OUTLINE NATIONAL PLAN TO INCREASE THE NUMBER OF NEARLY ZERO-ENERGY BUILDINGS IN ACCORDANCE WITH ARTICLE 9 OF DIRECTIVE 2010/31/EU ON THE ENERGY PERFORMANCE OF BUILDINGS

1. INTRODUCTION

The adoption of Directive 2010/31/EU will help to achieve one of the fundamental aims of the European Union's Europe 2020 Strategy of smart, sustainable and inclusive growth by achieving 20% energy savings of primary energy by 2020, and by laying the foundations for improving energy efficiency in buildings.

The Bulgarian government is working actively to improve energy efficiency and promote the use of renewables in the country. This will have a positive effect on economic growth and increase the competitiveness of the construction sector. In accordance with the requirements of Directive 2010/31/EU, Bulgaria is endeavouring to support the construction of new low-energy buildings and to achieve the same energy performance characteristics when existing buildings are renewed or repaired. We are analysing and re-working legislative acts and documents in order to implement the harmonised European requirements for nearly zero-energy buildings.

The departments responsible for implementing government policy with regard to energy efficiency in buildings and for developing national strategies, programmes and plans, including national plans to increase the number of nearly zero-energy buildings, are the Ministry of the Economy, Energy and Tourism (MIET), the Ministry of Regional Development and Public Works (MRRB) and the Sustainable Energy Development Agency (AUER).

Drafting a national plan to increase the number of nearly zero-energy buildings in accordance with Article 9(1) of Directive 2010/31/EU involves a detailed analysis and study of the dynamics in the construction market, a systematic analysis of statistical and other data on the energy consumption of existing buildings; various forms of applied research to determine national parameters expressed in numeric reference values of annual energy consumption indicators by class of energy consumption and building type (residential or non-residential: public buildings for education, health, culture and commerce, and administrative buildings); setting the energy performance standards for nearly zero-energy buildings, keeping up with the latest developments in building materials and heating, cooling and ventilation technologies using conventional or renewable sources of energy; and analysing and revising national legislation, documents and measures to support the implementation of Directive 2010/31/EU. This comprehensive project will be carried out in 2013 and involve experts from governmental and non-governmental structures, and will incorporate the results of numerous European projects.

2. GOVERNMENT POLICY IN THE ENERGY EFFICIENCY IN THE BUILDING SECTOR

2.1. Current national energy efficiency and renewable energy plans are directly linked with the national plan to increase the number of nearly zero-energy buildings, including goals, measures, undertakings by various departments, funding and deadlines.

• The Bulgarian Energy Strategy by 2020 incorporates the government's vision of Bulgaria's European development, taking into account the current European energy policy framework and worldwide tendencies in the development of energy technologies. The Energy Strategy is the underlying document for national energy policy development. Approved by the Council of Ministers and passed by the National Assembly in 2011, its aim is a reliable, efficient and cleaner energy system.

The main accents in sustainable energy development by 2020 are a 20 % improvement in energy efficiency, increasing the share of renewable sources to 16 % (20 %) of the energy end-use and a 20 % reduction in greenhouse gas emissions compared with 1990. The Bulgarian government therefore will focus on improving efficiency in the generation of electricity and heat, reducing transmission and distribution losses, improving the energy performance of existing buildings and introducing more stringent energy standards for new buildings, including energy-independent buildings.

• The national renewable energy action plan and the Second National Energy Efficiency Action Plan (Second National Plan)(based on Directive 2006/32/EC on energy end-use efficiency and energy services and covering the period 2011–6 and the forecast to 2020)

Implementing the Second National Action Plan will help to meet the National Energy Savings Target (in 2016) of 7291 GWh per annum and constituting 9 % of the mean energy end-use for the period 2001–5 (81 024 GWh). The provisional indicative target for the period 2011–3 (in 2013) is 6 % of the average energy-end use value for the period 2001—5.

One sub-target of the Second National Action Plan is a National Target for nearly-zero energy buildings. A Strategy to increase the number of these buildings in accordance with Directive 2010/31/EU has been proposed by:

- ✓ assisting the construction of new nearly zero-energy buildings and achievement of the same energy characteristics when existing buildings undergo major refurbishment;
- ✓ analysing and revising existing national legislation, documents and measures to support the implementation of Directive 2010/31/EU;
- ✓ analysing the state of the construction sector (growth of the construction process, business environment, financial and administrative obstacles, socio-economic conditions, market principles, etc);
- ✓ regulating the introduction of renewables in the construction of new buildings or the reconstruction, major refurbishment, major repair or conversion of existing buildings;

- ✓ fine-tuning the powers and functions of the competent authorities arising from the implementation of the new requirements of Directive 2010/31/EU with regard to the building sector (public and residential buildings);
- ✓ planning measures for the period 2012—3 to assign and implement applied research tasks to determine national parameters and requirements for the energy performance of nearly zero-energy buildings; supplementing the national calculation methodology with new elements from the relevant European standards for designing sustainable and smart buildings, taking into account standards for passive buildings and the level of technologies for heating, cooling and ventilation systems using conventional or renewable energy; systematic analysis of data in the information system of the Sustainable Energy Development Agency (AUER) regarding the state of energy use in existing buildings; and preparing projects, approving and publishing legislation, by-laws and administrative regulations;
- ✓ planning measures in the period 2012—3; defining the national targets, implementation mechanisms, activities related to recording, documenting and reporting results; pilot projects for new public-sector nearly zero-energy buildings for 2011—3; an approximate definition of the provisional target for 2015 of 1—1.5 % of the total floor space of new buildings occupied by central or local government departments with an energy performance corresponding to nearly zero-energy use; drafting a National Plan to increase the number of nearly zero-energy buildings;
- ✓ adapting the National Programme for housing renovation in Bulgaria for 2006—20 in order to comply with the EU's harmonised energy efficiency policy and the government's new policy for large-scale renovation of multi-occupancy residential buildings;
- ✓ schemes to provide financial aid under the Operational Programme Regional Development (Supporting energy efficiency in multi-occupancy residential buildings);
- ✓ priority for the renovation of concrete panel and other multi-occupancy buildings, and linking this process with the necessary energy certification and energy surveying of buildings;
- ✓ drawing up a pilot programme for nearly zero-energy public buildings;
- ✓ harmonising a package of legislation and regulations in accordance with the 2010 Energy Performance of Buildings directive by supplementing national legislative requirements with regards to the thermal transmittance (U value, W/m2K) of walls and glazed apertures, and building features, taking into account developments in the manufacture of building materials and products (Regulation No 7 of 2004 on energy efficiency, thermal insulation and energy economy in buildings, as amended in 2010, and Regulation No RD-16-1058 of 2009 on energy use indicators and the energy performance of buildings; and Regulation No 15 on the technical rules and standards for the design, construction and operation of buildings and facilities for the production, transmission and distribution of heat energy);
- ✓ stimulating the establishment of owners' associations within the meaning of the Condominium Management Act (ZUES) and assistance with surveys of condominiums.

2.2. State policy with regard to the technical regulation and harmonisation of standards for energy efficiency in buildings

The MRRB and MIET implement government energy efficiency policy with regard to buildings by transposing: Directive 2002/91/EU on the energy performance of buildings, Directive 2010/31/EU, Directive 2009/28/EC on the promotion of the use of energy from renewable sources, Directive 2006/32/EC on energy end-use efficiency and energy services, Directive 89/106/EEC on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products and accordingly Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, the 'New approach' directives and standards within their field of applicability, as well as technical standards, methods and the principles of good European practice.

National legislation in the field of energy efficiency includes: The Energy Efficiency Act (ZEE); the Territorial Planning Act (ZUT); the Energy Act (ZE); the Renewable Energy Act (ZEVI); the Technical Requirements for Products Act (ZTIP); the National Standards Act (ZNS); and others.

The main by-laws determining the technical level of energy consumption in buildings and establishing the legal and technical basis for energy efficiency requirements are as follows:

On the basis of the ZUT:

- Regulation No 7 of 2004 on energy efficiency, heat insulation and energy savings in buildings;
- Regulation No 5 of 2006 on technical certificates of buildings.

On the basis of the ZEE:

- Regulation No RD-16-1057 of 2009 on the conditions and procedure for energy efficiency surveys and certifying buildings, issuing energy performance certificates and certificate categories;
- Regulation No RD-16-1058 of 2009 on energy consumption and building energy performance indicators;
- Regulation No RD-16-348 of 2009 on circumstances subject to entry in the register of persons carrying out building certification and energy surveys, qualification methods and conditions and equipment needed for surveying and certifying buildings;
- Regulation No RD-16-932 of 2009 on the conditions and procedures for checking the energy efficiency of boilers and air-conditioning installations, pursuant to Article 27(1) and 28(1) of the ZEE and for setting up, maintaining and using a database thereof.

On the basis of the ZE:

- Regulation No 15 of 2005 on the technical rules and standards for designing, building and operating buildings and facilities for thermal energy production, transmission and distribution, and the methodologies for the implementation thereof,

On the basis of the ZTIP:

- The Regulation on the main requirements for buildings and assessing the conformity of building products, adopted by Decree No 325 of the Council of Ministers of 2006 (SG No 106 of 2006).

Article 169 of the ZUT (Directive 89/106/EEC and Regulation (EU) No 305/2011) implement the following substantial requirements for buildings: structural integrity stability and durability of building constructions and the underlying ground when subjected to operating and seismic stress; fire safety; protecting human health and safety and property; the safe use of buildings; environment protection; energy efficiency; thermal insulation and economy of thermal energy; and the sustainable use of natural resources. The ZUT defines the main players in construction, the relations between them, their obligations and responsibilities, and their obligation to check and certify that energy efficiency requirements have been met by evaluating completed investment plans for compliance and supervising works in accordance with the approved investment plans. The ZUT regulates the requirements and procedure for obtaining building permits and for putting completed buildings into operation. The regulations on building energy characteristics and on energy efficiency, thermal insulation and energy savings in buildings are implemented in a uniform manner and constitute the legislative basis for planning, designing, surveying and certifying buildings.

2.3. Developing national energy performance requirements for buildings

The process of regulating the technical standards for the design of thermal insulation of buildings, the technical installations of buildings and the characteristics of building materials used can be traced back to the early 1960s. Up to 1999 the energy requirements for buildings were constantly improved and updated.

In 2004 the ZEE and its secondary legislation on energy efficiency transposed Directive 2002/91/EU on the energy performance of buildings and marked a new approach in the development of national requirements by defining integrated energy characteristics and treating buildings as integrated systems in which energy use is the result of the interaction of the following main elements:

- building envelopes;

- microclimate parameter maintenance systems;

- external heat sources;

- inhabitants;

-climatic conditions.

The reference values (from the legislative acts current at the time the building is put into operation) of heat engineering indicators for building envelopes, and the efficiency of the building's

features and plants for heating, cooling, ventilation and water heating systems, are taken into account when existing buildings are surveyed and certified, and when their energy performance is calculated.

An example of the standards for building envelopes, which are one of the elements in a building‘s thermal and energy balance in the new calculation of annual energy consumption, is given in fig. 1.

National requirements for the thermal transmittance coefficient through building envelopes U, W/m^{2}K in building constructions and elements in Bulgaria in the period 1964-2012

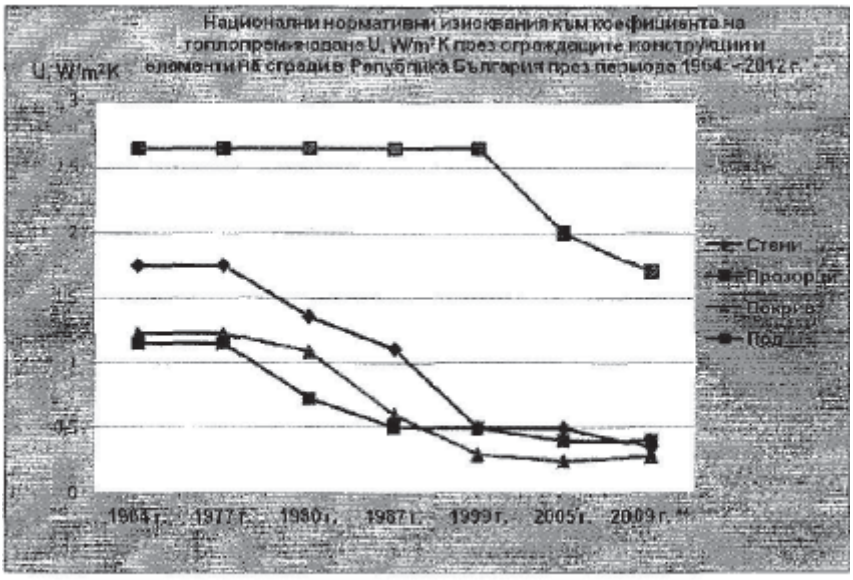
U, W/m^{2}K

Walls

Windows

Roof

Floor



Фиг. 1

Година		1964 г.	1977 г.	1980 г.	1987 г.	1999 г.	2005 г.	2009 г.**
U стени	W/m²K	1,75	1,75	1,36	1,11	0,50	0,50	0,35
U прозорци	W/m²K	2,65	2,65	2,65	2,65	2,65	2,0	1,7
U покрив *	W/m²K	1,23	1,23	1,087	0,603	0,30	0,25	0,28
U под	W/m²K	1,15	1,15	0,725	0,503	0,50	0,40	0,40

		1964	1977	1980	1987	1999	2005	2009**
U walls	W/m²K							
U windows	W/m²K							
U roof*	W/m²K							
U floor	W/m²K							

Notes

1. *Values are for Θ_e = - 12 ºC and for solid-built buildings with brick walls.*

2. ** Values are for flat roofs without ceilings.*

3. *** The values up to 2005 are the maximum permissible and are given as reference values for 2009. After 2009 the main indicator for compliance with national energy efficiency standards for all buildings (new and existing) is*

*the integrated building energy performance indicator EP**, kWh/m²/year.***

To calculate the energy consumption indicators and the energy performance of a building, the following classifications are used:

- residential, including individual houses; low, medium and high-rise residential buildings (blocks of flats); mixed;
- non-residential, including administrative buildings (administrative, office, ceremonial buildings, etc); educational buildings (schools, kindergartens, etc); health care buildings (various health establishments, etc); hotel and services buildings (hotels, motels, halls of residence, etc); commercial buildings (shopping centres, markets and arcades, shops, etc); public catering establishments (catering outlets, restaurants, etc); sports buildings; and other public use buildings (buildings for culture and the arts, transport buildings, etc).

The purpose of energy performance calculations is to determine: the consumption, energy economy and heat insulation of buildings; to determine the level of energy efficiency; to assess the compliance of every proposed investment project design; and to issue an energy certificate and a building certificate.

The national methodology for calculating energy consumption and energy performance is based on Bulgarian standard BDS 180 13790 and good European practice in calculating the annual energy consumption for heating, cooling and hot water. The unified methodology for establishing energy consumption indicators and determining energy performance of buildings was updated in 2010 and includes:

1. the orientation, dimensions and shape of the building;
2. the characteristics of the building envelopes and internal spaces, including thermal and optical characteristics, air tightness, humidity resistance and resistance to water ingress;
3. domestic hot water heating systems;
4. cooling systems;
5. ventilation systems;
6. lighting systems;
7. passive solar systems and solar protection;
8. natural ventilation;
9. systems for using renewable sources of energy;
10. external and internal climatic conditions.

The baseline values for climatic factors have been determined for nine climatic zones within Bulgaria.

The building energy consumption indicators have been classified into three main groups:

- ✓ ***group one:*** indicators to characterise the energy converting and transmitting properties of building envelopes and elements of the microclimate maintenance system;
- ✓ ***group two:*** indicators characterising the energy consumption of technological processes for heating, cooling, ventilation and domestic hot water;
- ✓ ***group three:*** indicators characterising the energy consumption of the building as a whole.

The rules for setting up a scale of energy consumption classes and for classifying a particular building to a particular class from A to G on the energy scale are normatively determined. The scale of energy consumption classes is based on two integrated energy performance values: $EP_{max, g}$ and $EP_{max,}$

$_s$, defined as the primary energy or as the energy demand (supplied), or saved carbon dioxide emissions, as follows:

1. $EP_{max, g}$ is the total specific energy consumed for heating, cooling, ventilation, hot water and lighting calculated in accordance with the National Methodology; the thermal engineering values of the building envelope and elements, and the efficiency of elements and plants of the heating, cooling, ventilation and domestic water heating systems, conform with current legislative acts at the time of the assessment;

2. $EP_{max, s}$ is the total specific energy consumed for heating, cooling, ventilation, hot water and lighting calculated in accordance with the National Methodology; the thermal engineering values of the building envelopes and elements, and the efficiency of heating, cooling, ventilation and domestic water heating system systems conform with legislative acts current in the year the building is put into operation.

The technical energy efficiency indicators when designing buildings and assessing the compliance of the designs with the energy efficiency requirements are as follows:

1. total annual energy consumption for heating, cooling, ventilation, hot water, lighting and appliances per square metre of the total heatable building area (A_f) in m^2, defined as the energy consumed and primary energy in the case of new buildings, where the outline plan/design agreement includes the design of a general heating installation for the whole building;

2. total annual energy consumption for heating, cooling, ventilation, hot water, lighting and appliances per square metre of the total heatable building area (A_f) in m^2, defined as the net energy in the case of new buildings where the outline plan requires local heating, or whose structures do not allow central heating with a common heating installation to be incorporated;

3. total annual energy consumption for heating, cooling, ventilation, hot water, lighting and appliances per square metre of the total heatable building area (A_f) in m^2 or per cubic metre of heatable space (Vs) in m^3, in terms of primary energy in the case of existing buildings with a rated temperature of the internal air above 15 ºC and relative air humidity below 70 %.

The reference value for the building is determined in the methodology by substituting the reference values for the building envelope and the reference values for the indicators for the building microclimate maintenance systems and plants in the calculations. The 2009 building envelope reference values are the same as for both new and existing buildings.

A building is deemed to have met the energy efficiency requirements if:

1. for new buildings in the design or construction process, the calculated indicators conform with energy consumption class B;

2. for existing buildings, the calculated indicator values conform:

a) at least with class C of the energy consumption scale for buildings put into operation during the period 1991—2009 inclusive;

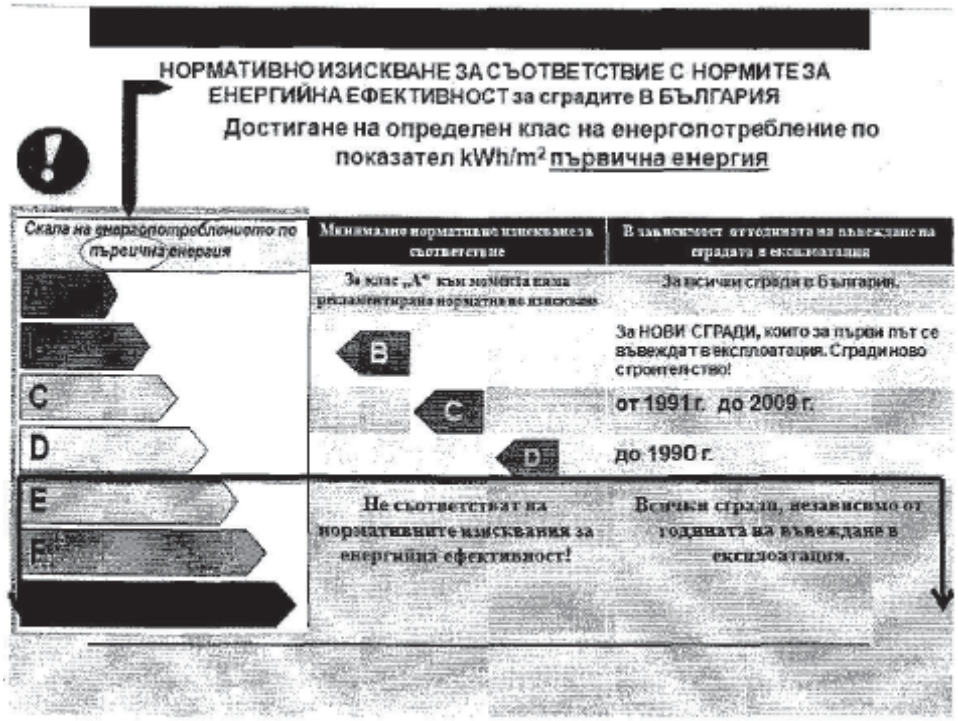
b) at least with class D of the energy consumption scale for buildings put into operation up to 1990 inclusive.

Implementation of the regulatory requirements is illustrated in fig. 2.

REGULATORY REQUIREMENTS FOR CONFORMITY WITH ENERGY EFFICIENCY STANDARDS for buildings IN BULGARIA

Achievement of a particular energy consumption class with the W/m^2K primary energy indicator

Scale of primary energy demand	Minimum compliance requirements	Depending on the year in which the building was made operational
A	There are currently no regulatory requirements for class A	For all buildings in Bulgaria
B	B	For NEW BUILDINGS being put into operation for the first time. New builds
C	C	from 1991 to 2009
D	D	up to 1990
E F G	Do not conform with the energy efficiency requirements	All buildings, regardless of the year they were made operational



Фиг.2

Each investment project for a new building or for the refurbishment, major renovation or conversion of an existing building requiring planning permission under the ZUT must contain a section on Energy Efficiency and, in accordance with the ZEE for new buildings with a floor space of over 1000 m^2, Investment projects must take into account the options of using (Article 8 of Directive 31/2010/EC):

1. decentralised systems for the generation and consumption of renewable energy sources;
2. installations for heat and electricity cogeneration;
3. central or local heating and cooling installations;
4. thermal pumps.

The ZEVI specifies that in the construction of new buildings or the reconstruction, major renovation, major repair or conversion of existing buildings, systems for generating energy from renewable sources shall be incorporated where technically feasible and financially viable: for public service buildings from 1 January 2012 and for other buildings from 31 December 2014. The possibility of using renewable energy forms part of the assessment of the annual energy consumption indicators for the building.

In these cases at least 15 percent of the total amount of heat and cooling energy needed for the building must be produced from renewable sources by implementing:

1. centralised heating using biomass or geothermal energy;

2. individual biomass incineration units with a conversion efficiency of at least 85 percent for residential and commercial buildings, and 70 percent for industrial buildings;

3. solar heating installations;

4. thermal pumps and surface geothermal systems.

An Act amending and supplementing the ZEE has been drawn up in connection with transposing requirements of Directive 2010/31/EU. The main aim of the draft is to make a significant contribution towards achieving Bulgaria's aims in energy efficiency, reducing energy consumption and promoting the improvement of the energy performance of buildings. Bulgaria will strive to provide support to construct new nearly zero-energy buildings and to improve energy performance when renovating existing buildings.

The draft Act amending and supplementing the ZEE aims to:

- ✓ supplement the energy savings measures recommended each time a building, or parts thereof which are in use, are reconstructed, undergo major repair or renovation, with a technical and economic feasibility assessment for using alternative systems and installations (Article 7 of Directive 31/2010/EU);
- ✓ improving the energy performance of buildings in use after reconstruction, major repairs or major renovation of the building, or of the repaired part thereof, so that they conform with the minimum energy efficiency requirements insofar as it is technical feasible and economically viable;
- ✓ introducing requirements into the National Plan to increase the number of nearly zero-energy buildings; a national definition of and technical indicators for near zero-energy buildings, reflecting national conditions; the duration of the plan; national targets for increasing the number of near zero-energy buildings based on the classification of building types; policies and mechanisms, including financial mechanisms, to promote the construction of near zero-energy buildings, and institutions responsible for drafting and approving the National Plan.

3. DEVELOPMENT OF THE CONSTRUCTION SECTOR

The construction sector in Bulgaria has a particularly important role to play in overcoming the effects of global climate change by adopting measures to increase energy efficiency by defining the quality of the living and working environment. The construction sector has a defining role in the Bulgarian economy and accounts for almost 7 % of the GDP of the country and employs over 5.5 % of the economically active population. Over 40 % of investments in fixed assets are in the construction sector. This sector is also a determining factor when it comes to national competitiveness and attracting

foreign investments. At the same time it is highly fragmented, with micro- and small enterprises accounting for over 96 % of construction enterprises.

Construction in Bulgaria is among the sectors most hardly hit by the world economic crisis. National statistics show that the volume of construction has almost halved, from BGN 21 billion in 2008 to BGN 11 billion in 2011, with an overall decline of 47 % in the industry compared with the pre-crisis years.

The first half of 2012 showed a shrinking of the market, the main microeconomic indicators being: formation of 6.5 % of the gross added value, providing a mere 184 000 jobs (compared with 297 000 in 2008 and 203 000 in 2011); a 7.5 % reduction in completions compared with 2011; negligible growth of 0.1 % in building construction; and a decline of 15.7 % in engineering construction compared with the first half of 2011.

The Operational Programme 'Development of the Competitiveness of the Bulgarian Economy' (2007—13) is being deployed to increase the competitiveness of construction enterprises and to ensure favourable investment conditions in Bulgaria, with some of the procedures under the programme being used to promote measures to use energy-efficient technologies, renewable energy sources, innovations, the renewal of manufacturing and office buildings, etc.

Housing construction

Households are the third largest consumers of energy, with a practically constant level of consumption of around 2.1—2.2 Mtoe yearly. The sector share has also remained constant, at about 25—26 % of energy end consumption.

The consumption of energy in housing increased from 0.553 toe/unit in 2007 to 0.567 toe/unit in 2009, with electricity consumption rising particularly quickly. The main factors in this increased energy consumption are: the larger size of new housing units; increased heat comfort levels and lighting; the penetration of air conditioning use, and the rising use of electrical appliances and electronic equipment. Issues as yet unresolved in domestic residences are the low efficiencies of wood and coal-burning stoves and chimneys, and the lack of domestic gasification. The problem of the energy efficiency of housing is growing: on the one hand, the price of fuels places a heavy burden on household budgets, while on the other hand there is a global push to save energy in order to achieve sustainable development, as heating accounts for around 70 percent of domestic energy consumption.

A priority of the National Programme to renovate residential buildings in Bulgaria 2006—20 is multi-occupancy buildings. The expected average energy savings that would result when the energy efficiency measures are implemented would be 25—35 kWh/m^2 of floor space per annum. The anticipated effect of the package of measures, taking into account the contribution of replacing sub-distribution stations, is around 35.5 % savings on the pre-renovation costs, taking into account the requirements for maintaining the standard domestic microclimate parameters.

In July 2012 Project BO161PO001-1.2.01-0001 'Energy renewal of Bulgarian homes' was launched with financial aid from Operational Programme 'Regional Development' 2007—13, co-financed by the European Union through the European Regional Development Fund. The project covers 36 city centres and will last for three years (2012—5).

The project's overall aim is to provide better living conditions for residents of multi-occupancy buildings in city centres by improving the quality of the living environment and implementing energy efficiency measures.

One particular project beneficiary is the Directorate of Housing Policy, a specialised administration within the MRRB.

The specific aims are:

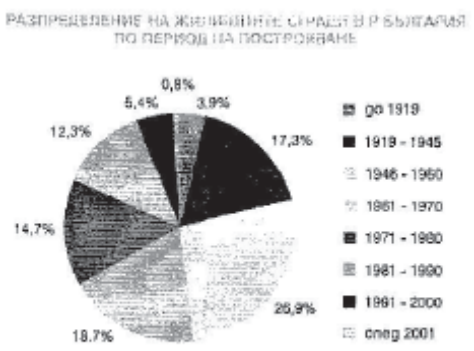
To carry out energy efficiency measures in multi-occupancy buildings in 36 urban centres to

- increase the energy efficiency of the buildings;
- to extend the physical and social lifespan of buildings by significantly increasing their functional qualities and the comfort of residents;
- create a living environment suitable for sustainable development.

Buildings that qualify for the project are those containing six or more self-contained residential units on three or more storeys.

Despite the fact that Bulgaria's housing stock is comparatively modern (about half of all buildings have been built in the last 40 years and only 3.9 % date from before 1919), the condition of these buildings is poor and constantly deteriorating, primarily due to inadequate maintenance and poor management by the owners. Fig. 3 shows the distribution of residential buildings by year of construction.

DISTRIBUTION OF RESIDENTIAL BUILDINGS BY CONSTRUCTION PERIOD IN BULGARIA



Фиг.3

The total amount of aid to be provided by OP 'Regional Development' under this project comes to BGN 50 million. The owners of multi-occupancy residential buildings are envisaged to receive financial aid equal to 50 % of the budget for renewing the building, with all the costs being covered to survey and determine the technical characteristics of the building, including the issue of a technical certificate, energy efficiency surveys and consultancy services by regional project managers in activities related to the establishment and registration of owners' associations, consultancy services regarding the implementation of the ZUES, for taking out credits to secure the financial share of the owners, etc.

The implementation of the renovation plans will be aided out of the Housing Renewal Fund.

The anticipated results of the project are:

- energy efficiency upgrading construction works for a minimum of 180 buildings;
- 426 550 m^2 of floor area renovated;
- improved living conditions for 13 500 residents;
- energy savings in renovated residential buildings of 21 500 MWh/annum.

The dynamics of completed residential buildings, the number of housing units and total floor area for the period 2004—12 is shown in the graphs below (figs 4, 5 and 6). They show that over 5000 residential buildings meet the more stringent energy efficiency requirements introduced in 2009 through the updated standards.

Fig. 4
New residential buildings put into operation, 2004-H1 2012*, units
*Based on preliminary data of the National Statistics Institute

1st half 2012*

Fig. 5
New residential buildings put into operation, 2004-H1 2012*, total floor space
*Based on preliminary data of the National Statistics Institute

1st half 2012*

Fig. 6
New residential buildings put into operation, H12009-H1 2012*, units

*Based on preliminary data of the National Statistics Institute

1st half 2009 1st half 2010 1st half 2011 1st half 2012

*Residential buildings *Dwellings

Fig. 7

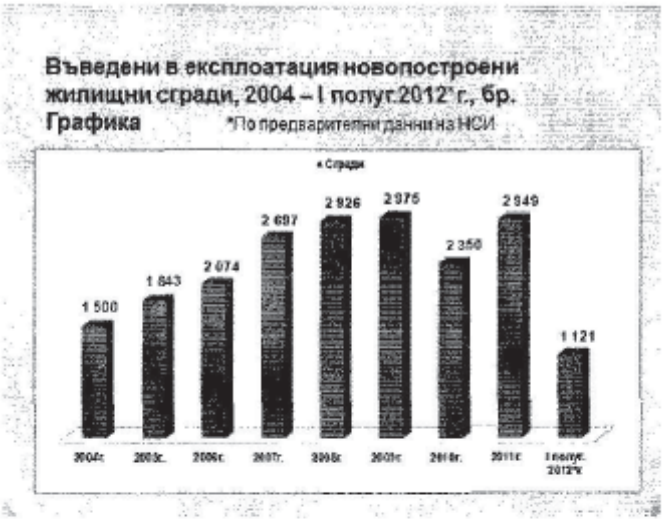
Fuel and energy shares in domestic energy consumption

liquid fuels/gas/electricity/heat energy/wood

Fig. 8

Energy consumption by households

ktoe		liquid fuels gas coal electricity heat energy biomass total
	year	



Фиг.4

Фиг.5

Фиг.6

Фиг. 7

The proportion of fuel types and fuel and energy consumption of households is set out in figs 7 and 8.

Фиг. 8

Public buildings

There are over 17 000 public buildings in Bulgaria, which illustrates the importance of implementing measures to reduce consumption in them. Because the public sector should set the trend in energy efficiency measures, the ZEE introduced mandatory certification for buildings with a floor space of more than 1000 m^2 and individual energy savings targets to be met. As a result, in 2005—11 3788 buildings were surveyed. Therefore the Bulgarian public sector clearly needs to lead the process of implementing the requirements of Directive 2010/31/EU.

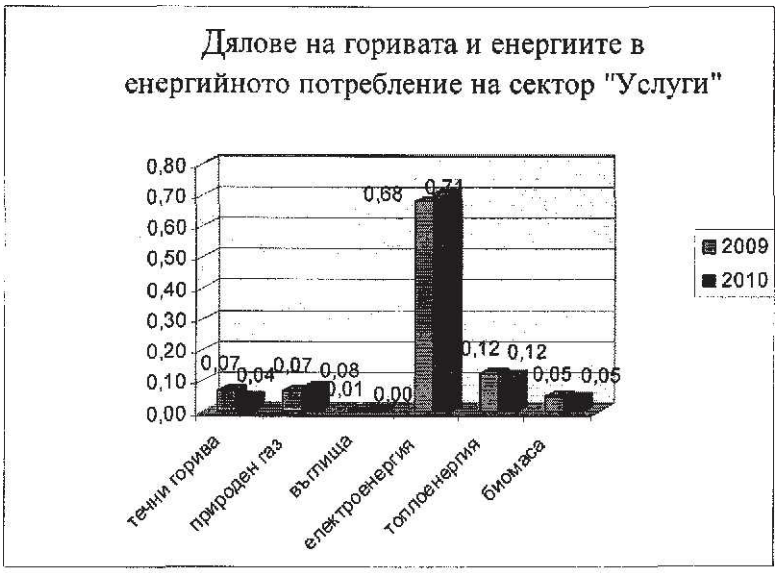
In accordance with the European Commission's new Energy Efficiency Plan of 2011, the national strategic documents envisage public buildings reducing their energy consumption by implementing consumption-reducing measures through repair and renovation works. The best-case forecast for fulfilling the national interim target by 2015 can be defined as between 1—1.5 % of the total floor area of new central and local government buildings, using 2012 as the selected base year. The base year was chosen on account that two years after significant revision of legislation regarding energy efficiency (the new 2008 Energy efficiency Act and the 2009 secondary implementing legislation), old buildings have been repaired and new buildings put into operation that had been designed and implemented in accordance with the new (current) energy efficiency and annual energy consumption standards. Achieving better energy performance, for example almost zero-energy buildings, should properly be compared with the base year when the harmonised minimum standard requirements, i.e. $EP_{max,\,г}$ in kWh/m^2 were implemented. After the plan’s impact has been assessed the national target, including the interim target, can be adjusted.

The proportion of fuel types and energy consumption in the service sector is set out in fig. 9.

Fig. 9.

Shares of fuel and energies in service sector energy consumption

liquid fuels	natural gas	coal	electricity	heat	biomass



Фиг. 9.

Completed projects and construction to support improvement of the investment climate and improve the energy efficiency of residential and public buildings under OP 'Regional Development' 2007—13.

During this period, and particularly in the last few years, a large number of projects to increase building energy efficiency have been completed under more than 15 of the programme's schemes: access to sustainable and efficient energy resources; energy renewal of Bulgarian homes; support for integrated urban renewal and development plans; a green and accessible urban environment; support for energy efficiency in multi-occupancy residential buildings; support for energy efficiency measures

in municipal educational infrastructure in urban conglomerations; support for energy efficiency measures in the municipal educational infrastructure of 178 small municipalities; and others.

New financial instruments have been devised during this period, such as the Housing Renewal Fund, which is a financial engineering instrument that aims to provide low-interest loans and loan guarantees for owners' associations in multi-occupancy buildings and to implement energy efficiency and renewable energy measures.

During the period 2007—12 projects were concluded and the following indicators accounted:

* number of buildings renovated: 285, of which 243 were educational, 20 cultural and 22 social services buildings;

• total energy savings: 34 994.89 MWh.

The number of contracts for energy efficiency measures in buildings totalled 359, with the total value being BGN 959 921 111, and the number of contracts concluded being BGN 192 134 194.

In the next programme period of OP 'Regional Development' 2014—20, energy efficiency in public and residential buildings will remain the main priority.

The table below summarises the targets and the energy savings achieved:

Period, year	**Energy end consumption**		
	Directive 2006/32/EC		**Directive 2010/31/EU**
	Energy savings target	**Energy savings achieved (in 2010) and anticipated (for 2016)**	**Target for share of buildings with near zero-energy consumption**
-	GWh	GWh	%
2010	2430	3549	-
2013	4860	5892	
2015	-		1—1.5* (estimate)
2016	7291	-	
2020			100

* Percentage total floor space of new buildings occupied by central and local government.

4. NATIONAL STRATEGY FOR AND NATIONAL DEFINITION OF NEARLY ZERO-ENERGY BUILDINGS

The draft national definition of nearly zero-energy buildings in Bulgaria has been defined in accordance with the underlying principles of the correct formulation of the definition of nearly zero-energy buildings extrapolated at European level and takes into account its characteristics for

clearly defined targets and conditions, of technical and financial feasibility, flexibility and adaptability to local climatic conditions, of promoting innovative technologies, etc. (Principles for nearly Zero-Energy Buildings — published in 2011 by Buildings Performance Institute Europe).

4.1. Baseline assumptions

In order to formulate a national definition for nearly zero-energy buildings, the following baseline assumptions are used:

- the definitions and requirements of Directive 2010/31/EU;
- the characteristics of the existing national legislative basis for assessing the energy performance of buildings;
- the specific economic and social conditions in Bulgaria;
- accounting the influence of local geographic, climatic and seismic conditions and impacts.

A formulation has been sought that can be updated every 5 years in order to account for advances in technology, the country's economic development trends and good European practice.

Establishing a national definition aims to achieve an economically viable cumulative effect of:

- reducing the energy consumed in buildings by improving the energy performance of building envelopes, microclimate parameter maintenance systems and other energy-consuming systems, and plants and devices in the buildings;
- the use of renewable energy generated in or in the immediate vicinity of buildings.

4.2. Definition of near zero-energy buildings

The definition is structured around three basic requirements:

- Primary energy consumption conforming with class A on the national scale. Under the current requirements, class A energy consumption is less than ½ of class B, with the latter regulating the mandatory requirement for making new buildings operational.
- Minimum share of renewables in the building's energy balance.
- Restriction of the maximum share of electricity in the building's total energy balance. This restriction applies only to buildings with a total floor space in excess of 500 m^2.

Taking into account the characteristics of individual types, buildings are sorted into the following three main groups:

BUILDING GROUPS	REQUIREMENTS FOR MEETING NEARLY ZERO-EMISSIONS STANDARDS
GROUP A: Single and multi-occupancy residential buildings with a floor area of up to **500 m^2**	1. To achieve class A primary energy consumption, whereby: 2. At least 50 % of the energy needed for heating, hot water, ventilation and cooling is from renewables.
GROUP B: Buildings with a floor space of **500 to 7 000 m^2**: - residential buildings, halls of residence, rest houses, multi-function buildings, public buildings for education, and science, culture, social services, administration, commerce, public catering and hotels, buildings for domestic services, public service buildings for transport and electronic communications, sports, ceremonial buildings, congress and conference centres, and health establishments.	1. To achieve class A primary energy consumption, whereby: 2. At least 30 % of the energy needed for heating, hot water, ventilation and cooling is from renewables. 3. The share of electricity in the building's annual primary energy consumption balance (including electricity for the heating, hot water, ventilation and cooling systems) is no more than 30 %.
GROUP C: Buildings with a floor space of more than **7 000 m^2**: – residential buildings, halls of residence, rest houses, multi-function buildings, public buildings for education and science, culture, social services, administration, commerce, public catering and hotels, buildings for domestic services, public service buildings for transport and electronic communications, sports, ceremonial buildings, congress and conference centres, and health establishments.	1. To achieve class A primary energy consumption, whereby: 2. At least 20 % of the energy needed for heating, hot water, ventilation and cooling is from renewables. 3. The share of electricity in the building's annual primary energy consumption balance (including electricity for the heating, hot water, ventilation and cooling systems) is no more than 40 %.

4.3. General framework of conditions in the definition of nearly zero-energy buildings

To apply the definition and to account for the parameters properly, a framework of conditions has been set up. This corresponds to the current system of standards in Bulgaria and contains the following components:

A. Energy balance:

A.1. Physical limits: Detached building

A.2. Balance make-up: Energy used for the following purposes is accounted:

- heating
- hot water
- ventilation
- cooling
- lighting
- pumps, ventilators
- appliances
- technical systems

A.3. Microclimate parameters:

Current legislative acts and documents set out the requirements for the maximum permissible variations in microclimate parameters: air temperature; relative humidity; air movement; minimum fresh air supply; light; and noise level.

A.4. Limits for energy from renewables:

The energy from renewable sources used generated within the building or within a radius of 15 km.

A.5. **Balance period and computational step:**

The energy balance is drawn up on an annual basis through computation. The monthly balance method of BDS EK 180 13790 is used.

D. Conditions for determining basic evaluations:

B.1. Specific energy consumption: This is defined by the conditioned area of the building calculated based on external dimensions in accordance with BDS EK 15217.

B.2. Primary energy: This is determined for the type of energy supplied using nationally determined coefficients that account for losses incurred during generation, transmission and distribution. These coefficients have a constant value at an annual level.

B.3. CO_2 emission equivalent: This is determined for the relevant type of energy using nationally determined coefficients. The assessment of emissions accompanies the assessment of the specific consumption of primary energy as additional information about the building.

C. Applicability:

8.1. Building types: Residential and public service buildings

8.2. Building status: New or after major renovation

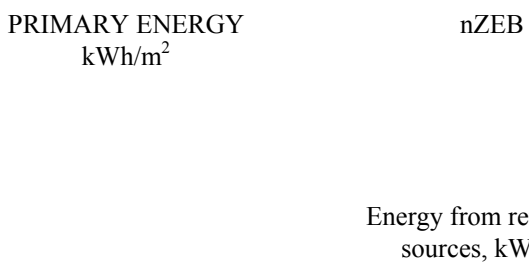
8.3. Ownership Private or central/local government-owned

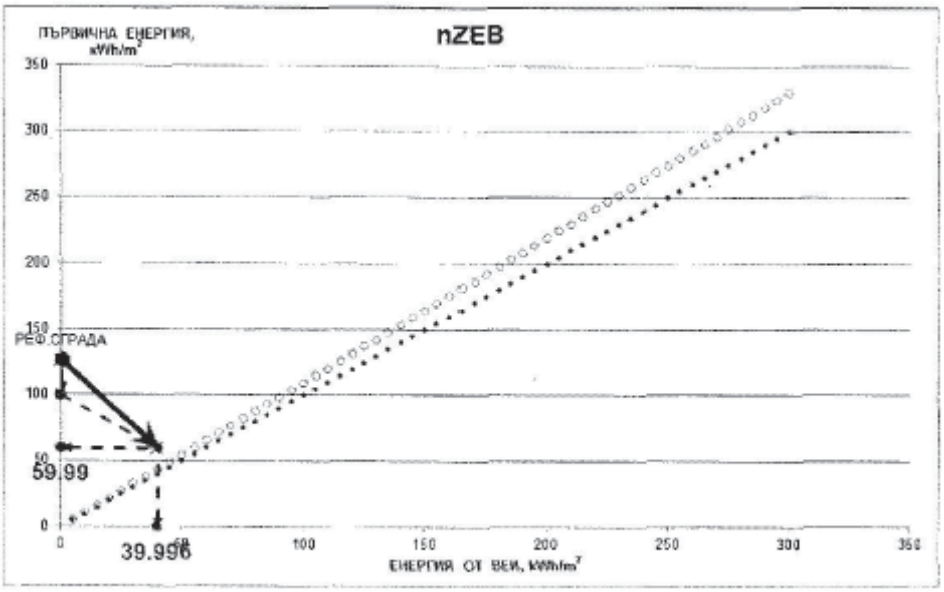
4.1. Model for assessing the achievability of energy consumption in accordance with the definition of a nearly zero-energy building

On the basis of the national definition of nearly zero-energy buildings described above, an automated energy model has been devised for buildings, allowing express assessments of buildings' conformity with the definition's requirements to be carried out. The model is applicable both at the design stage and at the stage when the results are checked after building completion.

Fig. 10 illustrates the results from a check made of a kindergarten on the possibilities of meeting nearly zero-energy building conditions.

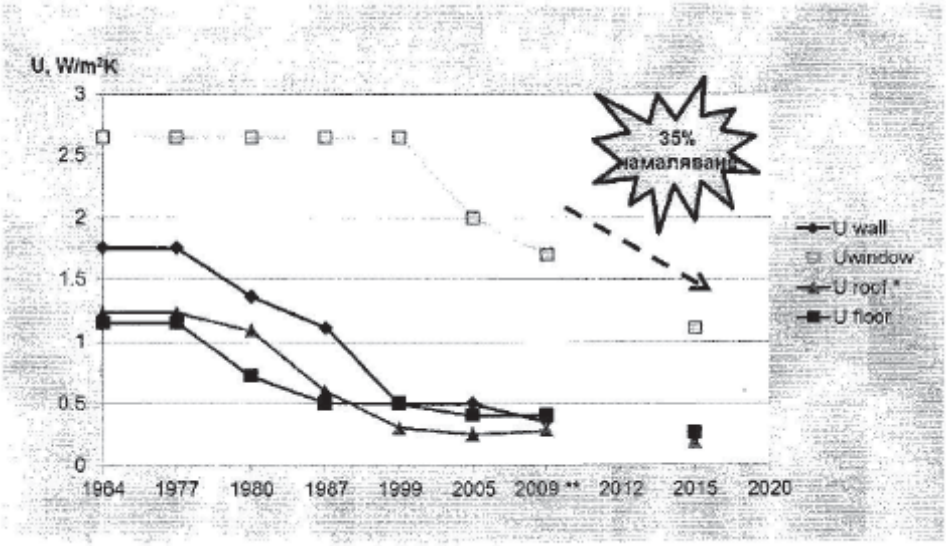
Fig. 10





Фиг.10

4.5. Proposal to improve the energy performance of building envelopes:



Фиг. 11

This element was checked for four reference buildings: a hospital; a school; a kindergarten; and a 5-storey residential block. The check showed a reduction in the energy demand for heating and hot water of between 18 and 32 %.

4.6. Proposal to improve the energy performance of systems for maintaining building microclimates:

- a minimum seasonal thermal pump transformation coefficient of 3.5;
- where central heating boilers are used – mandatory installation of condensation boilers;
- designing water-based heating systems with a heat medium temperature no higher than 60 ºC.

These indicative proposals to improve the energy performance of buildings and increase the number of nearly zero-energy buildings will be approved in 2013—14 after the data from statistical and information systems on the state of energy consumption in existing buildings have been thoroughly analysed, a number of engineering science and research projects have been carried out and feasibility and applicability calculations have been made, taking into account national characteristics. These would have been calculated using correlational and simulation methods, when national parameters expressed in numeric reference values for annual energy consumption by energy consumption class and building type have been determined, and after a public discussion has been conducted involving all players — designers, builders, consultants, consumers, etc. The indicative proposals will be approved with the adoption of the relevant standards for energy efficiency of buildings.