

IEA ECBCS Annex 36: Retrofitting in Educational Buildings –
Energy Concept Adviser for Technical Retrofit Measures

SUBTASK A

Overview of Retrofitting Measures



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Retrofitting in Educational Buildings
Energy Concept Advisor for Technical Retrofit Measures

Chapter 3

Heating systems

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Table of contents	
3.1. Introduction	39
3.2. Heating installations	49
3.3. Domestic hot water installations	65
3.4. Energy sources	71
3.5. Control systems	73
References	79

3.4. Energy sources and Generation system

It is necessary to differentiate between conventional energy based on fossil fuels and renewable energy sources. The heat generation can take place in both cases by means of heat exchange, i.e. transfer of energy due to temperature differences or by conversion from energy to heat, e.g. by means of combustion.

3.4.1. Conventional energy

Heat generation through heat transfer

Heat generation by heat transfer takes place decentral, i.e. the actual heat generation takes place in power plants. Coal, oil or gas are burned as fuels. So-called cogeneration generate power and hot water for local heat supply systems.

- **district heat**
- **local heat**
- **electric power**

Heat generation through conversion

By heat generation through conversion we understand a heat generation, which is generated in boilers (with hot water storage), block type thermal power plants or other e.g. thermal-chemical processes of transformation in fuel cells.

- **fossil fuel (oil, gas, coal, solid fuel)**
- **block-type thermal power plants**
- **fuel cell**

3.4.2. Renewable energy

Renewable kinds of energy are all forms of energy, which are available in nature eternally. Also in the case of renewable energy heat can be produced through heat transfer or through energy conversion:

Heat generation through heat transfer

Heat energy is produced with the use of solar power by heat transfer. The solar radiation is absorbed in the solar heat collector, converted into heat and used to heat up a heat distribution medium, usually water.

For the generation of heat, hydronic solar panels, with a temperature range up to 70°C are used. Vacuum tube collectors (heat pipes) are suitable for the production of process heat with temperatures beyond 70°C.

The solar heat is usually not available at the time of demand when heat is needed. Therefore solar systems are always combined with storage systems.

Differences are short time storage, i.e. storage of the demand of approx. 1-3 days and long-term storage or even inter-seasonal heat storage, which stores the heat from summer months for the demand of winter months.

In schools solar technology is usually used only for the generation of domestic hot water.

- **solar heat**
- **hydronic solar panel**
- **vacuum hydronic solar panel**
- **glas pipe collector**
- **heat pipe**

Apart from solar energy there are further renewable energy sources, which can be used for heat transfer. However economic use depends strongly on local conditions. Geothermal energy belongs to this group. Probes reach a depth of 300m. The water warmed up in this way can be heated additionally by means of a heat pump. Water from boreholes or watercourses can also be used with a heat pump for heating or as a free source of cooling.

- **geothermal heat**
- **heat form bore holes or watercourses**

Renewable sources of electrical power are photovoltaic panels, water turbines and wind generators. These all depend on local weather conditions.

- **solar generated electric power (PV)**
- **water and wind power**

Heat generation through conversion

As in the case of fossil fuels heat can be generated also by combustion of renewable materials. These are either in form of fermentation gas or liquid renewable fuel. Vegetable oil can also be used for combustion. Wood, in the form of wood chips or in form of pellets can be burnt CO₂ neutrally.

- **Renewable oil or gas fuels**
- **wood chips**
- **wood pellets**

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