

### New approaches and achievements in sustainable construction. Synthesis

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#### Summary

*The climatic changes, the reduction of the energetic dependency and the increasing price of the fossil fuels are acting together requiring important changes in civil engineering.*

*The article is presenting a documentary synthesis concerning some new approaches and achievements in sustainable construction, considering the interest for civil engineers and architects.*

**KEYWORDS:** sustainable construction, climate change, energy consumption, civil buildings.

#### 1. INTRODUCTION

Climate changes will have serious impacts on the planet's life conditions but the modifications are difficult to predict in detail.

The effects could be catastrophic: increase in temperatures, droughts and floods affecting the health and lives of millions of people and causing the loss of several species of flora and fauna. A rise in sea levels will threaten the existence of regions where millions of people live and will delete from the map some of the most beautiful sites in the world.

By reducing global greenhouse gas emissions as of today and in the longer term, we can and must avoid the worse effects of climate change. It is the major environmental challenge of the 21st century.

#### 2. THE CERTIFICATES CONCERNING ENERGY SAVING

The certificates concerning the energy saving shows the diminishing of final energy use, so that to contribute to the decrease of fossil fuels consumption and to the diminution of GHGs emissions. The objective established by the European



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Union is that until 2050, these emissions will be 4...5 times decreased in order to limit the climatic changes.

Also, this will contribute to reach the aim of saving the energy, and so on as the raised prices of fuels, heat and electricity. With their help, "the deposits" neglected by final energy saving of different construction, transport, trade and industrial consumers will be turned to good account.

The use of thermal and electric energy in residential and social buildings is far away of being optimized. The means for touching this aim exists but are not utilised in sufficient measure because of the habitudes established through one century of cheap energy.

The energy savings from fossils sources is concordantly with the environment protection and with the decrease of maintenance expenses.

Given as examples /1/:

- home equipments, fridges and new washers from A and B classes, consumes with approx. 30...50% less energy than those time-worn;
- the use of termopan windows combined with curtains and the attenuation of outline thermal bridges diminish the losses of heat from houses with across 7%, the replacing of one old heating station with a new one with condensation and a distribution thermal protected permits savings of more than 15%, the supplementation of thermal insulation of the walls contribute with 10...15%, and the installation of a programmable thermostat with another 7%. An individual solar collector reduces with 50% the heat necessary for preparing the warm water.

The occidental press pointed out the population preoccupation for climatic modifications. In Europe this is considered the principal present-day problem.

### 3. NEW STRATEGIC REPORT „CLIMATE – ENERGY”

On January 24, 2006 within the framework of European Union has been published a strategic report concerning the use of coal and the implications concerning the climate and the energy. The report /2/ emphasis that:

- the coal reserves represent 63.7% from total resources of fossils fuels, towards 18.2% oil and 18.1% natural gases. The biggest coal reserves are in USA (27% from the total), followed by Russia (17%), China (13%), India (10%), Australia (9%) and South America (5%);
- the weight of the coal in the world production of electricity is of 40%, and in the production of steel of 70%;



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- two thirds from the world consumption are fated of electricity production, and 90% from the growth of coal consumption is bound currently by the production of electricity;
- the coal is the strongest emissions of CO<sub>2</sub> provider, through the sequestration of CO<sub>2</sub> it can be obtained decreases of 80 – 90% of the emissions due the production of electricity.

The report presents previsions concerning the production of electricity and the emissions of CO<sub>2</sub> accordingly, having as horizons the years 2030 and 2050, based on two scenarios of technological evolution, in report with a reference scenario. Those two scenarios examine the impact of the most efficient procedures of coal burning in the electricity producer stations.

Compliant to the reference scenario, the world CO<sub>2</sub> emissions will grow with 56% in 2003 - 2030, and those connected with electricity production shall be tripled within 2050.

The main conclusion of the report is that the resort to coal reserves is not reconcilable with the mitigation of the greenhouse effect only in the conditions of a major technological jump for sequestration to which permit the decrease of CO<sub>2</sub> emissions. The European Union, beside other big world countries, will make the necessary efforts concerning the research area, and the mechanisms and regulation examination able to permit the realization of some competitive and efficacious coal stations.

#### 4. GERMANY AND SWITZERLAND

The meaning of the term 'low-energy house' has changed over time, and will certainly change in the future.

In Germany a Low Energy House (*Niedrigenergiehaus*) has a limit equivalent to 7 litres of heating oil for each square meter of room *for space heating* annually (50 kWh/m<sup>2</sup>a). In Switzerland the term is used in connection with the *MINERGIE*® standard (42 kWh/m<sup>2</sup>a).

The *MINERGIE* standard has been widely accepted in Switzerland. Today, more than 1500 buildings in Switzerland comply with it without legal enforcement. Also, more than 1000 dwellings have been built according to the Passive House standard in Germany and Austria /3/. In Switzerland, the Passive House standard just begins to spread. *MINERGIE* and Passive House standard differ in their methods. However, both aim to realize comfortable and economically attractive buildings with very low energy requirements and to assure the quality of such buildings (figure 1).



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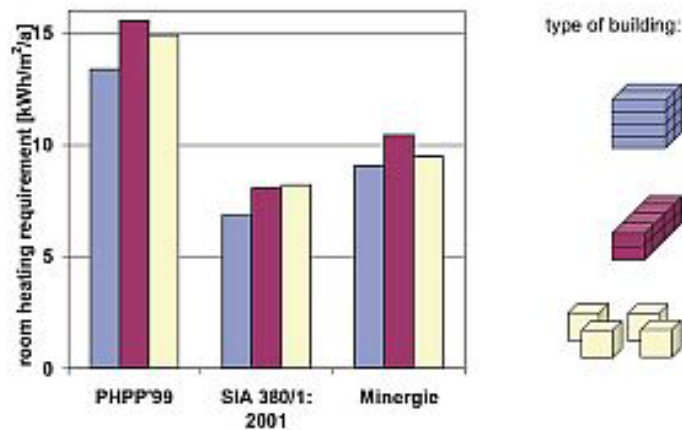


Fig. 1 – Room heating energy requirement calculated according to the methods used by the Passive House standard (PHPP'99), by Swiss code SIA 380/1 and by SIA/MINERGIE for the reference buildings (same net area, different geometry). The results differ because different reference floor areas are used, and because of differences in boundary conditions and standard values. (source: [www.empa.ch](http://www.empa.ch))

Low-energy buildings typically use high levels of insulation, energy efficient windows, low levels of air infiltration and heat recovery ventilation. They may also use passive solar building design techniques or active solar technologies.

## 5. FRANCE

France supports the objective of two-fold diminution of the world emissions of GHGs until 2020. It is often said: „Faisons vite, ça chauffe!”

For the building sector, the following measures /4/ are proposed:

- in the cold season, an average temperature of 19 °C should be assured in all rooms, except the ones from sanitary sector or for old people and small children. The rooms vacant for more than 24 hours or 48 hours should be warmed at 16 °C and 8 °C, respectively;
- in the warm season, the passive cooling techniques should be preferable. If air-conditioning installation are used, their energy use should be at moderate level, and the indoor/outdoor difference of temperature should be bellow 6 °C;
- before authorizing the building modernization works, a preliminary study must be made regarding the possibility of renewable energy use.



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The Climate Plan is an action plan drawn up by the French Government to respond to the climate change challenge, firstly by 2010 (complying with the Kyoto Protocol target), and, secondly, beyond this date.

The government has devised certain forms of action concerning direct emissions: these constitute 23% of the Climate plan's efforts and are directed at both new and existing homes. Indirect emissions are incorporated into the Climate Plan's energy section. The following initiatives /5/ have been devised:

- fiscal measures, such as the improved tax credit for efficient appliances, increased to a maximum of 25% and 40% for appliances using renewable energy, a market that is enjoying growing success;
- an energy efficiency diagnosis, incorporating the building energy label, will be compulsory as of 2006 to identify potential energy savings;
- heating regulations, created for the first time, concerning the most substantial renovations on all existing buildings.

## 6. CONCLUSIONS

Climate changes have already had and will continue to have impacts on human life, ecosystems and the economy of all countries. The costs associated with global warming will be colossal.

A decrease in greenhouse gas emissions well in excess of Kyoto objectives is necessary before the end of the century.

It is possible to reduce the impacts of climate change, but this requires immediate long-term action.

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