ROCZNIKI INŻYNIERII BUDOWLANEJ – ZESZYT 7/2007
Komisja Inżynierii Budowlanej Oddział Polskiej Akademii Nauk w Katowicach

POSIIBLE FUTURE USE OF ABANDONED BUILDINGS IN INDUSTRIAL TERRITORIES

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1. Characteristics of Industrial Territories

Industrial and mining activities influence negatively the environment in many aspects. Typical impacts are the subsidence of land, related changes in ground water level, vibrations (seismicity) resulting from ongoing coal mining (for instance, in the region of Karviná), contamination of soil in industrial territories, and air pollution. Since less coal is being mined now, non-conforming plants have been closed down, and regulations have become more stringent for permissible quantities of air pollutants, the air pollution is not a topical issue anymore though some places are still exposed to air pollution and environment load. Another specific impact on the industrial territories is escape of methane, this being also a consequence of shutdowns and restructuring of some coal collieries. There are not enough funds to minimise the leakage. All the mentioned influences are of negative impacts on those who live or work there. Reclamation costs are high, and the territory needs revitalisation because of the environment load.

2. Alternatives for Buildings in Industrial Territories

The consequence of limited industrial activities has become visible in industrial buildings the service lives of which will expire soon. And the question to be asked is what should be done with those buildings and plants? A suitable solution would be to find a new purpose of existence and remediate and reconstruct them. The other possibility would be demolish the delapidated buildings. In past, those buildings were built within the mass development. Now they often do not meet high demands of users. In some cases, they have suffered considerably by lack of maintenance or unsuitable repairs. Within the proposed remediation of the buildings on industrial sites, a building and technical survey should be carried out in order to find out the physical conditions of the building in detail. The organisation and intensity of the survey depends on the importance and degree of actions proposed for the improvement of the buildings. The building and technical survey consists of following phases: visual inspection of the site, study of the accompanying documentation, and possibly taking of samples (probes) and destructive/non-destructive tests When making decisions about the buildings in the industrial territories, it is essential

to pay attention to future visions of the zoning plan. The zoning plan should define purposes of existence of the territory.

3. CIDEAS Research Centre

Cideas is a research centre that is among organisations dealing with maintenance of buildings in industrial territories, decrease of energy demands, and integrated designing of structures and buildings systems in the Czech Republic. Cideas was established in 2005. It is co-funded by the Czech Republic Ministry of Education, Youth, and Sports. Department of management and maintenance of buildings in territories with increased industrial activities is located in Technical University of Ostrava. The department deals with general building-energy and technical-operational concepts, paying particular attention to use of the buildings for new purposes in the regenerated industrial land. The department investigates a multi-criteria analysis for decision-making on use of the building in the mentioned territories and structural acoustics and noise insulation properties of separating walls and inter-apartment walls. The tasks addressed by the department include a specific decrease of energy demands of the buildings in accordance with EU legislative and implementation of the regulation No. 2002/91/EU on energy demands in legislatives of individual EU member states.

4. Energy Dmeands of Buildings

Changes in methods used when assessing efficiency of energy used in housing stock and public amenities results from Decree No. 2002/91/EU that was implemented into Czech legislative on 1 July 2006 after changes in Act No. 177/2006 Coll. and 406/2006 Coll. Because of changes in the legislative it is essential to amend regulation No. 291/2001 Coll. giving details on use of energy for heat consumption in buildings. But the regulation has not been amended yet. According to the mentioned regulations, when assessing constructions and completed buildings that were funded from public and private funds, attention is paid to fulfilment of requirements for heat, technical and energy parameters. A particular attention is paid to consumption of heating energy in winter. The amended regulation should also address the energy produced by a building. The amendment is needed because not only overall energy performance (this means, the heating), but also ventilation, air-condition, or heating of water needs to be taken into consideration.

In the territory of Ostrava region that is considerably influenced by industrial activities, our workgroup has identified three buildings for research of thermal-technical and operational-technical requirements The buildings include a panel building with apartments (5 floors, T06B panel system), a school consisting of a fabricated skeleton system (3 floors, MS-OB), and an administrative building (7 floors, a skeleton building) Other studies of buildings are under preparation now.

5. Thermal Technical Requirements

The thermal-technical properties of peripherally-cooled building constructions, designed before the year 2002, do not meet today's strict norm requirements (Czech Norm CSN 73 0540 – 2: Thermal Building Protection. Requirements). Building energy demand is high. Maintaining and repairing appropriate disturbances is connected with the possibility

of reducing energy demand and thus reducing operational costs, which directly burden the financial budgets of households.

Table 1. The required and recommended values of heat penetration coefficients for selected constructions (taken from Czech Norm 73 0540 – 2/Z1: 2005)

Building description	**Heat penetration co-efficient U_N [W.m^{-2}.K^{-1}]**	
	Required values	**Recommended values**
Roof area and an inclinationup to 45°	0,24	0,16
Exterior wall: Ligot heavy	0,30	0,20
	0,38	0,25
Ceiling under an unheated attic	0,30	0,20
Floor set close to the ground	0,60	0,40
Window, doors: New repaired	1,7	1,2
	2,0	
Slanted roof window	1,5	1,1

In the complete heating of a building and making changes in filling in openings in the peripheral coat, there can be savings on financial costs for heating on average up to 35%. Although the period of return is various for different constructions, it moves from a range of 20 to 30 years. It is necessary to emphasis that the possibility of saving energy for heating is dependent on the thickness of thermal insulation, which is part of the heating system and also on the quality of windows, doors and other filled-in openings in the peripheral coating.

In improving the thermal- technical properties of the peripheral coat, which corresponds to the period liable to completing constructions, it is possible to heat through the help of certified heating systems. Legislation directs the fulfilment of thermal-technical requirements in cooling peripheral constructions for all new buildings, but also for the extensive reconstruction of buildings.

Two methods exist for heating buildings: interior and exterior. Each of them has its positive and negative aspect. The most extensive one is exterior heating, and it is mostly from the point of view of limiting the danger of condensation occurring from water vapour on the inside of constructions. In the cases of historically preserved buildings, the exterior heating of the preserved facade is inadmissible, and so it is the only possible method of interior heating, when it is necessary to place great emphasis on the correct design in the composition of heating layers (including vapour protection).

The exterior heating of the facade can be carried out by two methods: as a contact system or as a ventilation system with continuous air gaps. In improving the thermal-technical properties, the most important layer is in the thermal insulation heating system. The most frequently used types of thermal insulation for heating peripheral coats are stabilised foam polysterene (EPS), mineral fibre (MW) and extruding polystyrene (XPS). In heating roof surfaces, the most important insulation, besides EPS and MW, is sprayed polyurethane (PUR) with foam glass, The choice of using thermal insulation is calculated in the quality of the material as well as in the price.

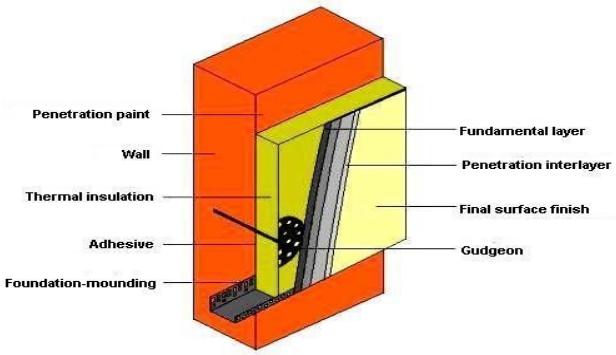

Fig. 1 The composition of the contact heating systém

6. Operational-technical Requirements

When designing and reconstructing technical services and facilities, most attention is paid to the heating, heating of water, and air-conditioning. The mentioned facilities are most energy demanding. Other services include distribution of water, gas, sewerage, and power supply.

Technical and moral conditions of general conceptions of the technical services and facilities in the buildings and their parts (for instance, the heating system) correspond to technical and economic situation in the time of construction of the buildings. In those days, heating costs were much lower.

When reconstructing heating systems, several basic rules must be fulfilled in order not to damage the supply and use of energy in the building. Generally, the heating should be thermally insulated and should fulfil requirements set forth in the standard ČSN 73 0540 that is in force (T06B Panel Housing Stock, Cideas 2005, Case Study, MS-OB Prefabricated Skeleton System, Cideas 2005, Case Study). The requirements are as follows:

a) to re-calculate heat losses pursuant to ČSN 06 0210 for new thermal values (in all rooms).
b) to assess whether heating elements in the individual rooms are not over-dimensioned.
c) to determine a new nominal heat gradient for the heating water using results of b). The new parameters of the heating water for the building should be set using a new central regulation in the connection point at the footing of the building – see e) low temperature operation.
d) to install a central regulation node for equithermal regulation of the heating water in order to make it possible to set the low-temperature operation for the section of the building under question.
e) to check existing thermostatic valves for function under new operation conditions and to make necessary questions (such as the installation of additional valves or electronically-controlled circulation pump in the regulation node).
f) to inform the heat supplier about the decrease in the maximum instantaneous hourly and average yearly consumption of heat (if this is the parameter that influences the price of heat) and, if necessary, to discuss other requirements and demands of the heat supplier.
g) to install an automated control system IRC (existing thermo regulation valves should be removed and internal apartment/room temperature sensors, building's control

systems and cabling for IRC should be installed. The whole system works as an accurate proportional measuring system that measures the heat consumption in individual apartments in line with requirements of the individual users).

6.1. Maintenance and Operation Training Programme

Operation of a heating system is often a problem in practice. An operation method influences considerably return on investment. If the heating system is operated incorrectly, its value may decrease even if the design were excellent. The more complex the system is, the more sensitive the operation must be.

Therefore, after the actions are taken, it is necessary to train an operator who will operate a new regulation-mixing unit at the footing of the building with a view to new properties of the thermally insulated building. The personnel should also maintain the system. It is essential to train sufficiently individual users of IRC control system.

- Operators must be qualified and be sufficiently motivated.
- Responsibilities for operation and control must be clearly divided among individuals.
- A complete operation and maintenance manual must be drafted and made available.
- Operators must be supervised regularly and consistently. If needed, operators must be replaced.

Generally, the new control system is almost unattended and fully automated. This, however, does not mean that the system will not be supervised.

In the fabricated skeleton system MS-OB that is among Cideas' research tasks, consumption of heat had gone down by almost 39%. One of most important and main changes in the heating system was the installation of an interactive system of management and control.

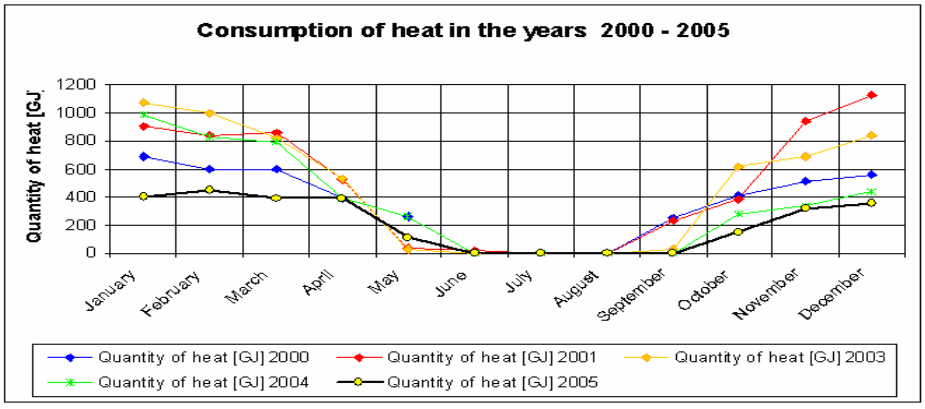

Fig. 2 Consumption of heat in the object type MS-OB in 2000 – 2005 (Comment: data from 2002 were not available in time of elaboration.)

6.2. Renewable Sources of energy – Solar Equipment

Use of solar energy is an interesting alternative for heating of water or heating of reconstructed buildings in spring or autumn. It is recommended to install bivalent reservoirs (Housing Development and Odra Mine Premises, Cideas 2006, Case Study). Each year, the surface of Earth captures 1,000 kWh/m^2 of energy in the Czech Republic. This energy ranges from 950 to 1250 kWh/(m.a) depending on weather and specific location. It is estimated that the solar energy that reaches the territory of Ostrava is ca. 1030 kWh/(m.a). Water heating offers a considerable potential for energy savings. In these geographical conditions, solar collectors and a central reservoir water heating represent an interesting alternative to operation of a heating boiler. It is recommended to use solar units as a supplement to the gas heating of buildings and heating of water. But it is not advisable to use solar units only because the gas equipment is highly efficient for heating of water.

The solar collectors can be highly efficient only if they are correctly oriented. A bearing indicates a deviation of a collector plane from the solar direction. If the collector plane is oriented towards south, the bearing is 0°. Because the solar radiation is highest at noon, the collector plane should be oriented towards south, if possible. Reasonable results can be also achieved if the deviation is less than 45° from south towards south-east or south-west. If the deviation is greater, a surface of collectors should be increased.

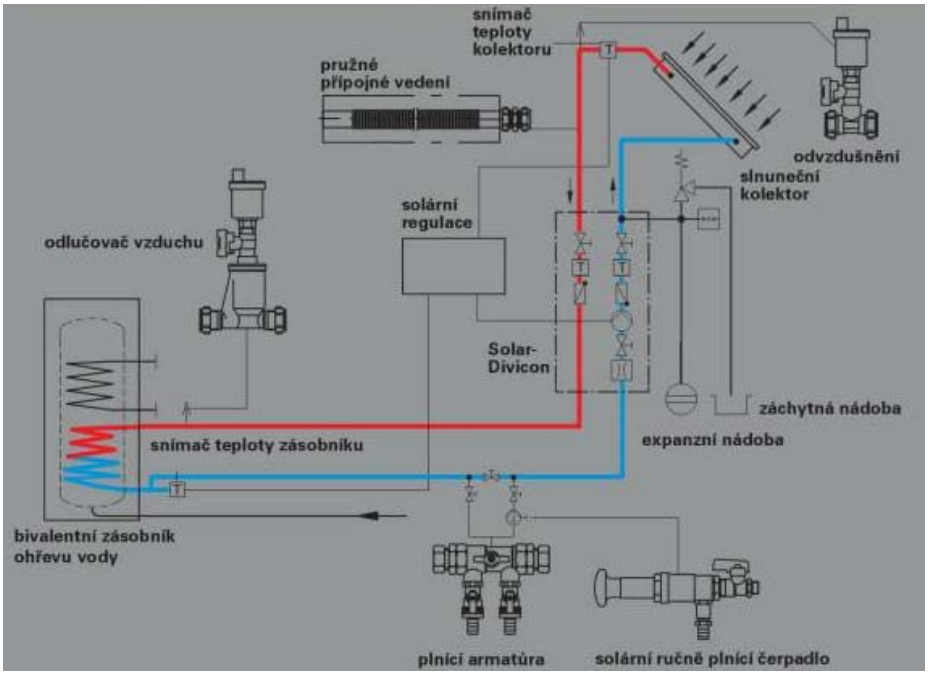

Fig.3 Solar unit components

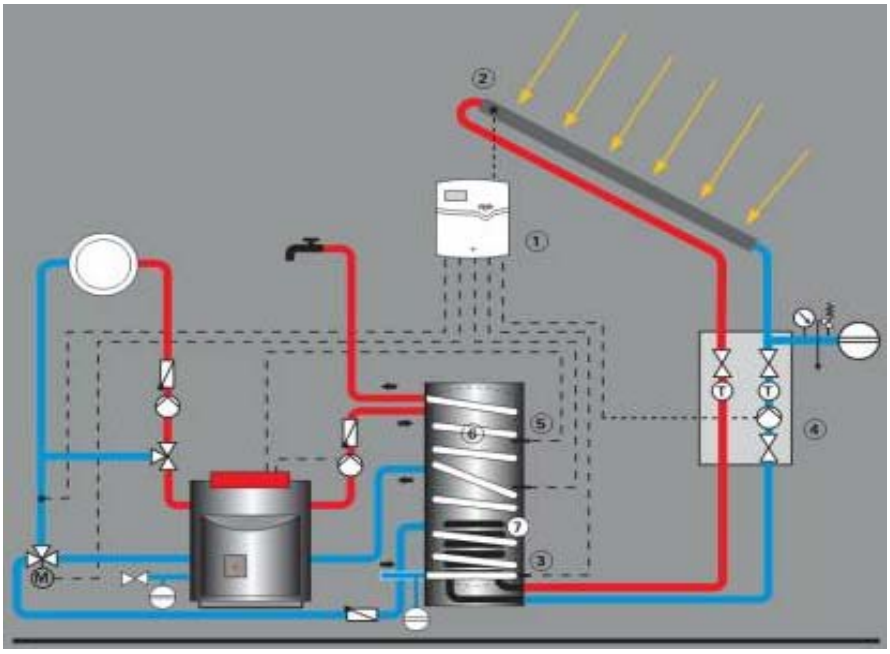

Fig. 4 Bivalent heating of drinking water supported by heating system

7. 2006 Energy Project

Cideas Research Centre has managed to complete a highly successful project dealing with reconstruction of an administrative building of a former Odra mine in Ostrava (this was a part of Ostrava-Karviná Collieries). In the Czech national competition 2006 Energy Project, that project was awarded the first prize. The project dealt with a general reconstruction of a seven-floor skeleton building that can be used for housing purposes or administration in the future. In 1997, the building was damaged by floods. In 1999, preservation of the building was carried out. A lightweight external cladding consisted of so-called Boletice panels and needed to be replaced. Possible installation of solar collectors for water heating and tempering of the building in spring and autumn has been taken into consideration. Attention has been also paid to use of photovoltaic systems for some internal installations. For more details see the case study Housing Development and Odra Mine Premises (Ostrava-Přívoz, Cideas 2006).

8. Conclusion

A specific assessment should be carried out for each individual building. Attention should be paid to a local context and conditions that vary for each building. Having evaluated the situation, a reasonable solution should be proposed pursuant to the legislative in force so that the reconstruction should be efficient not only now, but in the future as well. The building should provide services to satisfied users without any major structural intervention, with minimum maintenance costs and minimum energy demands for many years.

References

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[2] Haller, Humm, Voss: Solar energy by the buildings´ reconstructions, Prague, Grada Publishing, 2001

[3] ČSN 73 0540: Výpočet tepelných ztrát (Thermal Protection of Buildings; czech norm)

[4] ČSN 06 0210: Výpočet tepelných ztrát budov při ústředním vytápění (Calculation of Heat Losses in Building with Central Heating; czech norm)

[5] ČSN EN ISO 13789 Tepelné chování budov - Měrná ztráta prostupem tepla (Thermal performance of buildings - Transmission heat loss coefficient, czech norm)

[6] Act No. 406/2000 Coll. on energy management (czech act)

[7] Directive No. 2002/91/EEC on energy performance of buildings

www.cideas.cz

(case studies: Kubeckova Skulinova, D., Galda, Z., Kubenkova, K., Panel Housing Stock T06B, Panel Framed Construction MS-OB, Carcass Administrative Building Odra)

www.czso.cz

www.viessmann.cz

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Summary

Current desolate and dilapidation building what are unsatisfactory of present high demands of users constitute problem not only for ground with increasing industrial activity. However there are more socials problems in these grounds, especially problems resulting from restructuralization and inhibition programmes in area of industry and trade. Demolition of these desolate objects is not necessary in all of cases and solving this way can be often uneconomic. Lifetime of these buildings is not impoverishment and after some building adjustment we can use then for other function like living, culture and etc.

This outcome has been achieved with the financial support of the Ministry of Education, Youth and Sports of the Czech Republic, project No. 1M0579, within activities of the CIDEAS research centre.