

9.0 Societal, Health, Safety, Legal, Economical, and Cultural Issues

The health and safety factor of every user is of ultimate importance, and our design was made with safety in mind. Although most of the PCMs used in the industry are non toxic to human beings and animals, PCM ingestion should still be avoided, as well as long term exposure to the skin. To enforce this, cautionary information was written in the technical operation and maintenance manual. As for disposal, PCM materials are land-fillable, and the PCM that we are using has low flammability and is not considered a hazardous material. Nevertheless, proper disposal steps should be taken as there is little information regarding the impact of PCM on the environment, incineration may be a better way to dispose of PCM (Wu, Zhimin, Chin, et. al, 2018). As for the PCM tank, it does not pose any safety and health issues except for leaking of PCM, which may lead to accidental ingestion of PCM by children. This can be prevented by safety sealing the tank, as well as proper maintenance.

9.2 Society

In the past years, the increased fuel consumption and release of CO₂ emissions have affected the environment all around the world. To improve the defrost performance, many heat-pumps utilize electrical energy or some form of fuel consuming system to produce heat. The usage of PCM as a heat storing and release method would not consume any additional fuel or energy. This in turn helps the society by lowering CO₂ emissions, and reducing the effects of global warming as well as acid rain.

9.3 Legal

The use of PCM and our PCM tank design does not violate any existing laws, patents or copyrights. However, it is to be noted that the PCM SP-31 used in the project is a patented product by Rubitherm, and thus in the future if there are any plans to mass produce, discussion and contracts would be required with Rubitherm Germany. As for the PCM tank and the electrical circuitry, there are no problems in the legal aspect for the design and use.

9.4 Economical

For the economical aspect, it is projected that the usage of PCM would be able to lower electricity costs. As the team does not have industrial data regarding consumption of energy for standard heat pumps that use heaters or fuel for enhanced defrosting, we had to do some rough estimations and research based on information online. Due to lack of conclusive and recorded data, information from heat pump users were taken online.

With the use of emergency heat, which is a form of supplementary heating to complement heat pumps, the electricity usage was an additional 350% (Lennard, 2019). The user recorded that the energy used without emergency heat and with emergency heat was 9 kWh and 2 kWh respectively, which is a huge difference (Early Retirement, 2009). Hence, with the successful application of PCM Heat Exchanger, it should theoretically be more economical compared to a standard heat pump.

9.5 Cultural

For cultural impact, our project is able to encourage more energy saving in the thinking of our society and push for the gradual shift towards usage of devices that require no fuel or additional energy. This will bring a positive impact to society, because when more people begin to have the prioritise energy saving, such positive thinking will be able to spread easily. The team hopes to be able to encourage the use of fuel consumption free alternatives such as PCM, which relies only on absorbing and releasing waste heat as a method of heating. However, more progress and research would be required so that usage of materials such as PCM will be more widely implemented compared to fuel consuming alternatives.