time. The compressor with VSD worked at night or no load, whereas the compressor without VSD stopped at night or no load. If we would like to get energy saving efficiency from VSD installation in compressor rack, VSD system need to set additional function to turn off at night or turn off at no load demand.

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Keywords: Variable Speed Drive, VSD for refrigeration system, VSD of compressor

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1. Introduction

Building energy efficiency is the key to achieve energy conservation and reducing greenhouse gas emissions. The retail and wholesale building sector has been identified. Energy demand and consumption in this sector should be considered to improve efficiency. Refrigeration system in this building sector should be considered to manage and reduce energy consumption. It is operated 24 hour for sale area refrigerator and cold room in the stock area. This research expects to verify VSD in compressor rack in refrigeration system. VSD is a tool to minimize energy for compressor. It's also prove efficiency of conventional multi set compressor rack and additional VSD in this system.

2. Material and methods

2.1. Objective

This research objective is to find out Energy cost saving evaluation of VSD installation in compressor rack of refrigeration system for the retail and wholesale building. The evaluation is a comparison between conventional multi set rack and additional VSD in the rack of refrigeration system.

2.2. Scope of research

The case study building for experimental research is retail and wholesale building in Bangkok, Thailand. Building area is 10,000 sq.m. Sale area is 7,000 sq.m. The data parameter comparison is actual consumption and energy cost comparison.

2.3. Research Methodology

An experimental research is designed to know actual operation and consumption of both compressor rack between conventional multi set rack and additional VSD in the same system.

2.3.1 Experimental method.

This research is an experimental real condition and actual measurement. This system has controller to record performance data but it cannot record energy consumption (kWh) by each compressor. This research is set to know efficiency of each compressor by kWh meter addition in each compressor. Four compressor 56.36 kW in multi set rack are set to be 2 conditions. First condition is conventional compressor rack, and second condition is conventional compressor rack with one VSD compressor. Then energy parameter is recorded by automatic controller. Researcher measure kWh of each compressor, suction temperature, discharge temperature, ambient air temperature, indoor temperature and humidity. Those two condition are switched every day, 1st day is VSD, 2nd day is without VSD and 3rd days is VSD. to 10th days. All parameter are got 5 days per each one condition. All data will be used to find actual consumption and actual cooling capacity of each percentage load. Percentage load can find from turning on and turning off in each hour of compressor.

For this stage, Discharge temperature, Suction temperature, kWh and number of turning on and turning off of compressor in each hour, all of parameter can be find to convert to cooling capacity. Then cooling capacity (kWf) can be got from output of computer software (https://www.bitzer.de/websoftware.) The main method is actual measure kWh 10 days to get energy consumption saving by each percentage load, then convert data to cooling capacity (kWf) at all experimental time. After that, that saving of kWf by each percentage load can be linked to the whole year evaluation from data recorder.