ผลงานทางวิชาการ

ENVIRONMENTAL PRODUCT DESIGN OF COOLING TOWER: SMES CASE STUDY IN THAILAND

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1. Introduction

1.1 Thailand's weather and counter flow cooling tower

Since Thailand's weather is hot and humid cause almost industrial sector and large building sector need cooling tower as a main component for air-conditioning system while it's had a few development in the last decade but its component and energy used have a lot of impact on environment due to non-environmental friendly materials and low power efficiency equipments. Principle of cooling tower is the process consists of an air flowing upwards, a water thin film flowing downwards, and a large interface between these two phases then the heat transfer occurs at the interface[1)].

1.2 Life cycle thinking and Eco-design

1.2.1 Life cycle thinking (LCT) – the concept of Life Cycle Thinking integrates existing consumption and production strategies towards a more coherent policy making and in industry, employing a bundle of life cycle based approaches and tools. By considering the whole life cycle (Material acquisition, Manufacturing, transport, Use, End of life management), the shifting of problem from one life cycle stage to another, from one geographic area to another and from one environmental medium or protection target to another is avoided[2)]. Life cycle thinking addresses these life cycle generated impacts through the use of different approaches aiming at minimizing them such as: Life Cycle Assessment (LCA) [3)], Life Cycle Management (LCM), Life Cycle Costing (LCC), and Design for the Environment (DfE) [2)].

1.2.2 Eco-design or Design for Environment (DfE) - is the systematic design method which incorporates environmental issue into the product design and development for improvement of product environmental characteristics[4)]. The Design for Environment offers the possibility to lower the effort for decision support to product developers by a factor between 10 and 100, while being able to provide a similar reliability of the decision support as LCA studies can. DfE is hence the key to bring LCA to SMEs[2)].

2. Methodology

Small and Medium Sized Enterprises (SMEs) in Thailand are meeting increasingly strict legal and customer requirement on environmental issues. But the lack of knowledge, budget and resources is the problems. Life cycle thinking and Design for Environment concepts are applied to this case study to help SMEs whom confront those problems. The briefly procedure is as follow[5)]:

2.1 The first step of the case study is literature review for induce a firm to improve the environmental performance of its products.

2.2 Next, Select the 400 refrigerant ton cooling tower as a research model due to it is a top sell model. And also, the stakeholder's requirement was gathering too.

2.3 Build their environmental profile to identify the significant environmental impact and set up the priority that should be considered to reduce the impact serially. In this step LCT and computer aided design was use for analysis and evaluate.

2.4 Green idea creation was build upon the environmental impact priority from the above step. The idea creation was considered along with stakeholder's requirement.

2.5 Analysis and evaluate environmental impact for the new model after applied green idea.

3. Results and discussion

From the Environment impact assessment the highest impact is in the use phase due to extremely electric power consumption. The sample of the data collection is a factory which runs 24 hours a day, occasionally shut down for maintenance and has a power outage less than 10 days per year. Then it show that this factory consumes energy all over the year. The high efficiency motor is the best option for this problem. After comparison between the present motor which has 90% efficiency and the high efficiency motor which has 95% efficiency, the result shown that it can save more than 54,807kwh throughout its lifetime or equal to 18,980.31 $kgCO_2$ eq.

From stakeholder requirement the environment impact from filler is to be considered. Hence the next issue to improve is the reduction of environmental impact from filler.

4. References

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