

A2 LEVEL

Environmental Technology

Waste to Energy Technologies

For first teaching from September 2014

For first award in Summer 2015



environmental
technology

Waste to Energy Technologies



Specification Content

Students should be able to:

- describe the concept of embodied energy;
- discuss the advantages and disadvantages of recovering energy from waste (incineration);



Course Content

When we consider the energy associated with a material or product we tend to think of the chemical energy contained within the material or product itself which can be turned into heat energy if the material is combusted. However, the energy associated with a material can be regarded as encompassing a whole range of processes from the manufacture of the product or system through its transport to place of use and in its use for the particular application. Embodied energy is the name given to the collective sum of all the energy required to produce any material, product or service. It must be stressed that it is not the chemical energy stored within the material. For example, a brick used in construction will have gone through a number of processes from its initial manufacture through to its use such as;

- Extraction of the base material required to make the brick;
- Transport to the place of manufacture;
- Process involved in the manufacture of the brick;
- Transport to the building site; and
- Energy used in putting the brick into place in the particular application.



Further consideration could also be given to the energy required to make the equipment and materials used to manufacture the brick. Each can claim to have ownership of a proportion of the embodied energy in the brick. For certain other materials during their disposal could also require the use of energy which must also be taken



into account. So it is as if the energy associated with a material or product throughout its life cycle has an impact on its value in regard to its true “energy saving” or “environmentally friendly” rating. The material itself might appear energy efficient but the processes involved in its inception and use may actually have greater energy implications.

The measurement of the embodied energy in any object can be done in a variety of ways such as;

- Cradle to Grave – energy used from the extraction of raw materials through to the stage where the product reaches the end of its useful life.
- Cradle to Gate – energy used from the extraction stage through to the product reaching the factory gate.
- Cradle to Site – energy used from the extraction stage through to the point of use of the product.

There are many sources where information on the perceived embodied energy of a range of materials can be observed and compared e.g. www.greenspec.co.uk/embodied-energy.php



Pupil Activity

Use the link above to provide a list of the embodied energies of a range of typical building materials. Which materials have the highest values and which the lowest? Does this have any implications for building design?

Incineration

Incineration is the process whereby organic waste is treated by combustion and converted into ash, gases released and heat. The ash is mostly formed by inorganic deposits in the original material, the released gases must be carefully filtered and cleaned before release in to the atmosphere and the heat could either be used directly or to produce electricity. Commercial waste incineration provides some advantages;



- electricity and heat can be generated from sources which can act as a substitute for power plants powered by fossil fuels such as coal, oil or gas;
- developments in incinerator technology have reduced significantly the emission of harmful gases from incinerator plants;
- their use reduces the need for landfill sites which are becoming increasingly difficult to locate, particularly in densely populated areas; and
- incineration reduces the emission of methane and carbon dioxide into the atmosphere which might occur if alternative methods of waste disposal are being used.

Some disadvantages are;

- there is still concern over emissions from incinerators despite the technological developments mentioned above;
- the ash residues must be disposed of which can be problematic as it may in some cases be toxic;
- local communities are generally opposed to the location of incinerator installations in populated areas; and
- some reports suggest that the overall costs of incineration are greater than some of the alternatives to combustion of waste e.g. biological treatments such as anaerobic digestion.

