3.4. Heating systems

If the breakdown of energy consumption by end use in EU residential and commercial buildings (figure 4.1, 4.2) is analyzed, it can be observed that about 52 – 57% of total energy consumption for space heating and about 9 – 25% of total energy consumption for water heating are necessary.

The similar values are observed in Bulgaria and Romania. So for a medium flat built in Bucharest in the period 1970 – 1985 the breakdown of energy consumption by end use is presented in figure 4.3 and shows that more than 70% of total energy consumption is needed for space heating and water heating.

Figure 4.1: Breakdown of energy consumption by end use in EU residential buildings

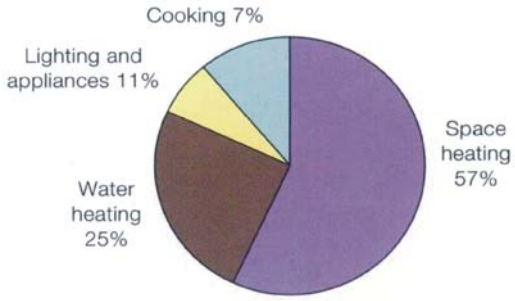
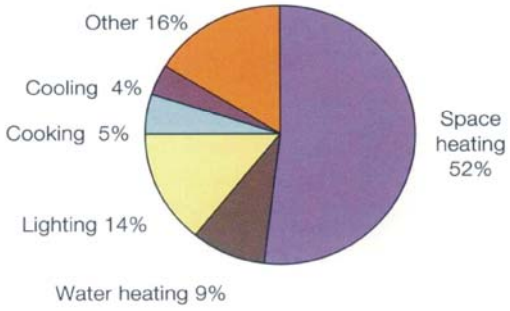


Figure 4.2: Breakdown of energy consumption by end use in EU commercial buildings



The increase of energy efficiency of the building has major significance because it contributes to ensure a normal comfort without an important increase of the expenditure for energy. So the decreasing energy consumption for heating depends on the design solution of the buildings and the heating systems, and the technical characteristic of the materials and equipment used.

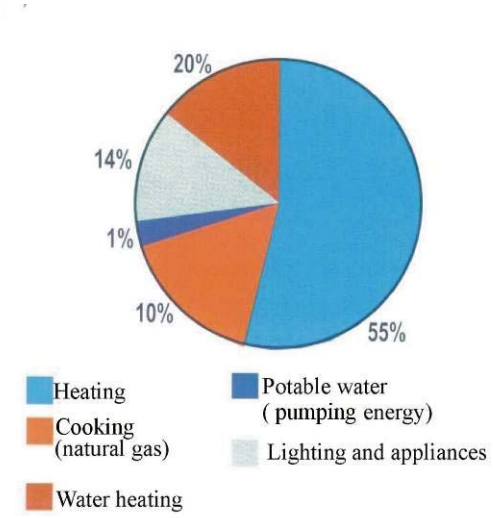


Figure 4.3 : Annual energetic balance of medium flat in Bucharest

The technological solutions and specific building envelope materials / components highlighted as potential targets for better promotion and support can be even more effective items for energy saving, if considered as integrated parts of a whole project or planning activity, e.g. one that considers wider settlements and urban areas. In addition, combining energy saving approaches with the integration of renewable energy sources into buildings can maximize the reduction both of building energy consumption

and of its environmental effects.

Evaluation of individual technologies requires a global perspective. This can help facilitate the environmental integration of a building into a city, for instance. It can also ensure that advantage is taken of a site's climatic situation in order to optimize indoor and outdoor conditions and therefore reduce the energy required for heating and cooling.

Although some concepts (e.g. extrainsulated houses and zero energy approaches) are showing results in terms of increased comfort, the principles of sustainable development also compel these involved in building construction to take into account social-economic factors and to undertake each of the following, to the fullest possible extent:

- Understand the local climate and its influence on the building;
- Influence building design to ensure appropriate use of solar energy;
- Bear energy demand in mind when choosing construction materials;
- Upgrade building standards and construction practices to avoid unwanted energy losses;
- Select innovative and efficient technologies on both the energy supply and energy demand side;
- Stress the importance of low maintenance materials which are conducive to human health;
- Acknowledge the principles of low embodied energy and lifecycle utilizing appropriate materials during the construction process.

Heating systems are the provisions of heat for heat distribution and hot water systems in buildings. Converting chemical energy from external sources into heat or transferring heat from an external source to the area where it is required can carry out this provision of heat.

Heating of the buildings can be achieved with the following elements:

- Stores which convert the chemical energy of a fuel (coal, natural gas, oil, wood) into heat;
- Boilers which convert the chemical energy of a fuel or the electricity into heat by combustion and transfers the released heat to the heat distribution system of a building;
- Heat pumps which absorb heat at a low temperature level from an external heat source and deliver it at a higher temperature to the heating system of a building;
- Combined heat and power (CHP) plant, which ensures the production of both heat and power from a single source; heat can be used to supply district heating systems;

- Various technologies for domestic hot water which are functions of standard of living, as well as building size and occupancy and the type and number of uses.

3.4.1. Improvement of heating systems through better preliminary planning

When designing a building, it is necessary to consider some restrictions if owners wish in winter to be warm and in summer to be cool, avoiding the suffocating air.

For these reasons, the engineers and architects should choose the solutions which ensure higher thermal resistance and energy saving.

Following this at the urban development level it is important to study the orientation of facades, the inclination of roofs, the conception of the houses of the adjoining and stacked dwellings. It is important to use facades and pitched roofs facing south.

At the dwelling level it is important to study the orientation of the living rooms and the windows, the sizing of the windows, the use of gallery, loggia or balcony enclosed by single or double glazing, the sun lounges etc.

The windows can strongly influence a building's overall energy performance. Their distribution, area and quality affect solar gains and heat losses. In the EU, about 25 – 30% of space heating energy consumption result from presence of windows. Improvement of window energy performance is therefore of great importance and must be combined with care in building design to avoid overheating risks.

3.4.2. Improvement of heating systems at dwelling level

The heating system can be improved in the design process by decreasing at minimum the pipe length and by using technological devices, which ensure the high efficiency in operation and in maintenance.

Some of the possible measures for improvement of heating system are the following:

- The use of new boilers with high efficiency and reduction of NO_x and particulate emission;
- The incorporation of condensation and low temperature technology to increase efficiency;
- The use of thermostatically controlled taps on radiators;
- The use of the new types of radiators;
- The use of high efficiency central – heating / hot water system (efficiency at full capacity > 90% for space heating);
- The use of separate energy consumption meters for heating and hot water;
- The use of cost – effective high efficiency devices, e.g. gas water heaters with condensed flue operation, superinsulated electric water heaters with

low stand-by losses, low-flow showerheads and hot/cold water mixer – taps;

- The achievement of normal maintenance of the devices;
- The educational programmes for economical use.

3.4.3. Improvement of district heating systems

At district level, heating systems should improve the operation of the combined heat and power plant or thermal plant and of large installations, which ensure the transport and the distribution of the heat. The prices paid by users should cover all costs (investment, maintenance, and operation).

The dimension of the district heating systems should be established in the following conditions:

- The knowledge of thermal consumption of the consumers in long term;
- The location of the consumer;
- The disposable fuels;
- The environmental requirement;
- The local condition.

In case of district heating from thermal power plant located in the district it is possible to improve the system by assembling of the device for domestic hot water at the consumer level. If the heating supply is achieved through thermal points it is possible to improve the system by elimination of thermal points (as points of transformation for the parameters of thermal agent) and by assembling of the device for domestic hot water at the consumer level. In this case, it is very important to achieve the energetic decentralized administration taking into consideration real consumption measured at consumers, which indicates the quality of the service.