



## INTEGRATED ENERGY SYSTEMS

### CLEAN ENERGY TECHNOLOGIES

## EFFICIENT COMMERCIAL SPACE HEATING

*Large commercial buildings such as factories, warehouses, arenas, and aircraft hangars are difficult to heat due to their high ceiling and large air volumes.*

Forced air furnaces or unit heaters are the conventional approach but they result in large temperature differences and poor comfort. Infrared heaters are more efficient at heating these buildings. These IR heaters use natural gas, electricity, or oil to heat the radiating surface. The heat is directed downward to the load, by line-of-sight and/or reflectors. The radiation warms occupants, objects, and the buildings floors and walls. Due to this direct radiant warming the indoor air temperature does not need to be set as high and hence the temperature difference and the energy consumption are reduced.

The IES laboratory has an ongoing project which will compare three different space heating technologies:

- A low-intensity Infra-Red heater
- A single-stage condensing unit heater
- A single-stage non-condensing unit heater

The evaluation of these tests has included: thermal comfort calculations, steady state efficiency measurements, temperature profiles, and a comparison of heating degree day versus gas consumption.



## Monitoring:

There were 20 T-type thermocouples used in the testing to measure the temperature at different locations.

In the middle of the room the thermocouples were placed to measure the temperature profile from the floor to the ceiling.

## Tests Methods:

The steady state efficiency was calculated by measuring the concentrations of the combustion products, such as carbon dioxide and carbon monoxide. Also the flue gas temperature along with the combustion air temperature was measured.

With the air and globe temperature, air humidity and velocity, the thermal comfort of the heaters can be determined. This was done by calculating the predicted mean vote and the predicted percentage of dissatisfied people.


**By plotting the energy consumption versus the heating degree day a linear relationship is seen. This relationship will show which heater will use more gas at a certain outdoor temperature.**



*Globe and Air Temperature Sensors*

### Your Invitation to Work with Us


We are interested in collaborating with you. Please contact the Business Office to discuss your particular needs.

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