

The role of the thermally activated desiccant cooling technologies in the issue of energy and environment

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ABSTRACT

This paper presents the review of the development and application of the thermally activated desiccant cooling technologies. The paper first introduces the global problem of energy and the environment related to the consumption of the carbon-based energy sources (gas, oil and coal). The contribution of the building sector to the above problem so as to maintain indoor environment providing human thermal comfort is shown. In this paper, the alternative methods for the provision of the human thermal comfort through thermally activated desiccant cooling technologies are discussed—solid desiccant, liquid desiccant and hybrid desiccant cooling systems. These technologies are potential alternatives to the mechanical vapor compression cooling technologies in the provision of human thermal comfort conditions. However, the development and application is mostly in developed and advanced developing countries. For a global scale solution to the problem of energy and environment contributed by the building sector for maintenance of comfortable conditions, dissemination of ideas and technologies to the developing world (Africa, South and South East Asia, South America) enhances the applicability and practicability of these technologies.

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1. Introduction

The global environmental problem is a serious one. The depleting conventional energy resources are other major issues. The world population is increasing every year. The human demand for better and comfortable condition is getting high. Urbanization is happening around the world. Industrialization is taking place in every corner of the planet. The above problems are complex as there are many parameters and considerations to be deeply looked into. These situations have become globally political, economical, and technological issues. Hand in hand solutions for these problems are a must to attain a common goal. Hence these issues of energy, environment, and technology are interrelated to each other and must be treated with interconnectivity if we have to attain clean and greener environmental conditions for humanity's survival (see Fig. 1 for the diagram) [1].

According to Lund [2], technological innovation is needed for future sustainable energy systems. From this, greenhouse gases emission such as carbon dioxide can be maintained, or if not, reduced. This will involve both political and technological will in tackling the issue through energy conservation, carbon sequestration and capture. In addition, development of carbon-free energy resources should also be given priorities as gradual alternative to carbon-based energy sources. Example, French cut the carbon dioxide emission by 27% in less than 10 years despite increasing energy consumption [3].

2. Energy and environmental issues

The problem of energy consumption is related to environmental problems. Burning of conventional energy sources emits lot of greenhouse gases (GHG) particularly CO₂ [4]. The CO₂ emission is increasing every year which mostly comes from the developing region [5]. The increasing CO₂ emission from the developing world is due to the massive economic development in these regions. Also, in the developing world, population is tremendously increasing which results to higher energy consumption [6–8]. In addition, as economic development progresses, massive usage and application of gadgets, devices and equipment contribute to the environmental problems. Hence, many of these contribute greenhouse gases (GHG)

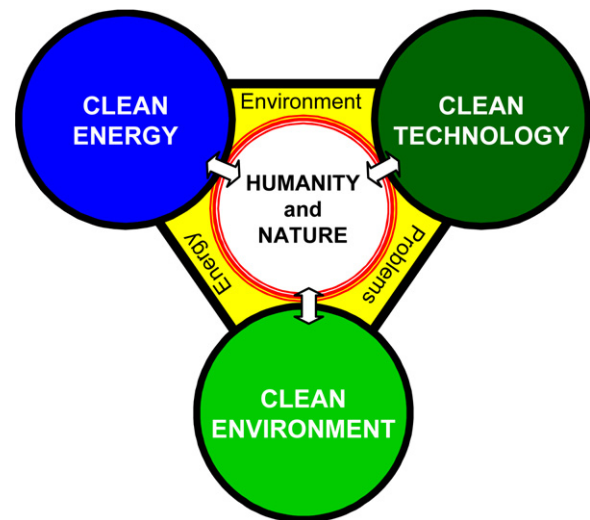


Fig. 1. Interrelated concept of the issues of energy, environment and technologies to the survival of humanity and nature [1].

and ozone layer depleting substances. In fact, air cooling and heating equipment and devices contribute a lot of these gases [9].

As presented by Lund [2], technological innovation for future sustainable energy is necessary. However, its development and implementation is costly as in the case of wave energy [10]. Government support and serious programs are needed if these energy sources should be gradually developed and utilized. Program such as the Global Climate and Energy Project of the Stanford University is good example [11]. As presented in Fig. 2, CO₂ emissions can be reduced through technology development and application. Nandwani [12] shows that minimization of return of investment and maximize the capability of the technologies make it appealing. Hence, for example, combined system such as combined heating and power system (CHP), combined cooling, heating and power (CCHP) system can reduce energy consumption and green house gases emissions [13].

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