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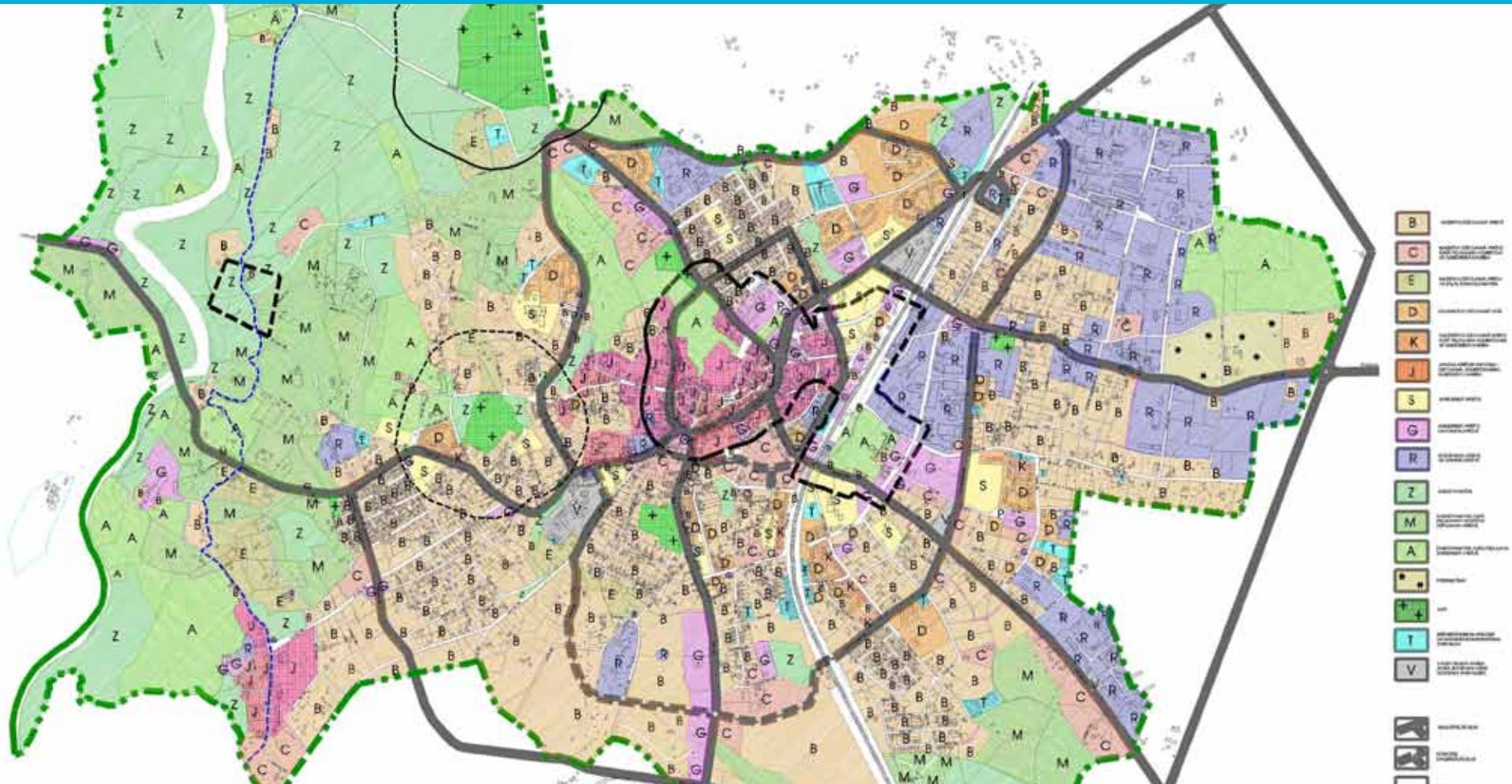


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# PRINCIPLES OF ENERGY EFFICIENT PLANNING

GET READY



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Today new buildings can be designed and built in resource efficient way including very low energy standards. However, such practices are rarely applied in municipal and private buildings in Central and Eastern European countries. This has several aspects:

- 1** Information about the main advantages of living in a house, which consumes less energy, therefore their demand for better quality, resource saving materials and possible construction methods is low.
- 2** The existing national standards do not promote energy saving measures for new buildings. But the requirements of the new EU building regulations are promising and in a long term will improve the situation in the Central and Eastern European Countries.
- 3** Due to the low demand, there is a lack of practical experience of construction business in building energy efficient houses.
- 4** Planning the building in an energy efficient way in a long term can enable you to save a lot of energy. It is useful for the environment and last but not least it saves you some money!

If you plan to build up a house by yourself this brochure will help you to go through the most important aspects.

# BACKGROUND INFORMATION

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## First phase – concept

Step1: Think through your real needs and the priorities of your future house and look for a good planner (architect) who will help you to put these into practice!

**Resource efficient planning** is the basis of low energy and water consumption (one possible option is the collection and reuse of rainwater). If you have a clear idea about your needs you can plan your house really in details. You can determine how many bedrooms, bathrooms you need, whether you need any special rooms (e.g for working) and how big these rooms should be, what is the need of your family in 10 - 20 years etc..

After thinking through your expectations you should also check the local/national legal frame for building your house. Before buying a site for the building it is important to get information about the building regulations applied to the site. Maybe you are not allowed to build a two- three-storeys house, or there is a restriction on the basic area of the building or on the orientation etc.

When you know the conditions for your house you should find a good planner who can plan the house according to the principles of energy efficient construction.

## Second phase – technical elements

### Step 2: “Passive elements” of energy efficient planning of new houses

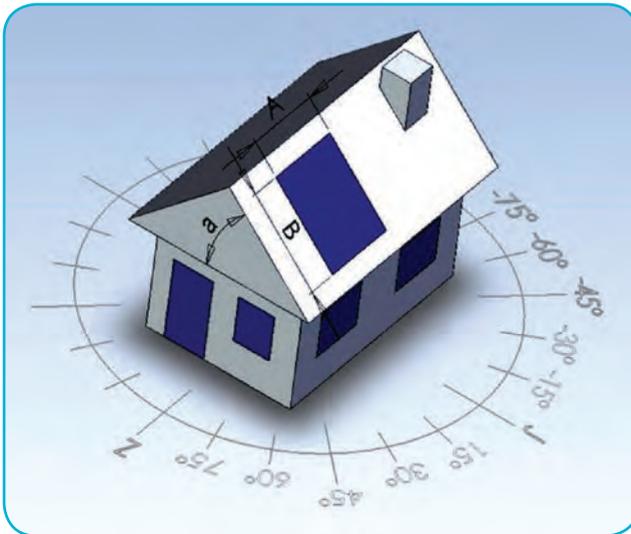
There are many technical issues of planning an energy efficient building. Passive architecture has the great advantage in that it requires no external energy source and therefore has neither a running cost nor does it contribute to environmental pollution. Such features can enhance the visual appearance of a building and will help to preserve its fabric. Passive elements could be considered the best when designing a new building.

Below you can find the main aspects of passive architecture which could help you a lot in planning your own house.

#### Orientation of the building

First of all, the good orientation of the building can save energy. The most important questions are the quantity, orientation and proportion

of the glazed surface. The huge glass surface on the southern side of the building increases the heat absorbing capacity of the building during the winter seasons. Try to avoid big window surface to the north as from an insulation point of view even the best window is worse than the wall.



## Shape of the building

It is important to think about the shape of the building during the planning period. It is better to have a compact shape indeed of an incompact. For example an L-shaped house consumes more energy than a cubic because of their wall surface size. It means the heat loss is also bigger.

## Main material of the walls

It is important to take into account the heat absorbing and storing capacity of the materials. For example bricks absorb the solar heat better and store it for a longer time than wood.

## Shading, trees around the house

The main objective of shading is to reduce the solar radiation. The usage of shading could be important mainly on warmer climate and in summer seasons. Suitable shading can provide good indoor climate control thereby avoiding air conditioning system during the summer whilst heating during the winter.

The followings are the most common options.

- deciduous trees – leaves provide shade during the summer but fall down in the autumn
- shutters which are preferably mounted outside the window; they are shading during the summer but let the sunshine in during the winter;
- external horizontal surface – mounted above the window to cut off direct solar rays;
- solar panels, flat or tubular, can be used to shade facades or terraces
- the roof – when exceeding the building with 60 cm or more to give shadow on the walls and windows.

## Step 3.: “Active elements” of energy efficient planning of new houses

The term of “active elements” means the building materials, the heating system, the ventilation and air-conditioning system if there is any.

### Building materials

The selection of the proper building materials is a key step. A good planner will make the energy certification calculations properly during the planning phase. It helps to understand which characteristics of the different materials are important for a new house.

#### Walls

As we already mentioned above the materials of the walls determine the heat absorbing and storing capacity of the walls. From this point of view modern, energy efficient bricks seem to be the best option. The type and thickness should be determined by your architect.

#### Windows

Glass is not insulating well. The heat is lost through the windows unless the window is properly insulated. Nowadays the minimum requirement is to have a double pane of glass with the space between either evacuated or filled with an inert gas. Nowadays two-panes-glazed windows have a U value of around 1.1 -1.4 W/m<sup>2</sup>K. (Old windows' U value is around 2.8-3.0 Wm<sup>2</sup>K.) Modern triple-

#### Info box

From the energy efficiency point of view the best known indicator for describe the material is the U-value. It is the heat transmission coefficient (thermal transmittance) of a structure, describing the heat flow through a building element in Watt per square meter at a temperature difference of one degree. (K) Unit: W/m<sup>2</sup>K . The higher the value the lower its thermal resistance and therefore the more heat/energy pass through the element.

glazed windows are getting more and more distributed in all countries. (U values around 0.6-0.8 W/m<sup>2</sup>K.)

### Insulation

According to the current practice insulation of walls (from outside), floor and roof is inevitable. Thickness is depends on the materials but as a general value we could say that 15-20cm insulation on the walls, 10-15 cm under the floors and 30-40 cm on the roof satisfies the needs of resource efficient buildings.

### Heating system

Heat energy can be produced in various ways of which those using non-renewable sources have the highest environmental impact and those using renewable sources have a low or negligible impact.

You can use individual heating in your house (central heating) or you can join a district heating system if there is any. A modern district heating system can be a more sustainable option.

Nowadays central heating is more general in family houses. This consists of a boiler which heats water by combustion. The distributing pipes and the radiators are transferring the heat into the rooms.

The most common heating source is natural gas which is burned in the boiler but similarly, oil, coal, wood or other types of gases or even biomass may be used in other types of boilers which burns the fuel and heats the water in a similar way.

The decision on the fuel depends on its availability, the cost and the limiting factor of climate change. Using renewable sources is more desirable. If you choose fossil fuel the best option is natural gas which has the lowest impact on the environment.

Another very important aspect is to consider the efficiency of the boiler. It is highly advisable to choose a condensing boiler. These models have efficiency around 90%, while older gas boilers have efficiency around 50-60%. This means that condensing boilers make much more heat from the same amount of fuel for the same price!

From a planning point of view it is important that you should be able to regulate the temperature by rooms (thermostatic valves).

### Ventilation and air conditioning

From a sustainability point of view using natural ventilation and avoiding air conditioning is the best option as this does not require electricity use.



**Fig. 1.** Example of usage of heat pumps  
Source: [www.rec.org](http://www.rec.org)

An important feature of traditional architecture is to use natural ventilation; that is allowing air to flow from a north to south facing window

or east to west during the summer. This air flow, which can be assisted by a fan, enables the dwelling to be cooled by the transfer of air from the cooler to the hotter side of a building. Potential depends upon dwelling orientation and position and size of windows. Opening windows on opposite sides of a room will induce natural ventilation.

Too much solar gain could be avoided by using passive architecture elements, see them above.

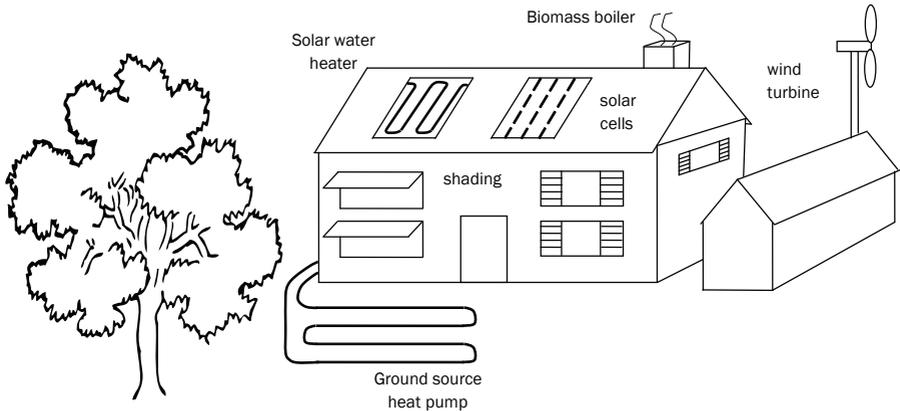
If the building characteristic requires mechanical ventilation you should consult with an expert in order to install the proper, most efficient system into your house.

## Renewables

When planning a resource efficient building it is essential to analyze the possibility of using renewable energy sources. The following options should be examined:

- solar panels for making hot water;
- solar cells for making electricity;
- biomass or biogas for heating;
- heat pumps for heating;
- small wind turbine for making electricity.

Before deciding on these option you should definitely consult with an expert becasues this question has a lot of technical, financial, economic and regulation aspects.



**Fig. 2.** Example of the usage of renewable energy sources at homes.  
Source: Application of small scale renewable energy sources to the home to prevent climate Change [www.kyotoinhome.info](http://www.kyotoinhome.info) p.64,2006

## Third phase – monitoring

### Step 4.: Monitor your energy consumption and adjust the system if needed.

If you managed to plan and build a resource efficient house it is really important to regularly monitor the energy and water consumption. Depending on the systems you installed, smaller or bigger fine tunings of the system would need.

Therefore we recommend you to monitor your energy and water consumption. Regularly check your electricity, gas and water meter and keep a diary per month / per year. If you use any other resource (e.g. biomass) you should add this all up. After the first whole year you can compare this to the calculations made during the planning phase. It is useful to discuss the results with the planner.

Calculators are available on the internet. You can calculate the carbon footprint of your house.

# THE CHECKLIST

With this simple table you can check the main characteristics of a resource efficient building. This shows the main points you should be aware when start planning your new house! Just tick YES or NO after the statements.

		Aspect	YES	NO
"Passive elements"		The approximate basic area per inhabitant is around 30 square metres		
		Major window surfaces are oriented to the south		
		There is no big window surface to the north		
		The shape of the building is rather regular than irregular		
		There aren't any evergreens in front of the windows to the south		
		The roof is exceeding the building with at least 50 cm		
"Active elements"	Building materials	Good heat absorbing and storing capacity of the walls		
		The windows triple glazed with an U-value of at least 0.8 W/m <sup>2</sup> K		
		The outside walls have an insulation of at least 15 cm		
		Insulation of floor plates is at least 10 cm		
		Roof insulation is at least 30 cm		
	Heat-ing system	The boiler is fueled with biomass or with natural gas		
		Condensing boiler is installed		
		Thermostatic valves are installed, the temperature can be regulated room by room		
	Renewables & rainwater	<b>At least one of the following renewable option is applied:</b>		
		solar panels for making hot water;		
solar cells for making electricity;				
biomass or biogas for heating;				
heat pumps for heating;				
small wind turbine for making electricity				
Rainwater is collected and reused				

If your result is:

### 13-16 YES:

Congratulations! You helped a lot in saving the environment and in a long term you will save a lot of energy and money! Enjoy your house!

### 7-12 YES:

You made a good planning. To make the building more resource efficient please, consult with your planner!

### 0-6 YES:

Your plan should be revised. Please, reconsider the options with your planner.

For your notes