Center for Energy Efficiency

«Future economic prosperity of Russia is across the energy efficiency bridge, and we must move real far across this bridge in the next 10 years!» (page 7)

№ 35

April-June 2002

ENERGY EFFICIENCY

Quarterly Bulletin *CENEf*

CONTENTS:

http://www.cenef.ru

Statistical Data. Reviews

ENERGY EFFICIENCY IMPROVEMENT IN DWELLING HOUSES

Yu. Matrosov, NIISF/CENEf

In recent decade the demand for heat necessary for heating new and retrofitted dwelling houses in Russia has decreased by 40-50%. The contribution of joint research by NIISF Institute and CENEf specialists involving US specialists into the result can be mentioned. A new "energy principle" regulating thermal protection of buildings has been developed and verified in the course of the decade, a complex of mandatory regulatory documents on federal and regional levels has been elaborated and put into practice, the construction complex of Russia has assimilated new energy efficient technologies.

Development of methods for regulating thermal protection of buildings towards more extensive use of energy saving measures can be subdivided into four stages.

1. Element-wise method serves as a reference point. At this stage heat transfer through exterior walling (building envelope) was mainly considered. Breakdown of the entire building envelope into elements (exterior walls, camp ceilings or coatings, ground floor ceilings, windows, doors, etc.) was performed and minimum permissible thermal resistance was ascertained for each of them. The method has been reflected in federal norms on thermal protection of buildings (SNiP "Construction heat engineering"), the document was effective up to 1995. The norms were based on prescriptive principle, i.e. designing potentialities were strictly restrained by regulatory requirements and instructions. The simplest calculation techniques were characteristic of this stage. For taking into consideration the "cold bridges" the calculation of reduced heat transfer factor was essentially complicated. The rated level of thermal protection in buildings had little in common with energy saving requirements.

2. At the second stage reduced (mean) heat transfer factor of the totality of building walling structures under steady-state conditions was regulated. It proved sufficient to assign one value for the totality of walling structures rather than regulate each element. As a result a greater variability in designing was attained, when lower thermal protection of one element could be compensated by greater thermal protection of the others. There was no way to control directly the rated values and the fact can be mentioned among drawbacks of this stage. Reduced (mean) heat transfer factor as a norm for the first time was introduced in Moscow municipal norms of energy saving in buildings in 1994 (MGSN 2.01-94 "Energy saving in buildings"). The document was the first step towards energy saving, it envisaged a 20% reduction of energy consumption. Calculation of specific demand for heat necessary for heating a building during a heating season and requirements to energy passport have been introduced into the norms for the first time.

3. At the third stage the value of final thermal energy demand for heating during a heating season is regulated. The stage reflects a systemic approach to thermal protection of buildings. Methodologies for the third and fourth stages have been developed within a model of norms for the RF subjects as a result of cooperation between Russian and American specialists. (Articles on new concept of regulating thermal protection of buildings were published in the "Energy Efficiency" Bulletin in 1994, 1996, 1999, 2001).

Reduction of demand for energy for heating buildings is attained not only at the expense of building envelope, but due to improved ventilation and heating systems along with passive use of solar energy by choosing the appropriate architectural, volumetric and planning approaches favorable from energy viewpoint. Relying on the methodology, fundamental changes in federal norms of construction heating engineering were developed and came into force in 1994-1995; their application provided a 40% reduction of energy consumption in newly constructed and retrofitted buildings in 2000 versus 1995. It can be stated that the new approaches reflected in the norms promoted largely the assimilation of new for Russia energy saving technologies in construction.

According to the third stage methodology in 1998-1999, when the norms of specific energy consumption were set, a new revision of Moscow municipal norms of energy saving in buildings (MGSN 2.01-99) was elaborated and currently the entire construction in Moscow is regulated by the norms. The norms contain energy passport of a building, which has been developed in detail, methodology for calculating energy consumption for hot water supply, as well as a new section to the project "Energy efficiency of buildings". The 2001 new federal norms "Single-family dwelling houses" contain well-defined regulatory requirements for specific energy consumption in low buildings. Another regulatory document, i.e. code of practice "Designing of thermal protection in buildings", contains the recommended form of energy passport and algorithm for calculating specific energy consumption in a building. The principle of rating, which

reflects requirements of a systemic approach in contrast to prescriptive norms of the first and second stages, is consumer-oriented.

4. And, finally, the fourth stage integrates normalization of thermal protection and heat supply systems by rating the demand of a building for primary energy. A similar methodology has been approved in the codes of practice effective in Great Britain, France, Italy, Germany and many regions of Russia in territorial construction norms (TCN) in reference to energy efficiency of buildings. In the period of 1999-2002 more than 30 TCN from Kalinigrad region in the west to Sakhalin region in the east and from Krasnodar Territory in the south to Nenets Autonomous area in the north were developed and put into practice. All the TCN made effective on the territories have been approved by heads of administrations of the territories, officially registered by Gosstroy of the RF and included in the list of regulatory documents effective on the territory of the Russian Federation. At least 70% (and in some regions, Moscow for instance, 100%) of newly erected and retrofitted buildings are designed and constructed in conformity with requirements stipulated by the TCN.

Results of introducing the new regulatory documents, reflecting the systematic approach to thermal protection of buildings and energy saving, into designing and construction suggest the following conclusions.

- The new principle of rating relying on complex index of specific energy consumption of a building during a heating season, which grants a greater freedom for choosing design approaches and permits control over energy consumption during operation of buildings, for the first time in Russian practice has been successfully accepted in more than 30 subjects of the RF.
- The new regulatory requirements have motivated the designers to develop energy efficient types of buildings, those with a broadened structures inclusively, and stimulated regional industry for fabrication of new advanced building materials and items complying with the world standards and for expanded production of high-quality effective heat-insulated materials, energy saving envelopes and new types of energy efficient windows.
- Analysis of new structural approaches to building envelopes relying on novel technologies including systems of external heat insulation, ventilated envelopes, three-layer punctual connection structures, along with experience gained in subjects of the RF when developing the approaches in practice confirm the feasibility of the new standards.
- Random inspection of the operated buildings for meeting the energy and heat engineering regulatory requirements (energy audit), introduced in all the territorial norms, is an indispensable element of erected building quality control, however, thus far it has not been provided with standardized methods of measurement, which impedes the activities aimed at analyzing actual energy saving effect due to introduction of the new norms.