

## **The Case for PTC Heating in Renewable Thermal Programs.**

### **Background**

Renewable Thermal (RT) programs seek to increase the adoption of high efficiency RT technology to reduce Green House Gas (GHG) emissions and heating and cooling costs for consumers. RT technologies that are being utilized in today's RT program initiative include cold climate air-source heat pumps, biomass pellet\chip boilers and furnaces, ground-source heat pumps, solar thermal systems, biofuels, and biogas. Increasingly RT technology is being considered to replace oil and electric systems that are being utilized for space heating. Accelerating the adoption of RT technology is a focus of the Mass Department of Energy Resources (Mass DOER).

"Increasing the market share of renewable heating and cooling technologies at an accelerated pace will enable the Commonwealth to address a series of important challenges. These include reducing the state's dependency on heating sources that are either costly (oil, propane, electricity), constrained (natural gas), or both. Renewable heating and cooling technologies can help Massachusetts meet greenhouse gas (GHG) emission reduction targets, increase energy efficiency, and improve air quality.

However, realizing the full benefits of renewable heating and cooling in time to meet the challenges described above requires a comprehensive approach to market development. "

#### **Commonwealth Accelerated Renewable Thermal Strategy (CARTS) Report**

In order to maximize the adoption of RT technology in the Commonwealth we are proposing that the current portfolio of RT technologies be expanded. Expanding the scope of RT technology has the potential to significantly reduce consumer energy cost, Green House Gas (GHG) emissions while proliferating the use of clean, safe and highly energy efficient heating systems. Enter Positive Temperature Coefficient (PTC) Heating Technology, a new and very exciting category of RT that is the result of innovation in material science (nanotechnology) and the integration low voltage electricity. PTC Heating offers superior performance to other forms of space heating. This performance benefit is achieved in all types of buildings making it a new catalyst to drive wide spread market adoption of RT Technologies

### **What is PTC Heating Technology and How Does it Work**

#### **PTC Heating and Nanotechnology**

Positive Temperature Coefficient (PTC) heating uses a thin (1.2 mm), flexible and durable self-regulating heating element made of Nano carbon polymers. The Nanomaterial modifies its behavior of conduction when electrically charged and Nanoparticles heat up as isolated cells. These Nanoparticles are evenly embedded in a unique light conductive polymer blend. When the Nanoparticles heat up the plastic expands thus reducing the conductive pathways between the isolated cells. This function restricts the flow of current feeding the cells and less current produces less heat. The self-regulating heating elements supply more wattage when cold and less wattage as they warm up. The elements are connected to a step-down transformer to power the heating elements with 24 volt power. PTC elements can receive AC or DC power.

#### **Self-Regulating & Self-Modulation**

A PTC Heating element is self-regulating and self-limiting, meaning every point of the heater independently keeps a constant temperature without the need of regulating electronics. PTC Heating elements can never exceed a given temperature at any point, which makes it safe and energy efficient. In times of an external heat gain, no energy will be used until its temperature decreases. When the ambient temperature is cold, PTC Heating elements will operate at full capacity to overcome the temperature differential.

## Energy Efficiency / GHG Mitigation

Using the Ashrae standards for Heat Loss calculations it is calculated that PTC heating consumes between 14-77% less kWh than other heating systems (compared to Central Heating, Electric Heat Pumps, Water Tubing Radiant Heat, and Electric Cable Radiant Heat). PTC Heating, using electricity, accumulates more cost savings than all other fuel types. The very flat PTC Heating elements cover a larger floor space (60% compared to 1% with other radiant heating) which allows the technology to operate using an even, lower, and consistent level of energy. Unlike traditional heating, PTC Technology heats the objects and the building itself, rather than the air. The materials in a building are denser than air and they retain heat better and for a longer period of time.

The use of PTC Heating, utilizing electricity as its only source of power, contributes to the mitigation of GHG's by producing zero emissions or harmful GHG's. All materials used in PTC Heating elements are recyclable and eco-friendly.

## PTC Heating and DOER's Renewable Thermal and Cooling Objectives

The use of PTC heating will greatly increase the NPV of benefits through the fuel savings accumulated by the Commonwealth's customers and through the Commonwealth's avoided cost of CO2 emissions. The PTC elements have a 0% failure rate and provide a sustainable heating technology that requires no maintenance which will also accumulate savings for the Commonwealth and for customers.

In order to meet the 2020 GHG goals, the use of energy efficient electric heating technology must be utilized. Use of PTC heating technology provides a viable option for customers to switch from using fuel types that emit GHG's thus providing a zero emission alternative that also happens to be more energy efficient than other space heating technologies.

If the Commonwealth can adopt PTC Heating as a new category in the RT program, the Commonwealth will be able to offer a technology that produces no GHG's, is sustainable, and uses less energy than all other RT technologies. It will provide an option to residential and commercial building owners that electric heating technology can use less energy and save money. PTC heating is a substantive technology and a potential key technology in meeting the 2020 GHG goals.

## In Summary

Expanding the planned scope of the Renewable Thermal program being launched by DOER to include PTC Heating has a number of significant benefits that includes:

- Enabling a RT technology that offers Zero GHG emissions thus supporting the Commonwealth's 2020 GHG reduction goals.
- Reducing the cost energy to consumers and businesses. PTC systems are 4 times less costly to operate vs an oil or electric based heating system
- Expanding the portfolio of available technologies available to residential and commercial buildings owners who seek to convert from oil based or electricity based space heating by offering a solution more energy efficient than other RT technologies or traditional heating systems.

We encourage DOER to expand the planned RT program to include PTC Technology as a matter of urgency. Thank you for the opportunity to present our rationale for the expansion of RT Technology.