Department for Business, Energy & Industrial Strategy

Energy Technology List

HVAC: heating, ventilation and air conditioning equipment

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

Department for Business, Energy & Industrial Strategy

Energy Technology List

Contents

Department for Business, Energy & Industrial Strategy

Energy Technology List

Introduction

The Energy Technology List (ETL) is a 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 the life cycle cost before investing in equipment can help reduce costs and improve 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 energy saving equipment which qualifies for the ETL.

The following equipment is covered under the HVAC category of the ETL:

- Building Environment Zone Controls
- Active Chilled Beams
- Close Control Air Conditioning
- Evaporative Air Coolers

Eligible HVAC products on the ETL can be searched at:
https://etl.beis.gov.uk/engetl/fox/live/ETL_PUBLIC_PRODUCT_SEARCH

Department for Business, Energy & Industrial Strategy

Energy Technology List

Setting the scene – building environment zone controls

Building environment zone controls can be hugely beneficial in non-residential buildings, especially in offices, hotels, wholesale and retail trade service buildings.

Definition

Building environment zone controls are specifically designed to automatically control, in an energy efficient manner, the amount of heating, cooling, ventilation or air conditioning that is applied to individual rooms or defined areas within a building, known as “zones”. In general, these controls are applied to five types of HVAC equipment:

- Wet (hydronic) heating systems.
- Underfloor or storage heating – wet systems and electric heating.
- Ventilation.
- Air conditioning and comfort cooling.
- Chilled water systems.

Effectively managing the use of energy within a building through the implementation of zone controls, that have been properly installed and commissioned, can result in up to 20% savings over systems without this level of control.

Did you know?
Reducing your thermostat set point by 1°C can reduce your heating bill by 8%

Department for Business, Energy & Industrial Strategy

Energy Technology List

Setting the scene – active chilled beams

Active chilled beams can be used anywhere where comfort cooling and fresh air supply is required. Furthermore they can be combined with other services including lighting and smoke alarms.

Definition

Active chilled beams are specifically designed to deliver chilled air into an environment in order to achieve comfortable working and living conditions. They are terminal units for heating, ventilation and air conditioning (HVAC) systems and require a simple low velocity primary air supply and chilled water connection.

Typically building spaces will use a variable air volume (VAV) system with a terminal fan coil unit (FCU) to supply cool air. These can often be energy intensive and costly to run.

Active chilled beams can be an attractive alternative to fan coil units, needing less energy to supply cool air to a space. Active chilled beams can therefore offer an energy cost saving of 20-25%.

Did you know?
Thanks to the convective cooling of an active chilled beam, no fans are required in the unit to move air. This makes them quieter than conventional cooling units.

Department for Business, Energy & Industrial Strategy

Energy Technology List

Setting the scene – close control air conditioning

Definition

Close control air conditioning units are typically used in rooms containing servers or other computer, electronic and telecoms related equipment; or where temperature sensitive industrial or laboratory processes are carried out.

Close control air conditioning equipment is designed to control the temperature in rooms and enclosures containing heat-generating equipment, or processes with high sensible heat loads. It also offers the option to control relative humidity.

Close control air conditioning is estimated to account for around 40% of all UK packaged air conditioning energy consumption and around 20% of the entire air conditioning sector.

Energy savings may be delivered by selecting more energy efficient close control air conditioning products. Manufacturers can make more energy efficient products by using more efficient components such as fans and fan motors, compressors, electronic expansion valves and larger heat exchangers, and by incorporating free cooling coils.

Department for Business, Energy & Industrial Strategy

Energy Technology List

Setting the scene

Assumptions

ETL listed HVAC equipment 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:

- HVAC operates continuously, 8,760 hours a year
- Price for electricity 11.14p/kWh
- Carbon emissions for electricity 0.35156 kgCO_2/kWh
- Price for gas is 2.59p/kWh
- Carbon emissions for gas is 0.18416 kgCO_2/kWh
- Boiler efficiency assumed to be 80% unless otherwise stated
- ETL listed products are presumed to be in the top 25% of energy efficient products available in the marketplace

Energy cost and emissions data from BEIS 2017

Department for Business, Energy & Industrial Strategy

Energy Technology List

Products eligible for the ETL:
building environment zone controls 1/3

Did you know?
Underfloor heating systems are able to provide more consistent and even heating across a space compared to traditional radiators. They can also provide heat to a larger area then an individual radiator, and could reduce heating bills.

Zone controls for heating/cooling systems are covered by the ETL

Temperature can also be controlled by automating window shading. These products use solar tracking sensors, to adjust internal or external window shades to minimise the need for cooling.

Heating/Cooling

ETL compliant heating/cooling controls can be used for both hydronic and electric heating systems as well as chilled water systems.

Systems are controlled by a temperature sensor and predefined temperature set-points. Further refinement to the controls can be given by activity and occupancy sensing or schedules.

Wet heating systems controls also incorporate frost protection, temporary override options, and “self adaptive weather compensation”.

Other features of ETL compliant products include optimum start. This activates the heating circuit at an early enough time in the morning to ensure that the zone air temperature reaches the desired set-point by the beginning of occupancy and not several hours earlier.

For the installation of electric underfloor heating zone controls where none previously existed within a typical 1,000m^2 naturally ventilated cellular office building, using 151kWh/m^2/year on heating, the potential annual savings at 20% are calculated as:

- £3,363
- 30.2 MWh of space heating
- 10.6 tonnes CO_2

With a typical capital cost of £5,500, lifetime energy and AIA benefits could be around £34,800 at today’s prices. With a potential AIA of approximately £1,050 plus additional energy savings in year 1, the extra capital cost is recovered in less than 2 years of purchase.

Department for Business, Energy & Industrial Strategy

Energy Technology List

Products eligible for the ETL:
building environment zone controls 2/3

Did you know?
ETL listed warm air and radiant heater systems are also available. More information can be found at: https://www.gov.uk/guidance/energy-technology-list

Zone controls for ventilation systems are covered by the ETL.

The same system controls for heating, cooling and ventilation can also be used to control lighting and electrical appliances to create a fully integrated system.

Ventilation

With improvements in building fabric insulation and levels of air-tightness (reduced air infiltration), the relative contribution that ventilation makes to a building's energy consumption is increasing.

The ventilation to a zone can be controlled by activity, occupancy or air condition sensors. This ensures appropriate airflow to a zone, as well as appropriate air quality. Unoccupied zones can be switched to a an economy or standby mode.

Some products have a "night cooling mode" to remove excess heat by natural ventilation when the intended zone is unoccupied.

For installation of ventilation zone controls where none previously existed within a typical 5,000m^2 air-conditioned office building, using 109kWh/m^2/ year electricity and 178kWh/m^2/kWh of gas for space heating and cooling, the potential annual savings at 20% are calculated as:

- £16,742
- 287 MWh of space heating/cooling
- 71.1 tonnes CO_2
- 1.7 year payback

With a typical capital cost of approximately £27,500*, lifetime energy and AIA benefits could be around £173,000 at today's prices. With a potential AIA of approximately £5,250 plus additional energy savings in year 1, the extra capital cost is recovered in less than 2 years of purchase.

*Twenty five units at £1,103 per unit in 2017

Department for Business, Energy & Industrial Strategy

Energy Technology List

Products eligible for the ETL:
building environment zone controls 3/3

Zone controls for comfort cooling and air conditioning are covered by the ETL.

Comfort cooling and air conditioning

There are a wide range of air conditioning and comfort cooling systems, including constant air volume systems, variable air volume systems (VAV), fan coils and heat pumps.
As with hydronic heating systems, zone controls can play an important role in ensuring that air conditioning and comfort cooling systems maintain desired internal conditions without wasting energy.

Did you know?
ETL listed air to air energy recovery systems are also available. More information can be found at: https://www.gov.uk/guidance/energy-technology-list

For the installation of cooling system zone controls where none previously existed within a typical 1,000m^2 air-conditioned office building, using 109kWh/m^2/year electricity for space cooling, the potential annual savings at 20% are calculated as:

- £2,427
- 21.8 MWh of space cooling
- 7.7 tonnes CO_2
- 1.8 year payback

With a typical capital cost of £4,400*, lifetime energy and AIA benefits could be around £25,200 at today's prices. With a potential AIA of approximately £800 plus additional energy savings in year 1, the extra capital cost is recovered in less than 2 years of purchase.

*Four units at £1,103 per unit in 2017

Department for Business, Energy & Industrial Strategy

Energy Technology List

Products eligible for the ETL: active chilled beams 1/1

Did you know?
Active chilled beams can have both lower operational costs and a longer lifetime than conventional space cooling systems

Active chilled beams are covered by the ETL.

Active chilled beams

Thanks to the use of convective dry cooling, there is no need for either fans within the unit, or for condensate collection. Hence, this system provides an energy efficient alternative to fan coil units with lower energy input and potentially reduced need for regular maintenance.

Eligible active chilled beam units may be of a linear or modular form and available in a range of sizes; and bulkhead active chilled beams are also available.

Multi-service chilled beams (MSCBs) which incorporate other building services (lighting, controls, cables, public address systems) within the unit may be eligible for the ETL, depending on whether the incorporated services are also compliant with their respective ETL criteria.

The potential annual savings of installing ETL compliant active chilled beams over traditional fan coil units, in a typical 1,000m^2 air-conditioned office building, using 109kWh/m^2/year electricity for space cooling, are calculated as:

- £2,676
- 23.5 MWh
- 8.3 tonnes CO_2

With a typical capital cost of £1,300 and lifetime energy and AIA benefits of around £26,600 at today's prices, the financial benefit of choosing an ETL listed product is over 20 times the additional cost. Furthermore with a potential AIA of approximately £250 in year 1 plus additional energy savings, the extra capital cost is recovered within the first year of purchase.

Average 21.6% energy saving using ACB over FCU

Department for Business, Energy & Industrial Strategy

Energy Technology List

Products eligible for the ETL: close control air conditioning 1/3

Direct expansion close control air conditioning equipment is covered by the ETL.

Direct expansion (DX)

Direct expansion close control air conditioning units use the expansion of a refrigerant vapour to provide cooling. The warm air to be cooled is simply passed directly over the refrigerant fins, before being returned to the space to be cooled.

This system has advantages in that the entire unit is self contained. This allows for easier and less costly installation as well as being able to be installed on a smaller footprint compared to other forms of air conditioning.

There are four types of direct expansion close control air conditioning equipment eligible for the ETL, which are:

- Air cooled without free cooling coil
- Air cooled with integral chilled water free cooling coils
- Water cooled without free cooling coil
- Water cooled with integral chilled water free cooling coils

For the installation of an ETL listed 60 kW DX air cooled close control air conditioning unit, the potential annual savings are calculated as:

- £9,188
- 82.5 MWh
- 29 tonnes CO_2

Comparing the installation of an ETL listed unit over a non-ETL listed unit, there is a typical additional capital cost of approximately £1,900* and lifetime energy and AIA benefits of around £8,600 at today's prices, meaning the financial benefit of choosing an ETL listed product over a non-listed one is over 4 times the additional cost. Furthermore with a potential AIA of approximately £2,700 in year 1 plus additional energy savings, the extra capital cost of an ETL listed unit is recovered within 1 year of purchase.

*Assumed unit costs of ETL/non-ETL compliant units are £14,262 & £12,402 respectively with 12 year lifetime

Department for Business, Energy & Industrial Strategy

Products eligible for the ETL:
close control air conditioning 2/3

Energy Technology List

© Stulz

Chilled water close control air conditioning equipment is covered by the ETL.

Chilled water (CHW)

Chilled water close control air conditioning equipment can be an efficient and popular option for large installations, and spaces with a high cooling demand.

CHW systems rely on a chiller unit which reduces the temperature of water before it is piped around to where it is needed within a building. This system works well in comparison to traditional air conditioning thanks to the non-corrosive, non-toxic nature of water.

For the installation of an ETL listed 80kW chilled water close control air conditioning unit, the potential annual savings are calculated as:

- £4.341
- 39 MWh
- 13.7 tonnes CO_2

Comparing the installation of an ETL listed unit over a non-ETL listed unit, there is a typical additional capital cost of £835* and lifetime energy and AIA benefits of around £14,200 at today's prices, meaning the financial benefit of choosing an ETL listed product over a non-listed one is over 16 times the additional cost. Furthermore with a potential AIA of approximately £1,500 in year 1 plus additional energy savings, the extra capital cost of an ETL listed unit is recovered within 1 year of purchase.

*Assumed unit costs of ETL/non-ETL compliant units are £8,074 and £7,239 respectively with 12 year lifetime

Department for Business, Energy & Industrial Strategy

Energy Technology List

Products eligible for the ETL:
close control air conditioning 3/3

Dual mode close control air conditioning equipment is covered by the ETL.

The potential for continuous, no-downtime operation over many years makes these systems ideal for use in the IT sector and for hospitals.

Dual mode

Dual mode close control air conditioning is able to take advantage of both a direct expansion (DX) and chilled water (CHW) system. This means that it is able to operate in the most efficient mode depending on the cooling demand required.

These systems can be useful for cooling in highly controlled environments where backup is required in case of one cooling system failing, or to manage spikes in cooling demand.

There are two types of dual mode close control air conditioning equipment eligible for the ETL, these include:

- Air cooled and chilled water cooled
- Water cooled and chilled water cooled

Department for Business, Energy & Industrial Strategy

Energy Technology List

Products eligible for the ETL: evaporative air coolers 1/1

Evaporative air coolers are covered by the ETL.

Evaporative coolers are quieter, less costly to purchase and cheaper to run than traditional air conditioning systems.

Evaporative air coolers

An evaporative air cooler is a device that cools air through the evaporation of water. They are available with a wide variety of efficiencies. The ETL aims to encourage the purchase of direct evaporative air coolers and higher efficiency indirect evaporative air coolers.

Evaporative cooling is used for commercial and industrial cooling as an alternative to refrigeration based cooling and is increasingly popular in data centres. Substantial energy savings are achieved because there is less power requirement involved in evaporative cooling systems compared to refrigeration-based ones.

This form of cooling offers other advantages over traditional air conditioning thanks to the fact it doesn't rely on any harsh chemical coolants, needs no heat rejection duct, consumes relatively little power, operates more quietly, and does not lead to the dry, refrigerated air often associated with air conditioning. However it does consume a continued source of water to operate.

There are two types of evaporative air cooler eligible for the ETL:

- Direct – primary air supply is cooled by evaporation. This can lead to high humidity levels in the cooled air produced.
- Indirect – a secondary air supply is cooled via a heat exchanger from the initially cooled primary air supply.

- Direct evaporative coolers can achieve energy and carbon savings of up to 80% compared to air conditioning.
- Indirect evaporative coolers can achieve energy and carbon savings in data centre applications of around 75% compared to a chilled water cooling system with 100% recirculation and around 50% compared to a direct free cooling system.

Department for Business, Energy & Industrial Strategy

Energy Technology List

Refrigerant gases and the F-Gas regulation 1/2

Refrigerant gases used in cooling and heating products are more harmful to the environment than CO_2. But that is changing…

Refrigerant gases

The refrigerant gas R404a has 3,922 times more global warming impact than CO_2, i.e. 1 tonne of R404a emitted into the atmosphere is equivalent to emitting 3,922 tonnes of CO_2.

The European Commission considered the environmental impact of refrigerant gases to be so significant to the EU's climate goals that they introduced a phased withdrawal of many existing refrigerants from the market.

The Fluorinated Gases (F-Gas) regulation came into effect in 2015 and since then has affected the production and supply of refrigerant gases onto the EU market.

The regulation was intended to have an initial gentle impact on the market for refrigerated gases.

Refrigerant gas	Global Warming Potential
R404a	3922
R32	675
R1234ze	6
R290	3
CO_2 (R744)	1

Department for Business, Energy & Industrial Strategy

Energy Technology List

Refrigerant gases and the F-Gas regulation

The F-Gas regulation phase down is related to the relative GWP impact of the refrigerant. The market will remove refrigerant gases with higher GWP's first.

The EU F-gas regulation controls the total global warming potential impact of refrigerants being sold in the EU market.

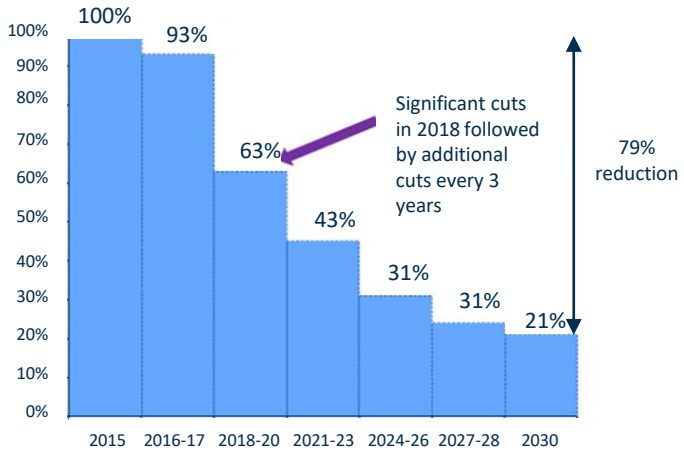
Refrigerant gases

Since 1st January 2018 the F-Gas regulation has had a substantial impact on the market. It requires a 37% reduction in the global warming impact (GWP) of refrigerant gases sold in the EU. The reduction is being met through the removal from sale of refrigerants with high GWPs such as R404A and R134a.

When choosing new refrigeration equipment, select a product that uses a refrigerant with a medium or low GWP (e.g. R32, R290, R744).

Choosing a product that uses a low GWP refrigerant future-proofs the investment. It reduces ongoing maintenance costs as prices for high GWP refrigerants are increasing rapidly (e.g. 800% in 2017).

It also avoids the need to refurbish the equipment at a later date to use a lower GWP gas, once higher refrigerant gases are removed from the market.



Department for Business, Energy & Industrial Strategy

Energy Technology List

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