

Infrared Heating Technology

Alan Mulry K00262019



Aim of the Project

The Aim of the project is to research the area of infrared heating technology and conclude the findings.

- Research the area of Infrared heating technology in relation to domestic infrared heating panels.
- Compare and contrast domestic Infrared heating to conventional wet systems e.g. convective radiators.
- Carry out theory-based calculations to analyse the heat transfer of Infrared heating panels V's conventional radiators.
- Carry out interviews/questionnaires to gain knowledge on people's experiences here in Ireland who use Infrared heating.

Background

According to provisional agreements between the European Council and Parliament heating systems that use fossil fuels will be phased out in Ireland in the next decade. Alternative heating technologies such as air-to-water/refrigerant systems have now become the mandatory spotlight of the future. However, this type of technology results in large capital expenditure, operation and maintenance expenses. Infrared heating is a competitive and alternative method of heating homes, businesses, and industrial spaces.

Conventional wet heating systems use domestic-style radiators to heat spaces using mainly convective heating with limited levels of radiation. These systems require lots of labour to install and maintain. Infrared heaters on the other hand are an innovative electrical-based heating solution that emits heat predominantly by infrared radiation to give a more consistent heating pattern.

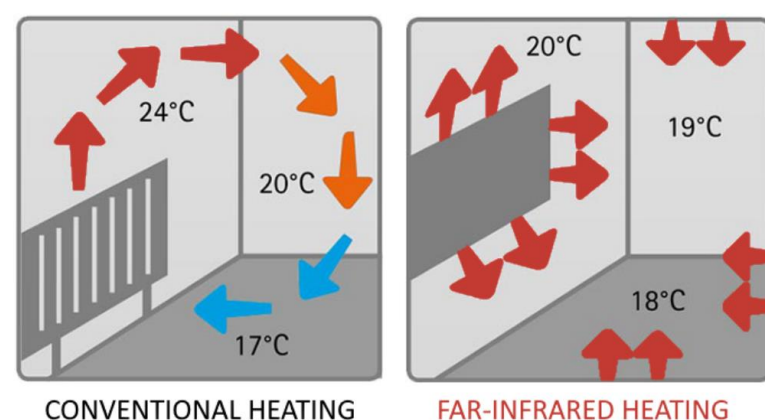


Figure 1: Conventional Heating V's Infrared Heating

Near Infrared Heaters

Electrical infrared heaters are categorised into two types Far-Infrared and Near-Infrared. Far Infrared heaters take the form of domestic/commercial indoor slimline panel heaters. These panel heaters emit infrared radiation invisible to the human eye within a wavelength band of $5.6 \rightarrow 1000 \mu\text{m}$.

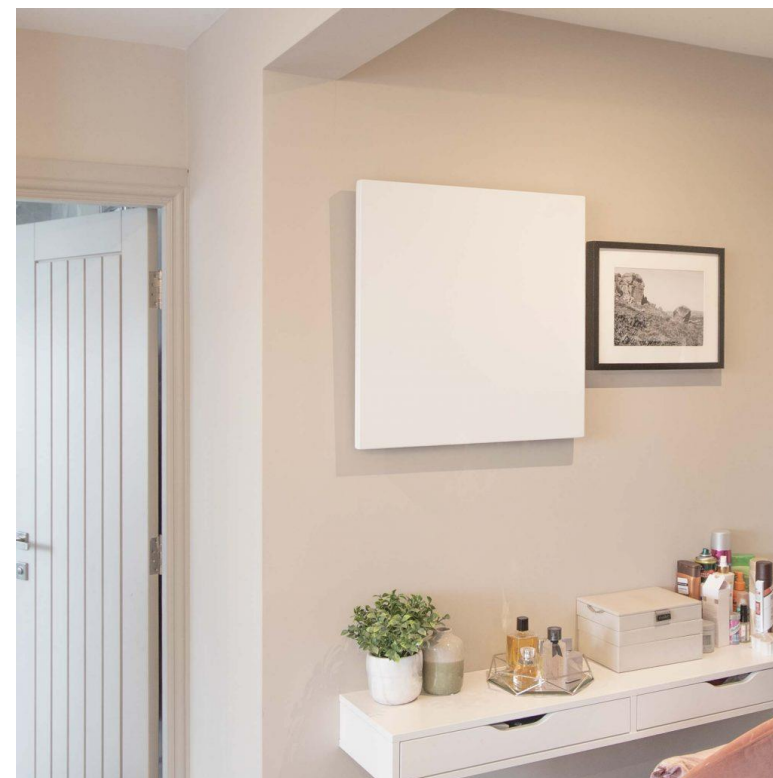


Photo of: A Wall Mounted Electrical Far-Infrared Panel

Near Infrared Heaters

Near-Infrared heaters are typically associated as the most intense form of infrared heater, emitting infrared radiation with a ruby red glow. These heaters have the shortest wavelength ranging from $0.76 \rightarrow 1.5 \mu\text{m}$ and are typically used to heat large uninsulated draughty spaces such as warehouses, factories and smoking areas.



Photo of: Chain Hung Electrical Near-Infrared Heaters

Numerical Analysis Of Heat Flow

Numerical analysis was carried out to analyse and compare the levels of heat flow from a conventional domestic radiator and an electrical Infrared panel. The calculations carried out quantified the level of convection and radiation heat transfer from both heat sources.

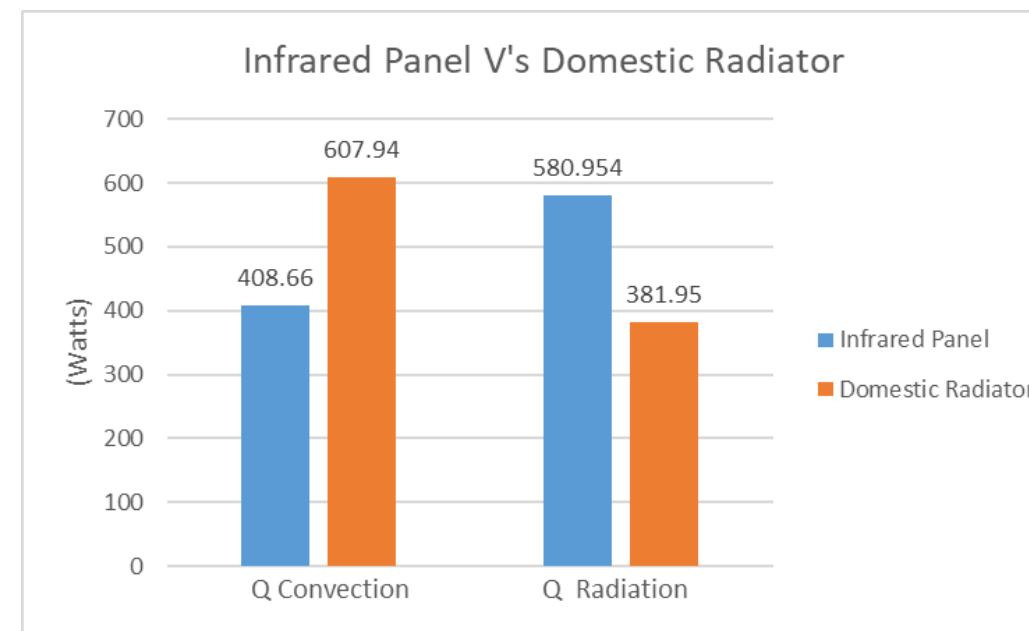
$$Nu = \left\{ \frac{0.825 + (0.387 Ra^{1/4})}{\left[1 + \left(\frac{0.492 Pr^{1/4}}{Pr} \right) \right]^{4/27}} \right\}^2$$

Equation For Heat Transfer By Convection.

$$\dot{Q}_{rad} = \sigma A \varepsilon (T_s^4 - T_a^4)$$

Equation For Heat Transfer By Radiation

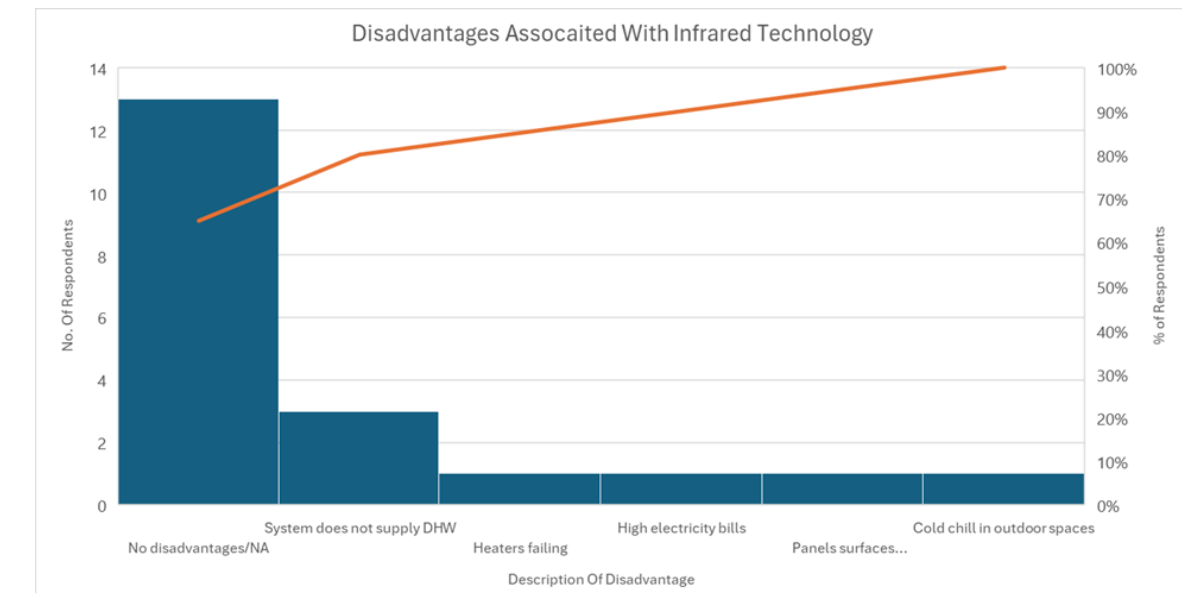
The emitted convective heat transfer for the heating panel was calculated to give a value of 408.66W and a radiation value of 580.95W. The emitted convective heat transfer for the heating panel was calculated to give a value of a value of 608.94W and a radiation value of 381.95W.



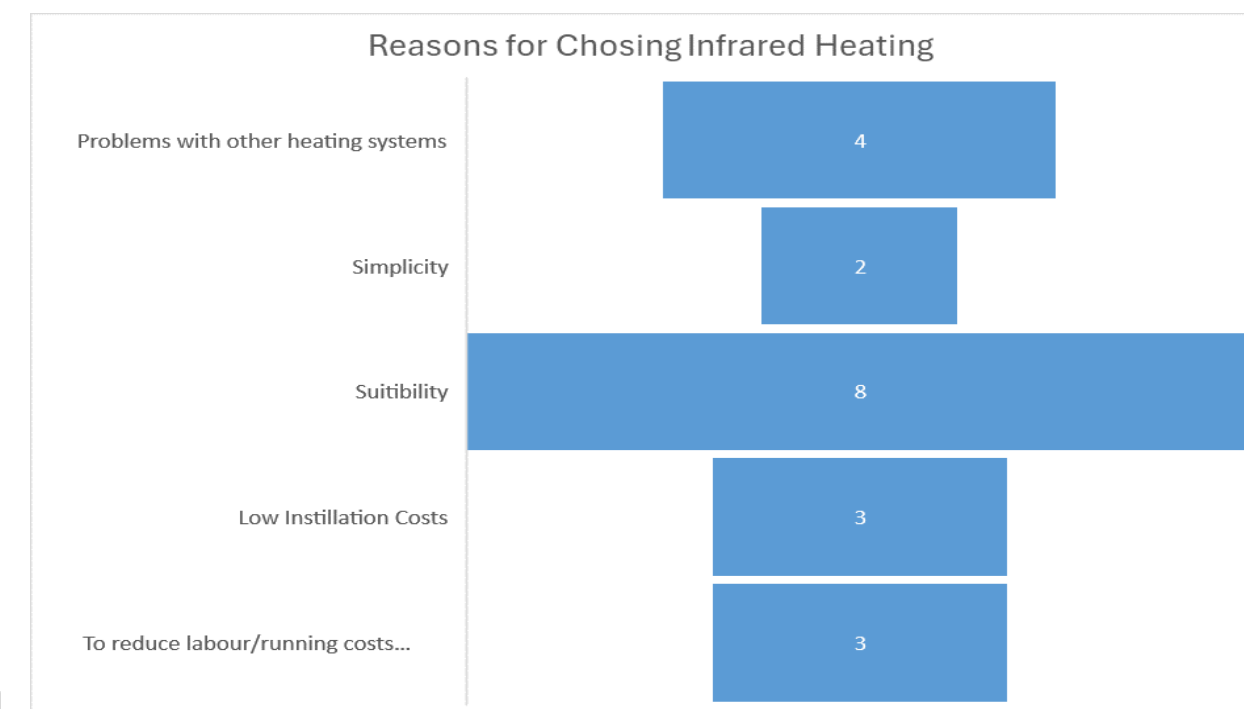
Graph of :Numerical Calculation Results

Questionnaire

A brief questionnaire was created on MS Forms. This questionnaire was set out to anonymously gather information from infrared heating users regarding their experiences with the technology. Overall, the customer feedback was very positive. Some of the feedback from this questionnaire can be seen on the Pareto and unnel chart.



Pareto Chart: Questionnaire Responses Disadvantages With Infrared Heating Technology



Funnel Chart: Questionnaire Responses Reason For Choosing Infrared Heating

Interview

An interview was conducted with a manager of a nursing home. The nursing home opted for IR panels due to rising building costs and to address inefficiencies with the existing gas heating system. IR heating, recommended by Infrared Heating Ireland, was chosen for its lower costs, ease of installation, and room-by-room zoning control, indicating a move towards sustainability. Feedback shows that IR heating has significantly improved comfort levels by emitting gentle warmth and eliminating cold and damp sensations, meeting critical comfort and health requirements in the nursing home setting.

Conclusion

- Electrical Infrared heaters are categorised into two types.
- Far Infrared heating panels are used for indoor domestic applications.
- Infrared heaters emit more heat by radiation when compared to domestic radiators.
- Infrared heating has many advantages and minimal disadvantages according to individual feedback.