Department for Business, Energy & Industrial Strategy

Energy Technology List

# Heating: warm air and radiant

A guide to energy efficient equipment listed on The Energy Technology List (ETL)

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# Introduction

The ETL is a government register of energy saving products. When you select products from the list you are choosing from amongst the most energy efficient products in the marketplace.

When replacing equipment, businesses are often tempted to opt for equipment with the lowest capital cost. However, such immediate cost savings may prove to be a false economy. Considering higher energy efficient products, means that life cycle costs are reduced, improving cash flow in the longer term.

Businesses can also claim accelerated tax relief through the Annual Investment Allowance (AIA) for investments in plant and machinery equipment. The AIA has been temporarily increased to £1 million from January 2019.

**This leaflet illustrates the benefits of investing in warm and radiant heating equipment which qualifies for the ETL.**

The ETL comprises two lists:

- **Energy Technology Criteria List**: defines the performance criteria that equipment must meet to qualify for the ETL;
- **Energy Technology Product List**: is the list of products that have been assessed as being compliant with ETL criteria.

Eligible warm air and radiant heating products on the ETL can be searched at:
https://etl.beis.gov.uk/engetl/fox/live/ETL_PUBLIC_PRODUCT_SEARCH

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# Setting the scene – warm air heating

Direct fired heaters (whether gas, oil or biomass-fired) are not eligible for the ETL.

## Definition

Warm air heating equipment covers products that are specifically designed to provide space heating using the heat generated by a burner to raise the air temperature in the space(s) being heated; and optimising controllers that ensure warm air heating systems operate in an efficient manner.

## Indirect-fired warm air heaters

Warm air heaters are widely used to provide space heating for warehouses, retail sheds, sports centres, factories, and other buildings containing similarly large spaces. Warm air heaters contain a gas or oil fired burner that is used to heat the air in the space directly, or indirectly by means of a heat exchanger. A fan is used to distribute the warm air throughout the space(s) being heated. Warm air heating is often used as a replacement for traditional water based heating systems within commercial spaces.

Warm air heaters are available in a range of different types and efficiencies. The ETL encourages the purchase of higher efficiency indirect warm air heaters. Product types including on/off, high/low and fully modulating are covered; all must have the same efficiencies (when tested) to be listed, but fully modulating products are typically more efficient in use. This is because they are continually and automatically able to adjust the heater output to reflect the temperature requirements of the room, thereby cycling on and off less often and reducing energy consumption.

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# Setting the scene – radiant heating

Note: Electric radiant heaters are **not** listed on the ETL.

## Definition

Radiant heating equipment covers fuel-fired products that are specifically designed to heat people or objects in the space below them by infrared radiation without heating the surrounding air directly, and optimising controllers that ensure radiant heating systems operate in an efficient manner.

## Radiant heating

Typically 35% of the heated air in commercial buildings is lost through ventilation and air infiltration. In large, open, high-ceilinged buildings with high ventilation rates, the proportion can be even higher, particularly where there is local exhaust ventilation for fume control.

Radiant heating reduces these energy losses by heating the occupants directly, not the air. Units typically contain a gas or oil-fired burner that is used to heat a tube, cone or plaque that emits infrared radiation when hot. The infrared radiation is focused and directed by reflectors within the units. This means that the air temperature, and hence the energy lost through ventilation, and the amount of fuel used is significantly lower than in a building heated by fan convectors or low temperature radiators.

Radiant heating reduces losses and can improve comfort as there is more control over when the heat is on and where it is directed – the whole space need not be heated. Correct positioning of the heater is important and should be placed directly in line with the person/object requiring the heat. Typical applications for radiant heating include retail units (particularly DIY outlets), sports centres, warehouses, factories, workshops and animal houses.

As a rule of thumb, every 1°C reduction in air temperature through the use of radiant heating will produce a 5% to 10% reduction in annual energy consumption.

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# Setting the scene – assumptions and calculations

## Assumptions and calculations

**An ETL listed warm air/radiant heater must meet defined energy efficiency levels under various load conditions. In this document, the baseline scenario below, has been used to calculate the potential financial (£), energy (kWh) and carbon savings (tonnes $CO_2$) unless otherwise indicated:**

- Assume heaters operate for 16 hours per day, 6 days per week, for 32 weeks
- A load factor of 0.6
- Assume ETL listed products are 15% more efficient than non-ETL compliant ones
- Price for electricity* 11.14p/kWh
- Carbon emissions* for electricity 0.35156 kg$CO_2$/kWh
- Price for gas* 2.61p/kWh
- Carbon emissions* for gas 0.18416 kg$CO_2$/kWh

* BEIS 2017

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# Products on the Energy Technology List:
## Warm air heating

### Indirect-fired warm air heating equipment

**Warm air heating**

- Indirect-fired packaged warm air heaters consist of a gas or oil burner, heat exchanger and hot air fan. Air from the room is recirculated through the heat exchanger and back into the room at high velocity. The hot air may be discharged directly from the unit or ducted into the room. Flue gases are discharged to the atmosphere outside the building. Both floor standing and suspended units are available.
- Indirect-fired packaged warm air heater **modules** use a similar set of burners and heat exchangers, but are designed to fit within air handling units to heat the fresh air being introduced to the building. Only the module is eligible for the ETL and not the air handling unit in which it is mounted, or the associated ductwork.
- Installation or replacement of indirect-fired warm air heating should always be considered in conjunction with possible building fabric improvements and minimising uncontrolled air leakage. There may also be benefits from the installation of ventilation heat recovery in some circumstances.
- Condensing models (units that recover additional heat from the water vapour within the exhaust gases) are available that offer far superior energy efficiency over typical non-condensing models. These may be more expensive but are still very cost-effective over their lifetime.

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# Products on the Energy Technology List:
## Warm air heating

### Indirect-fired warm air heating equipment:

**Advantages of indirect-fired warm air heating equipment:**

- Low or high-level mounting possible
- Relatively inexpensive
- High thermal outputs available
- More efficient than using a boiler and convector

**Example: Installing an ETL listed indirect warm air heater at a total cost of £9,000 rather than a typical non-condensing product at a cost of £5,500 the potential annual savings are:**

- £1,070
- 41,400kWh
- 7.6 tonnes $CO_2$

**With a typical additional capital cost of £3,500 and lifetime energy and AIA benefits of around £11,600 at today's prices, the financial benefit of choosing an ETL listed product is over 3 times the additional cost. Furthermore with a potential AIA of around £1,700 and energy savings of £1,070 in year 1, the extra capital cost is recovered in just over 2 years.**

*Assuming the ETL listed product is 15% more efficient than the standard product but 63% more expensive to buy.

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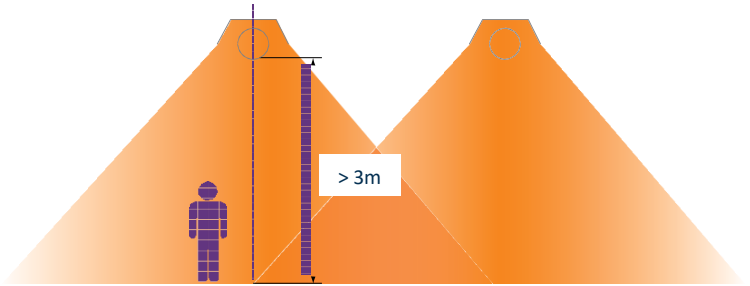
# Products on the Energy Technology List:
## Radiant heaters

### Radiant tube heaters

**Radiant tube heaters**

- A radiant tube heater consists of a steel tube with a gas or oil burner at one end of the tube and a flue gas fan at the other. The tube is surmounted by a metal reflector to produce a cone of radiant heat. As gas is burned, the temperature of the tube increases (up to 500ºC) and it radiates heat. This heat radiation is directed downwards to heat the occupants of the space, much in the same way as light from a fluorescent tube. The radiant heater tubes are usually mounted on the ceiling and must be designed to be mounted above head height to be eligible for the ETL.
- Within the radiant tube heater category, there are three basic types of radiant tube heating included on the ETL: unitary radiant tube heaters, multi-burner radiant tube heater and continuous radiant tube heaters.




Source: Radiant tube heating, BSRIA

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# Products on the Energy Technology List:
## Radiant heaters

### Radiant tube heaters

**Example: Installing three ETL listed 35kW gas fired radiant tube heaters at a cost of £9,300 over a similarly rated non-ETL listed system, running for 16 hours per day, 6 days per week for 32 weeks, the potential annual savings are:**

- £750
- 29,000 kWh
- 5.3 tonnes $CO_2$

**With a typical additional capital cost of £2,100 and lifetime energy and AIA benefits of around £8,200 at today's prices, the financial benefit of choosing an ETL listed product is over 3 times the additional cost. Furthermore with an approximate AIA of £1,770 and energy savings of £750 in year 1, the extra capital cost is recovered within 1 year of purchase.**

*Assuming the ETL listed product is 15% more efficient than the standard product which has a load factor of 0.6, and has a price premium for 30% over capital cost of non-compliant system at £7,200.

**If your building is subject to high ventilation rates then installing an ETL listed radiant heating system could help reduce your heating costs by up to 20% compared with conventional air heating systems.**

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# Products on the Energy Technology List:
## Radiant heaters

### Radiant tube heaters

#### Unitary radiant tube heaters

These consist of a single tube with one burner (13kW to 50kW input) and one fan. They are either linear or bent into a U-shape (so that the burner and flue gas fan are at the same end). Different tube lengths correspond to different heat outputs. Up to 20 unitary radiant tubes are commonly used to heat a space, but more may be used.

#### Multi-burner radiant tube heaters

This is an assembly of radiant tubes, each with its own burner but connected to a common flue system. The component tubes and burners are commonly of the same structure as for unitary radiant tube products.

#### Continuous radiant tube heaters

These consist of a long radiant tube fitted with several burners along its length and a common flue gas fan at the end. The multiple burners ensure that the tube's working temperature is maintained along its entire length, which may be more than 100 metres. The tube can be straight or bent in the horizontal plane to fit the space. In some cases, multiple branches of a continuous radiant tube may be connected to a single flue gas fan.

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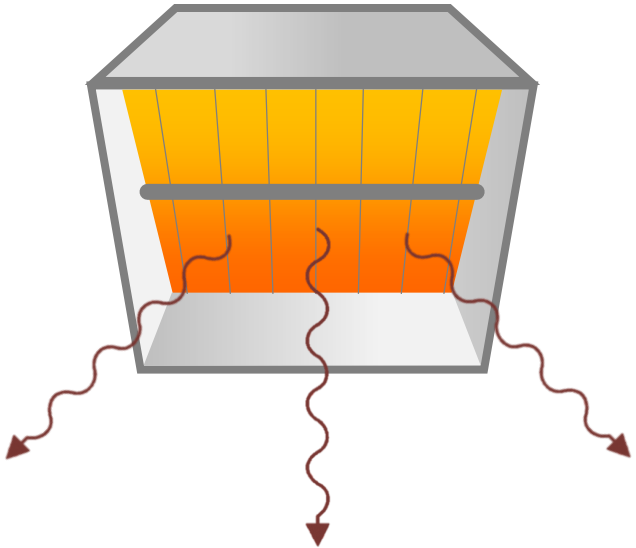
# Products on the Energy Technology List:
## Radiant heaters

### Radiant plaque and cone heaters

**Radiant plaque and cone heaters**

- For radiant plaque and cone heaters, a radiant emission is generated by an exposed flame passing over a catalytic matrix, the 'radiant matrix'. This becomes extremely hot (up to 950°C) resulting in an intense radiant source that is used mainly for local or spot heating.
- Plaque heaters (8kW to 40kW input) have a plaque shaped radiant matrix. They can be suspended or fixed to walls or pillars surrounding the occupied space.
- Cone heaters (6kW-12kW input) have a cone shaped radiant matrix, surmounted by a circular reflector. They are designed for suspension from the roof.



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# Products on the Energy Technology List:
## Optimising Controllers

### Optimising controllers

**Optimising Controllers**

Optimising controllers for radiant heating systems are also covered by the ETL. These include both standalone units and add-on module type products (for warm air and radiant heaters) and ensure heating systems operate in an efficient manner. These are pre-programmed to control the temperature in zones based on occupancy schedules and to switch the units off when there are zones unoccupied. The controllers also need to incorporate an optimum start mechanism that prevents overheating and a 'self-learning' program that monitors and updates the heating curve by taking into account changes in the climate and building usage. In addition, some heaters themselves may incorporate optimising controllers already.

Optimising Controllers:

- Automatically control the temperature in one or more zones within a building in an energy efficient manner that reflects predefined zone occupation schedules.
- Automatically switch heating equipment on and off in accordance with the predefined occupation schedule for each of the zones being controlled.
- Should also incorporate frost protection, condensation protection, and an anti-tampering mechanism.

Building managers can define the occupation times for the building and for each zone controlled for each day of the week and define the temperature set-points for each zone to +/- 1 degree Celsius. Building users may be able to 'override' the pre-set programme times – but only temporarily.

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# Where can I find more information?

**For information about the ETL please visit:** https://www.gov.uk/guidance/energy-technology-list and see our Information for Purchasers factsheet. Or contact the ETL Help Line on 0300 330 0657; email ETLQuestions@carbontrust.com

**For more information on the ETL:**

**To search for a product on the ETL please visit:**
https://etl.beis.gov.uk/engetl/fox/live/ETL_PUBLIC_PRODUCT_SEARCH