

**UNECE project "Enhancing Synergies in Commonwealth of Independent States (CIS) National Programmes on Energy Efficiency and Energy Saving for Greater Energy Security "**

**Development of the Regional Action Plan and Recommendations for development and implementation of energy efficiency and energy saving policies in the CIS**

**2013**

## List of abbreviations:

CHP	Combined heat and power plant
CIS	Commonwealth of Independent States
ECE	UN Economic Commission for Europe
EE	Energy Efficiency
ESCO	Energy service company
ES	Energy Saving
EU	European Union
GDP	Gross Domestic Product
GEF	Global Environment Facility
KWh	Kilowatt-hour
MW	Megawatt
IMF	International Monetary Fund
IEA	International Energy Agency
R&D	Research and Development
RES	Renewable Energy Sources
toe	Tons of oil equivalent
TWh	Terawatt-hour
UN	United Nations
UNDP	United Nations Development Programme

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## **Chapter 1. Review of international experience in increasing energy efficiency**

### **1.1. Energy saving in the world and long-term prospects for energy savings**

Energy saving and energy efficiency strategy allows to obtain very good results with relatively low risks. In fact, the model of growth based on the principles of energy efficiency and environmental acceptability is a global response to the challenges of energy security.

Average costs of energy saving measures are twice more effective than maintaining and developing capacities of fuel and energy complex (FEC), and this difference increases with the growth of fuel prices and tightening of environmental requirements. In addition, as a rule, reduction of energy consumption through increasing energy efficiency leads to a significant improvement of environment by reducing emissions of greenhouse gases and pollutants, i.e. increasing energy efficiency is an adequate response to environmental threat.

In this regard, the inevitability and certainty of energy conservation as one of the sources of economic growth without negative consequences for the environment is generally accepted in the world. However, despite the fact that energy saving is cheaper than additional energy production, it demands more sophisticated organizational structure because of the need to motivate both population and economic entities.

Experience in implementing policies aimed at improving energy efficiency proved that for the best results, energy efficiency should be integrated into other areas of economic and social policies, ranging from industrial development to transportation and environment, which means practically into all spheres of state activities.

In the past two decades, the focus was on the integration of energy efficiency with environmental policy, particularly with regard to global climate change. Almost all national and regional energy efficiency strategies are directly linked to climate change prevention policies.

Global energy savings potential is huge. According to the International Energy Agency, the successful implementation of energy efficiency measures would cut greenhouse gas emissions by 80%, while significantly increasing the security of supply.

According to the IEA estimates, just increasing energy efficiency of electrical appliances by using best available technologies in the framework of a policy aimed at reducing the cost of using electrical appliances for the final consumer, will save up to 1,000 TWh by 2030 compared to the existing situation. Production of vehicles with lower fuel consumption will drastically reduce the fuel demand. According to the existing forecasts, transport sector will account for

43% of energy demand by 2025 in the rapidly growing economies of developing countries compared with nearly 35% in 2008.

Energy efficiency of technologies and products is currently one of the main indicators of competitiveness because energy conservation policies cover more and more countries.

Energy efficiency can be improved also in developing countries, and this group of states is already aware of the prospects for energy saving. For example, developing countries with rapidly growing economies could develop and implement a set of measures aimed at improving energy efficiency of its rapidly growing park of machinery and equipment.

China, India, Brazil and other countries with a rapid economic and energy demand growth over the last two decades are also beginning to move to energy conservation policy under the conditions of rising hydrocarbon prices.

One of the most important recent trends is the improvement of energy-saving and energy-efficient technologies in the construction sector. Energy saving potential is high – IEA estimates the share of buildings and equipment at one-quarter of possible CO<sub>2</sub> emissions reduction in the period until 2050.

Energy saving in the transport sector is also a priority.

Increasing the share of new and renewable sources of energy is also integrated into energy efficiency policy in developed countries. Due to the continued development of new technologies the use of renewable energy sources like solar energy, hydropower and biomass becomes more affordable and efficient. Economic factor is the main limit – they are still expensive. However, the continuous scientific and technological progress in utilization of new and renewable energy sources (NRES) and constant rise in price of traditional energy resources, primarily liquid hydrocarbons, extend the application of NRES mainly in the areas where centralized energy supply is not available.

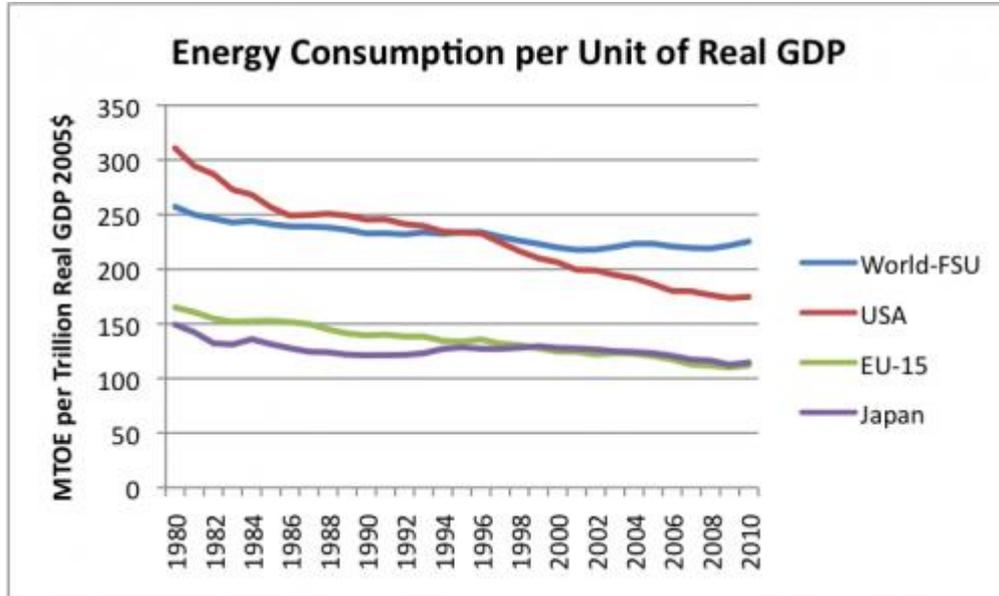
## **1.2. Major trends and approaches to increase energy efficiency in developed countries**

There are very clear differences in approaches to energy saving in different countries associated with the peculiarities of national mentality, cultural preferences and prevailing stereotypes of behavior. However, an important common feature of developed countries is to focus energy saving policy on the side of energy consumption.

This implies that the generating companies even without explicit policy are interested in improving efficiency of their facilities and the rational use of fuel, as it allows them to increase profit and to improve the competitiveness of companies in the market.

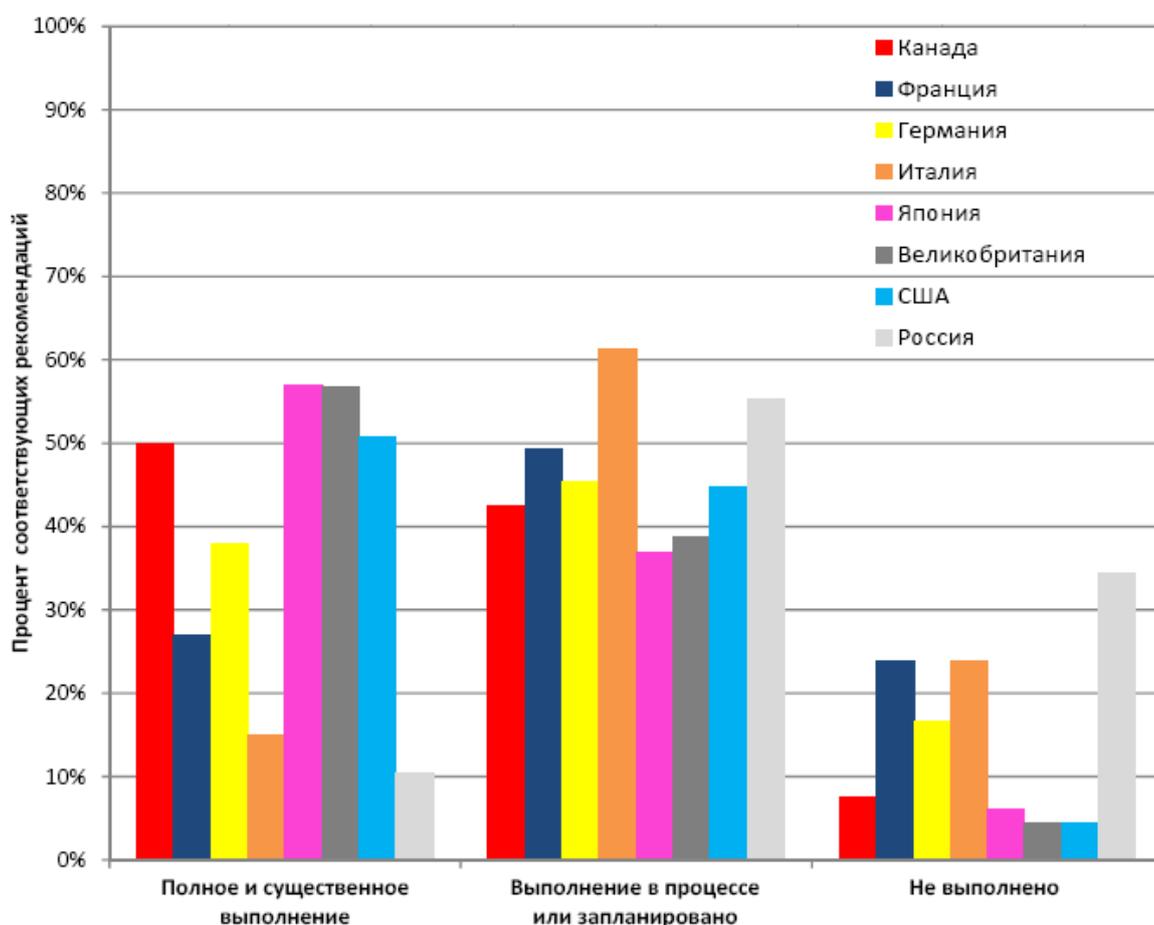
The following figures demonstrate the overall dynamics of specific energy consumption by the most developed economies in the world, as well as illustrate the governments' efforts to improve energy efficiency.

**Figure 1. Dynamics of GDP energy intensity in the U.S., Japan, EU-15 and the average in the world (except for the countries of the former USSR)**



It is important to note that despite considerable experience gained by the leading economies of the world in the area of energy saving, even the most advanced countries have not yet produced clear energy efficiency indicators and methods to measure them. In this regard, the detailed statistical data does not exist. The energy intensity of GDP is the only relatively universal and internationally comparable indicator of energy efficiency. For countries with comparable climatic conditions and levels of socio-economic development there are sometimes indicators of energy consumption per capita.

Almost all international organizations working in the area of energy have addressed the issue of energy efficiency in the last 5 years. The International Energy Charter, the IEA in collaboration with the newly established International Partnership for Energy Efficiency Cooperation, UNECE issued a series of analytical reports on the policies, tools and approaches to financing energy efficiency.



The problem of monitoring and evaluation of energy efficiency has not been solved yet due to the lack of clear measurement methodology and evaluation criteria, as it is noted in publications, and so the provided information is obtained by calculation by national authorities and incomparable.

Results shown in Fig. 1 and 2 data demonstrate that the EU-15 and Japan are leaders in improving energy efficiency and have quite similar results in specific energy consumption.

This chapter is devoted to the general approaches and particular features of energy efficiency policy implementation in the United States, Japan, Germany, the UK and Norway.

### 1.3. U.S. approaches to energy saving

The U.S. economy is 2.5 times more energy efficient than Russian economy. According to some expert estimates the energy intensity of the industrial production in the USA is 9 times lower than in Russia.

Currently, the level of energy consumed in the country per \$1 of production of goods and services, has decreased more than 50% compared to 1970. Cumulative energy consumption in

the U.S. since 2000 has remained virtually unchanged at the time of steady growth of GDP until 2008.

USA achievements in energy efficiency are the result of long-term efforts to implement energy saving policy.

***The main and specific feature of U.S. energy efficiency policy is a broad use of various financial incentives and avoiding all sorts of codes and standards.*** The main focus is incentives rather than command and control.

Realizing the opportunities of energy efficiency, more than 60 leading organizations representing various stakeholders across the country joined their efforts to develop the National Action Plan to improve energy efficiency in 2006. Many of these stakeholders are the groups that can themselves provide energy savings: electricity generating and gas supply utilities, regulatory bodies of states, and other organizations.

The Action Plan identifies the main barriers for investments into energy efficiency. It outlines five key recommendations to achieve the goal – to reach the cost-effective energy efficiency. The plan also provides a framework strategy "Prospects for 2025", which provides activities to achieve the goal in a steady and sustainable manner.

The Action Plan was broadly supported by the state governments, generating companies, and consumers throughout the country. More than 120 organizations have endorsed the recommendations and publicly took the voluntary obligations to assist in the implementation of the initiative "Prospects for 2025". Environment Protection Agency and U.S. Department of Energy only facilitate the implementation of this public-private initiative and thus the positions and statements of its members reflect only their own views.

"Prospects for 2025" is the main document of the Action Plan. The U.S. regulation system for energy utilities envisages a key role of states: majority of measures to remove barriers to energy efficiency could be implemented at the level of states. Therefore, the approach set out by "Prospects for 2025", which is a part of the Action Plan, became a basis for strategy that contributes to cost-effective energy efficiency and recognizing at the same time the diversity of regional, national and local conditions and regulatory structures. Further development of strategy details and decision making on its implementation are carried out at the level of states. The proposed basis could be updated and improved in future.

As part of "Prospects for 2025" more than half of the states have adopted their own Energy Efficiency Programs and established Construction Codes that require energy efficiency in new buildings. In addition, approximately half of the states have established targets for energy saving and have overcome barriers for generating and municipal companies to improve energy

efficiency. For example, some states have adopted measures which do not allow municipal energy companies to obtain profit from the sale of additional energy.

In general, the U.S. has not achieved the same success in ensuring consistent stable funding for energy efficiency projects and other activities. Construction of power plants, power lines and gas pipe lines is consistently funded due to the regulatory framework at the level of states, which allows return on the approved capital investments into infrastructure improvements through increasing consumer tariffs.

States, energy companies and other organizations spend about \$ 2 billion per year on energy efficiency programmes. This level of investments allowed to reduce electricity consumption and save annually the amount of energy equal to the generation of 30 power plants with the total capacity of 500 MW per year, and to reduce greenhouse gas emissions in the amount equal to emissions of 9 million vehicles per year. It permits energy consumers to save annually about \$ 6 billion.

The economic stimulus approved by the Congress and endorsed by the President provided a significant increase of financing for energy efficiency projects. Moreover, this package of measures will help develop human capital with experience and training in the area of energy efficiency.

The strategic framework of "Prospects for 2025" set out in the Action Plan are offered to the states to consider and determine how they could encourage energy saving and preserve jobs in the long term period. In some cases it is possible to revise the distribution of incentives between consumers and suppliers of energy.

American Recovery and Reinvestment Act, which entered into force on 17 February 2009, aimed at promoting unprecedented level of investments into energy efficiency in the United States. State budget allocations for energy saving and energy efficiency improvements within the received package of economic stimulus increased by \$ 17 billion.

In particular, in 2009 the following amounts were allocated:

- \$15 billion to develop new technologies for renewable energy use and to increase the efficiency of produced vehicles;
- \$5 billion to help low-income families to increase energy efficiency of residential buildings (the programme has been existing already for about 30 years);
- \$4 billion to modernize public housing;
- \$300 million for discounts to consumers who buy energy-efficient appliances;
- \$3.2 billion grants to states to support energy saving programmes in public buildings;

- \$4.2 billion to improve energy efficiency in buildings owned by the federal government;
- \$6.9 billion to improve energy efficiency of public transport systems.

According to the Government, investing in more efficient technologies and methods used in homes, enterprises, schools, government institutions and industries, which account for 70 percent of natural gas and electricity consumption in the United States, is one of the most productive and economically viable methods to create new jobs. At the same time, these investments will help address the problems linked to high energy prices, energy security and independence, the environment and global climate change in the short term. It is expected that improving energy efficiency would help the United States to deal with the anticipated increase of electricity and natural gas consumption in the coming decades by 50 percent or more by reducing energy costs by billions of dollars and significantly reducing greenhouse gases and other air pollutants emissions.

### **1.3.1. Key objectives and directions of improving energy efficiency in the U.S.**

The main objectives of public policy to improve energy efficiency:

- to reduce the dependence of the U.S. on oil imports;
- to develop and implement energy-saving technologies for public buildings, residential buildings, transport, energy and industry sectors;

To ensure the implementation of these goals, the Office of Energy Efficiency and Renewable Energy was created in the structure of the U.S. Department of Energy with the following main tasks:

- strengthening energy security of the U.S.;
- improving the quality of environment;
- ensuring the economic viability of public-private partnerships, which are aimed at the improvement of the labour efficiency and productivity, the implementation of environmentally friendly, reliable and affordable energy technologies, the introduction of alternative energy sources, providing higher quality of life, into the daily life.

Main directions of budget financing:

- Investments into the development of energy efficiency technologies with high implementation risks;
- promotion of clean energy technologies and practices;

- promotion of energy-efficient appliances and equipment with low environmental pollution;
- reduction of the construction costs for energy-efficient houses;
- assistance to the low-income population to reduce energy consumption costs;
- maintenance of the reliability of energy transportation infrastructure.

**There are two basic ways to stimulate energy efficiency in the U.S: financial incentives and broad public awareness about possible energy savings.**

General principles of the government policy to improve energy efficiency:

- energy efficiency goals should be fully reflected in actions;
- activities in the areas selected by the government should be beneficial to people and businesses through government incentives and preferences;
- the government should provide detailed information to households and businesses concerning the objectives and priorities in improving energy efficiency as well as on the conditions to receive governmental support for activities in the priority areas.

### **1.3.2. Types of economic incentives for energy saving in the U.S.**

**Tax exemptions** are used for:

- taxation of vehicles with hybrid engines, electric motors, vehicles using LPG and hydrogen as a fuel, fuel cell vehicles, vehicles with engines running on lean fuel mixture;
- taxation of slow-moving vehicles.

**Tax credits** in the amount of 10% to 30% are available to those businesses that:

- install alternative energy equipment: solar energy installations, micro turbines, small wind farms, micro-CHP with efficiency above 60% to utilize wind energy and tidal energy, installations using fuel cells and geothermal energy;
- purchase appliances that meet the requirements of the energy efficiency standard “Energy Star 2007”;
- build residential houses with energy efficiency indicators 30-50 % higher than energy efficiency standard requirements;
- use energy from alternative sources (wind, landfill gas, municipal waste, geothermal energy, micro-hydro power plants, tidal and wave power plant).

**Personal tax credits** for improving energy efficiency of houses (up to 30% of the expenses) are used for financing the following types of improvements:

- insulation;

- energy-efficient windows and doors;
- insulating roofs;
- heat pumps;
- efficient water heaters;
- centralized air-conditioning and ventilation systems;
- use of gas;
- biomass heat generators;
- solar energy installations;
- fuel cells;
- small wind power plants;
- geothermal heat pumps.

**Tax deductions.** Amount is determined per square meter of the building separately for the application of various methods to improve energy efficiency:

- insulation;
- air-conditioning;
- lighting, etc.

Provision of improvements in the design documentation is the basis for deduction. Tariff discounts for using alternative energy sources and confirmed savings are excluded from the tax base.

**Issue of tax-free securities.** A project contractor receives government securities with a fixed amount equal to the cost of the project. Securities should be presented by the project contractor for payment for the work done. The project contractor produces separately an interest-free repayment of securities value to the government. Tax-free securities are provided on a competitive basis.

**Soft loans.** A set of federal programmes envisage repayment of the loan rate for the loans used for EE project implementation.

**Accelerated amortization for** the list of alternative energy installations:

- various equipment for solar energy use;
- fuel cells;
- micro-turbine;
- geothermal energy installations;
- heat pumps;
- small pressure wind turbines;
- co-generators;

- biogas plants;
- joint use of several sources of energy for power generation.

**Research grants** are used for financing of research in the following areas:.

- solar energy ;
- training of professionals for the development and operation of solar power systems;
- the labeling of energy efficient products;
- activities related to the development and implementation of LED and organic solid-state light sources;
- support of perspective researches, selected on a competitive basis, including " incubators " of energy;
- repayment of the part of investments into alternative energy projects.

**Stimulating the production of "clean" energy.** Compensation of the cost of energy generated from (per kW-h):

- solar energy;
- landfill gas;
- wind;
- biomass;
- geothermal sources;
- anaerobic digestion;
- tidal energy and wave energy;
- heat of the ocean.

### **1.3.3. Informing about the opportunities of energy saving**

There are federal programs to promote energy efficiency and ways to improve energy efficiency in the United States. The websites of public authorities and EE funds present to the public information in accessible form and free of charge. There are also libraries of regulations involved into implementation of state programs for energy saving and improving energy efficiency.

"Energy Star" - program of voluntary certification of electrical household appliances, which is held since 1992, plays an important role. Companies whose products win the annual competition are awarded. This event is accompanied by massive information campaign for consumers calling to give preference to certified products. According to the estimates,

consumers who have chosen the products labelled as «Energy Star» - only in 2008 saved \$ 19 billion on municipal services bills and prevented greenhouse gas emissions equivalent to emissions of 29 million vehicles.

At the beginning of the program only computers and monitors were labeled. Today logo «Energy Star» can be found on more than 60 categories of goods, including major appliances, office equipment, lamps, and home electronic utilities. New houses as well as commercial and industrial buildings also could be certified on a voluntary basis according «Energy Star» rules for more than 10 years.

By 2007, about 12 percent of new houses were built according to «Energy Star» standard. This means that they consume 35-40 percent less power than the average house. The Environment Protection Agency is committed to improving the energy efficiency of housing already existing in the country by upgrade of "the whole house". There is a hope to overcome obstacles to the reconstruction of housing, which allows owners to achieve an average of 20 percent of energy savings, by implementing the program and directing owners to skilled professionals in the field of building renovation.

#### **1.4. Approaches to energy saving in Japan**

Energy saving measures were adopted in Japan after the first oil crisis and allowed to decrease the GDP energy intensity by 35% by 1985. But after this energy consumption increased annually by an average of 3.1% during 7 years. Therefore, the Japanese government have revised the Law "On the rational use of energy" in 1993. According to the new Law, the Ministry of Economy, Trade and Industry of Japan (METI) have to establish and declare the basic policy principles aimed at encouraging a comprehensive energy management, and the main consumers should contribute to improving energy efficiency in accordance with this policy. Japanese Centre for Energy Saving is the main institution to implement state EE policy.

#### **Legislative framework and its characteristics**

There are three main laws regulating the sphere of rational and efficient use of energy and resources: "On the rational use of energy", "On energy policy" and "On promoting the efficient use of energy".

The purpose of the Law "On the rational use of energy" is to ensure the efficient use of energy resources in accordance with the economic and social situation in the country and abroad, and to take measures aimed at the rational use of energy by industries, organizations, transport and construction companies, and when operating of machines and energy consuming equipment.

According to the Law the METI develops policy guidelines for energy efficiency, which include the following directions:

- identification of EE measures to be implemented by energy consumers;
- development of incentives to promote the efficient use of energy;
- other issues related to energy efficiency measures to be implemented, taking into account the long-term forecasts of energy supply/demand, the technical level required for efficient use of energy and other conditions.

Developed by METI policy framework, are revised by the Japanese government as necessary due to the changes in conditions affecting the energy consumption.

The law obliges the government to take financial and tax measures to improve energy efficiency, to promote scientific developments in the field of efficient energy consumption, to raise public awareness and explain the need for rational use of energy.

The purpose of the Law "On energy policy" is to promote activities to ensure the security of energy supply in the long term period, the environmental protection and sustainable development of the national economy.

According to the law, METI on behalf of the government develops a Plan of energy supply for 3-years period and submits it to the Parliament. The following questions should be reflected in the Plan:

- main directions of energy policy;
- actions to ensure energy supply, which are necessary to conduct on systematic and long-term basis;
- development of energy technologies.

Plan is developed on the basis of three principles enshrined in the law:

- ensuring energy security, including measures for resource saving, diversification of supply of imported energy resources and development of relations with the major exporting countries, increasing energy self-sufficiency, creation of strategic reserves of oil, oil products and natural gas;
- environment protection, including measures to reduce greenhouse gas emissions, increasing use of alternative energy sources, development and implementation of resource- and energy-efficient technologies;
- pursuing energy policy on the basis of market mechanisms.

Law "On promoting the efficient use of energy" was adopted to support the businesses and organizations that voluntarily carry out activities to promote the efficient use of energy and natural resources.

According to the Law government is developing requirements for the projects to improve energy efficiency and saving of resources. Companies or building owners should provide project plan to the relevant ministry to obtain support and approval by the government. The law defines three categories of projects which are the subject for the government support:

- the installation or upgrading of equipment to improve energy efficiency;
- using energy-saving materials in the construction of building;
- organization of research and development works in the area of energy efficiency.

According to the law, the government provides the following support measures:

- loans with minimum interest rates (up to 2% per year);
- subsidies by New Energy and Industrial Technology Development Organization (NEDO) - an independent organization under METI.

National Strategy for Sustainable Development of Japan adopted by the government of the country in 2007 set the goal for Japanese society to reach in the 21st century leading positions in the field of waste recycling, using environmental, resource-saving technologies and production of environmentally friendly goods.

The Japanese government through setting up the goal to increase energy efficiency by 30% up to 2030 compared with the level of 2006 is obliged to provide the modern structure of the energy supply and demand in the market with high prices, which are expected by the government in the medium and long term.

Japan took the obligation to invest about \$ 1.6 trillion yen into the creation of so -called "low-carbon society" - a society with low CO<sub>2</sub> emissions , including 3.77 trillion yen into the replacement of old cars with new more fuel efficient ones, and 295 billion yen into assistance in purchasing energy-efficient appliances.

Japan stimulus package also includes the allocation of resources to subsidize businesses that implement energy-efficient equipment and utilities as well as to improve small and medium enterprises through energy audit and investing innovative energy-saving technologies.

In April 2009, the Government of Japan, relying on the strategy of economic development and measures to overcome the economic crisis, approved the concept of reducing CO<sub>2</sub> emissions. The main purpose is to overcome the stagnation and to provide medium-and long-term economic growth in Japan by giving an impetus to the national production in addition to increase and wide use of new and renewable energy sources.

The concept envisages the introduction of 3 basic components into various spheres of society. Those are solar energy, electric cars and energy-saving appliances. The specific objective is to double the share of renewable energy consumed and to achieve the highest rates in the world - 20%.

Plan for the dissemination of practice of new energy sources utilization includes:

1. 4-year plan of financial support for increasing the generation of solar energy.
2. Soft financing program for wide utilization of household fuel cells in housing sector. The state and local governments provide a 10-year programme of soft lending for houses with electric panels and guarantee to purchase electricity surplus.
3. Policy of supporting hybrid, electric and other environmentally friendly vehicles.

According to long-term energy strategy, Japan plans to increase the level of energy self-sufficiency from 18% to 70% in 2030. As the global competition for resources is expected to increase, the government aims to strengthen energy security.

As part of the program, the government contributes to the creation of alliances of generating companies, oil and gas companies on the one side and other stakeholders interested in the renewable energy business on the other side. In particular, this programme provides financial support to the companies implementing RES projects abroad.

In 2010 in Japan the large-scale R&D investigations were launched in the area of modern high-performance wind turbines (allocated financing - approximately \$23 million per year), new types of energy storage units (\$30 million), powerful long-life batteries for cars (\$25 million) and stationary accumulating systems (\$43 million).

#### **1.4.1. «Top Runner» programme**

Japanese programme «Top Runner», established in 1999, provides standards to promote more efficient appliances and cars on the market. It was developed in order to ensure compliance with the country's commitments under the Kyoto Protocol.

*Its purpose is to establish the average (but not minimum) standards for energy characteristics on the basis of average sales volume of energy efficiency mandatory targets for manufacturers.* The program applies to mechanical engineering products and equipment used in the country in commercial quantities, which consume significant amounts of energy. Obligations to perform the specific tasks are applied both to domestic producers and importers.

Target indicators are set on the parameters of the most energy efficient products available on the market. Standards are usually revised every 4-8 years.

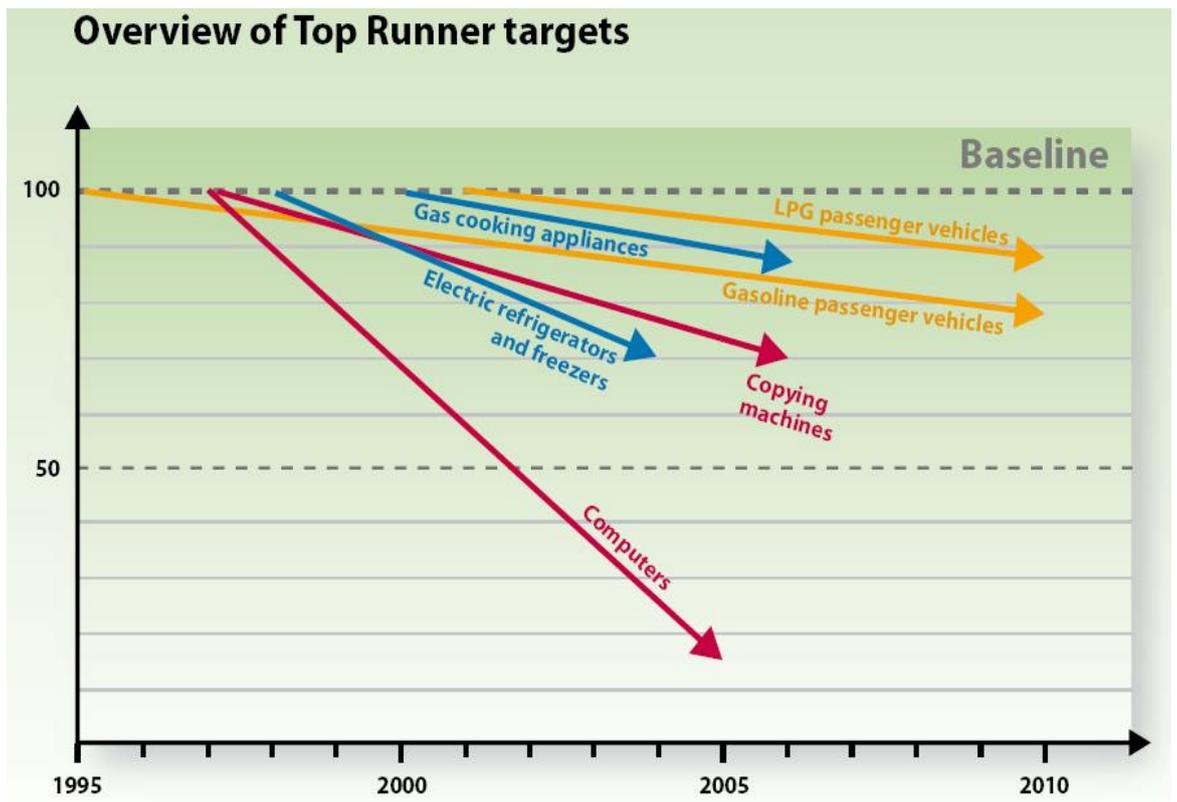
Figure 3 shows the targets for energy savings for different types of household and office equipment.

Achievements of the first programme "Top Runner" exceeded all the expectations and the program was expanded. Initially, the programme covered cars, air conditioners, fluorescent lamps, TVs, VCRs, copiers, computers, magnetic disk storage, trucks, electric refrigerators and freezers. In 2002, its scope was extended to household electric heaters, gas stoves, gas water-heaters, diesel heaters, electric toilet seats, vending machines and cast resin transformers.

The plan of energy conservation "Top Runner" in the framework of the National Energy Strategy of Japan supports the national strategy to reduce oil consumption. In 2006, the programme was expanded to microwave ovens, electric steamers, writing DVD-players.

Japanese standards of fuel consumption for heavy-duty vehicles, which are being gradually introduced until 2015, became an innovation in the world energy efficiency policy for transport sector. Japan is the only country in the world where such standards are in force. In addition, Japan has the most extensive programme of "eco-driving".

Figure 3. Energy savings targets for different types of appliances and office equipment.



Germany, United Kingdom and United States are also implementing programmes of eco-driving, taking into account the experience of Japan. The IEA estimates that eco-driving allows achieving 10% of fuel economy in transport sector in the medium term (up to 3 years).

Japan and Germany have introduced incentive schemes for scrapping old vehicles.

## **1.4.2. Regulatory practice in the area of energy saving in Japan**

### **A. Regulation in the industrial sector**

Currently, the industrial sector, which consumes more than 50% of the energy, the regulatory practice includes the following main areas.

#### **1. Methodological guidelines for managers of industrial enterprises**

METI with the assistance of specific regulating bodies for each particular industry, sets standards and guidelines for managers and CEOs and give the necessary instructions concerning energy use in relation to:

- efficient fuel combustion,
- improving heating, cooling and heat transfer,
- prevention of heat losses,
- use of waste heat;
- efficient conversion of thermal energy into electric power;
- electricity losses reduction.

#### **2. Energy management**

METI obliges each industrial enterprise and energy company, consuming gas and heat in quantities exceeding 3000 toe per year, or more than 12 GW of electric power to establish energy management service.

Head of the company should appoint a certain number of licensed energy managers, the main task of whom is to take measures for the rational use of energy and to provide annual energy efficiency reports to the ministry or government agencies supervising this industry.

Examinations and licensing of energy managers is performed by the ministry itself or by the authorized organization. The law defines the procedures and criteria for examinations as well as other rules concerning the granting and revocation of licenses.

It is interesting that the average rate of successful attestation for heat supply engineers is 30% and for power supply engineers is 22%.

#### **3. Monitoring of the use of energy**

If the company allowed flagrant violations of the energy management principles, the ministry may require (itself or through the appropriate authority) the head of company to submit an energy saving plan; to react to violations of energy saving discipline, ministry will demand to perform activities required by the instructions.

#### **4. Energy audit**

Large enterprises obliged to establish the energy management unit should have the necessary monitoring equipment to conduct energy audit themselves with the support of energy managers.

For small and medium-sized enterprises (with fewer than 300 people), energy audit is free. One or two inspectors of the Japan Center for Energy Management (JCEM) fulfill the audit in one or two days. In medium or large companies GSEM conducts regular energy audits. Two or three experts conduct first a preliminary examination, which will be followed by a detailed audit of industrial processes with proposals of concrete activities for energy saving plan with the definition of expected benefits and the required funds.

#### **B. Regulation of energy consumption in buildings**

Any person or organization intending to construct a building is obliged to take all possible measures to prevent heat losses, to use in rationally all types of power equipment in building in accordance with the standards established by METI and Ministry of Construction. There are the limits for heat loss through the walls of buildings, energy consumption limits for air conditioners, fans, efficiency of lamps, heating systems, elevators, etc. Both ministries give the necessary advice and guidance both for the contractors of large buildings and for owners of private housing.

If the Ministry determines that for buildings larger than 2000 m<sup>2</sup> energy efficiency does not conform to the standard and owner does not follow relative requirements, the ministry should inform the appropriate authority.

#### **B. Energy efficiency regulation measures for energy-intensive equipment and vehicles**

Large share of energy consumption falls on cars, air conditioners and other energy-intensive equipment. Its efficiency envisaged by design parameters is determined at the

manufacturing stage. The law imposes certain obligations on manufacturers and importers of vehicles and household equipment. METI sets energy efficiency standards, obligatory for major suppliers. Similar standards are set for electrical appliance, up to identification of power consumption limits for magnetic disks for computers.

#### **D. Informing the consumer**

There are measures taken to raise public awareness about energy saving: brochures and posters published, symposiums organized and media used. Among the public events are "Day of energy saving", "Month of energy saving" and "Energy Saving General Inspection" - to educate the population and to increase public activity.

Equipment shall be labeled in such a way that ordinary consumers could choose the most efficient models. Labeling rules for energy efficiency equipment are defined by METI and other ministries.

Energy saving law sets also other requirements related to financial and tax stimulus to promote energy efficiency. The law establishes a reporting procedure, rules for inspections and penalties. The law envisages the possibility of amendments and changes of certain articles in accordance with the changing conditions.

In particular, in the period of increase in energy consumption due to the low energy prices, the government imposed special financial and technical measures to reduce energy intensity in industry and the public sector.

#### **J. Specific features of the organization of work in the field of energy efficiency on enterprises**

Enterprises in Japan widely practice so called "quality teams" - small groups consisting of employees of the company who develop and implement proposals to improve labour conditions and production process including energy efficiency, themselves or with the assistance of senior executives. This work is initiated and promoted by the company's management. The activity of "quality teams" gives a tremendous practical effect.

Basic principles of "quality teams" work:

- full realization of the potential of each person and of the group;
- improving working conditions, so that work become pleasant, vital and satisfying;
- contribution to the improvement and development of the enterprise.

Senior executives provide the conditions for "quality teams" in order to strengthen the enterprise capabilities.

## **Tax, custom, credit and other mechanisms to promote energy efficiency and resource conservation**

### *Credit programme*

On the basis of the law "On energy saving and recycling" in 2008, a special loan programme for small and medium-sized enterprises was developed.

In case of purchase, rent or leasing of energy-saving equipment, Japanese Finance Corporation (JFC) provides loans to cover the cost of equipment up to 270 million yen with special discounted rates, and for amount over the indicated limit - with standard rate. Financing Terms: direct loan (the amount for equipment is transferred directly to the account of the seller) - 720 million yen, an alternative (the amount is transferred to the merchant via the buyer's account) - 120 million yen. Interest rate depends on the conditions of financing, credit risks and loan period. Loan period is up to 15 years (grace period of loan repayment - 2 years).

### *Tax benefits*

This programme is based on the document "Tax system for reform and promoting investment in energy supply and demand projects".

In case of purchase of energy-saving/energy-efficient equipment and start of using it no later than one year after purchase the buyer can take advantage of one of the two tax schemes:

A. For small business - tax credit in the amount of 7% from the cost of purchased equipment, which cannot exceed 20% of paid income tax or corporate tax.

B. For all businesses - tax deduction in the amount not exceeding 30% of the cost of the equipment in the year of purchase.

### *Subsidy programme*

The government has developed a special subsidy programme for the companies that increase energy savings.

#### In the industrial sector:

- Support for projects promoting rational use of energy in the operating plants;
- Support for investigation projects aimed at consideration of modernization possibilities;
- Support for projects promoting energy saving services in the market.

#### In the commercial sector:

- Promotion of projects for the introduction of energy efficient technologies in houses and office buildings;
- Promotion of projects providing services in the field of energy saving;

- Grants for promotion of highly efficient natural gas water-heaters;
- Support of projects of installation of energy-efficient air-conditioning systems.

In the transport sector:

- Promotion of projects of modernization and upgrading vehicles.
- Installation of additional equipment to improve engine efficiency.

## **1.5. Approaches to energy efficiency in the European Union**

### **1.5.1. Common approaches to energy saving**

The European Union is the main driving force in the promotion of energy efficiency strategies and combating global climate change. The influence of its norms and standards extends far beyond its 28 Member States.

Not all EU member states pay equal attention to energy efficiency but now there is a requirement on certain basic policy. Several countries have moved far beyond this minimum. Non-EU countries are encouraged to create tougher legislation in the area of energy efficiency with regard to their relationship with the EU. So many states which are not members of the European Union, achieved significant results in the implementation of commitments established by the EU.

A number of policy statements (concerning Green Paper on Energy Efficiency, Action Plan in the field of energy efficiency, energy policy, climate change) were accompanied by legislative initiatives, ordered the EU Member States to prepare energy efficiency action plans. Even if not all EU member states give the same priority to energy efficiency in their policy, the EU requires following the basic policy, which is much tougher than these countries have implemented before. Thus, the EU is an important initiator of the development of national energy efficiency strategies.

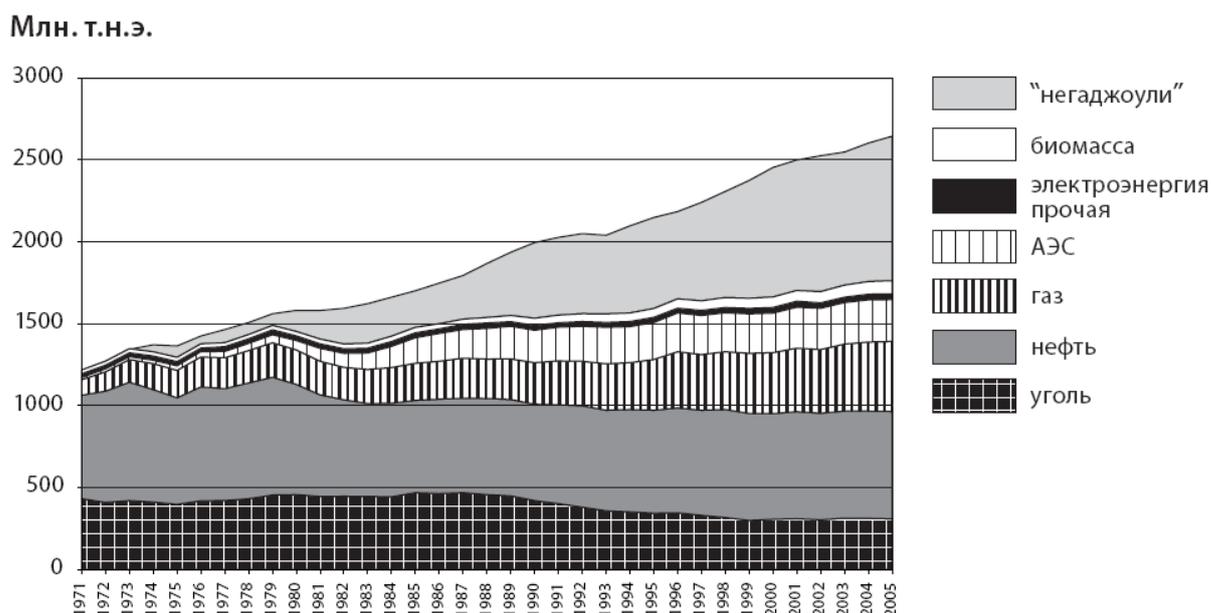
A number of countries have adopted an integrated policy in the field of renewable energy and energy efficiency, where such a combination is often referred to as a sustainable energy strategy. Such measures have been implemented for a long time, and benefits leave no doubts concerning its results.

Since the 1990s, the EU policy in the field of energy efficiency is closely linked to climate change issues and integrates many aspects of the use of renewable energy technologies and improving the use of all fossil fuels.

In 2000, the European programme in the field of climate change was established. Its emphasis was on improving efficiency. In the framework of measures recommended for all end-use sectors: wider use of combined heat and power generation, improving energy efficiency standards for electrical equipment, improvement of standards for industrial processes, improving efficiency with limited carbon dioxide emissions (for boilers, construction materials, etc.), expansion of services to small and medium-sized enterprises (SMEs); development of the model of voluntary agreements; government procurement of energy-efficient technologies for end-use sectors, energy audits and certification of thermal characteristics, improving the structural and operational characteristics of buildings (lighting equipment, building design and planning of infrastructure); setting of tariffs for transportation, and the European campaign to promote driving skills designed to ensure fuel economy. All these measures were practiced in the past, but now they are widely accepted in the context of the strategy to combat climate change.

The EU Energy Efficiency Action Plan provides an analysis of consumption and energy savings since 1971. It shows that by 2005 the increase in energy consumption was carried out mainly by the so-called "negaJ" (i.e., energy consumption, which has been avoided due to energy saving).

**Figure 4.** Dynamics of primary energy demand and "negaJ" (EU)  
 ("NegaJ" - energy savings, based on the energy intensity for 1971)



### 1.5.2. Regulation of energy efficiency in the EU

The EU applies a very comprehensive approach to the creation of a legal framework in the field of energy efficiency. Main types of instruments used in the European Union are as follows:

- *Resolutions* - are fully binding and directly applicable in all Member States;
- *Directives* - are mandatory for Member States in terms of results to be achieved and should be reflected in the national legal framework;
- *Decisions* - are binding only for those subjects which they address;
- *Recommendations and conclusions* - are not binding and declarative documents.

In March 2007, the European Union adopted the **Energy Efficiency Action Plan for 2007-2012** (so-called plan "20-20-20"). This Plan was formed to implement the Green Paper on Energy Efficiency (2005) and grounded, in particular, on the execution by EU member states of appropriate conditions and measures to ensure by 2020:

- relative energy savings of at least 20% due to improving energy efficiency in comparison with the basic conventional development scenario (*i.e.* the actual reduction of energy consumption by 20%);
- achieving a mandatory share of renewable energy in the total energy consumption of the EU of 20%;
- reducing greenhouse gas emissions by 20% relatively to 1990;
- increase energy efficiency in the residential sector by 20%;
- modernizing and improving the efficiency of power generation sector due to increase of efficiency coefficient by 20%;
- achievement by 2010 of 10% volume of the electricity and gas transmission connection systems, etc.

In 2007, the European Commission tightly controlled the development of national energy efficiency plans (procedures related to the violation of terms of providing national plans against 12 states were initiated) and made a comparative evaluation of these plans.

The European Commission has developed also the additional energy efficiency measures in the framework of the Second Strategic Energy Review in 2008: it was planned to revise the directive on energy consumption in buildings, directive on energy labeling of appliances and preparation of a new directive on labeling of tires. In 2009 the EU member states have reached a preliminary agreement on the above issues

In 2009 a mid-term review of the implementation of national plans for energy efficiency was also done.

In June 2012, the EU adopted a Directive on energy efficiency, which is aimed at achieving the objectives to reduce the primary energy consumption by 20% by 2020 compared with the indicators in the basic scenario.

Full implementation of the Directive countries should implement by the spring of 2014.

Office for implementation of energy efficiency policies of the Ministry of Energy and Climate Change of UK will play a leading role in the implementation of the Directive. It will act in cooperation with other government departments and decentralized authorities to meet the requirements of the Directive at the lowest cost.

For example, the Office consulted on the implementation of the requirements for energy audit in large commercial buildings in 2013.

In EU countries the institutions responsible for the implementation of energy efficiency policies tend to combine the functions of regulation with incentives and provision of information from the very beginning. They work in all end-use sectors, setting goals in accordance with national priorities.

As for the states with a federal structure, the institutions the federation units depending on the legal regulation of separation of powers between the center and the subjects of the federation play the important role. Among the states with strong institutions and responsibilities in practical implementation at subnational levels are Belgium, Germany, Spain, United Kingdom.

The European Union plays an important role in promoting regional and local institutions, often providing seed funding for a limited period of time. ManagEnergy is an initiative of the European Commission's Department on Energy and Transport, designed to provide support to participants working in the field of energy efficiency and renewable energy at the local and regional levels. Its main tool includes workshops for training and events online. There is special search system on its website which allows finding partners from around 3,000 organizations, including 380 energy agencies, which provide an opportunity to gain experience and establish partnerships in the implementation of energy activities at the local and regional levels.

### **1.5.3. Public policy in Germany to improve energy efficiency. Basic approaches, goals and achievements**

There is no specific frame law on energy saving In Germany, but there are Federal law on cogeneration and Regulation on energy efficiency (for the introduction of a standard for housing with low power consumption). Core legal frame is based on the transfer of EU directives on energy efficiency into the national legislation.

An important feature of energy saving system in the country is the predominant funding of banks and large corporations, not the state into energy efficiency activities.

Primary federal institution responsible for energy saving is DENA - German Energy Agency (Die Deutsche Energie-Agentur GmbH - DENA-Limited Liability Company). The Agency was created in 2000 in Berlin. Its founders are Germany (state) and the financial Institution - Credit Office Recovery and Development (KfW) in equal shares.

The system of energy saving management envisages the delegation of main functions to the regional and local levels.

Energy efficiency is closely linked to the efforts to reduce climate change. As part of the German contribution to climate protection in May 2008, the Federal Government has adopted an Integrated Energy and Climate Program (IEKP), consisting of 14 laws, decrees and 7 further activities. The program aims at reducing greenhouse gas emissions by 2020 by 40 % as compared to the basic year (1990). This figure should be achieved through the development of renewable energy, as well as by a significant increase in energy efficiency both in the economy and in households.

It is decided to invest 133.3 billion euro into development of local and regional institutions. At the same time measures to reduce CO<sub>2</sub> emissions and improve energy efficiency, including the use of renewable energy sources are of top priority.

About 1.8 million people, representing about 4.5 % of all employees in Germany work in the field of environmental protection. It is planned to increase their number by half of a million people by 2020. It is assumed that such actions will allow the Federal Government to reduce annual energy costs by 2020 by 20 billion euro and to generate additional investments of \$ 30 billion per year, which will lead to higher economic growth and increased employment.

In addition, the government has increased funding for the modernization of buildings. In 2009, a total of € 1.5 billion has been allocated from the federal budget as grants and low-interest loans to promote the energy efficiency of residential buildings and buildings of local infrastructure.

The main policy objectives of the Federal Government of Germany in the field of energy efficiency are:

- continuous improvement of energy efficiency of the national economy with the aim of doubling the energy efficiency by 2020 as compared with 1990;
- increasing funding for Buildings modernization program in terms of CO<sub>2</sub> emissions for at least 1.5 billion euro per year, significantly improve its efficiency and attractiveness (e.g. by using investment grants and tax reduction measures as well as by including the leased property

into the program) and implementation of energy certificates for buildings. The challenge is to increase the energy efficiency of five percent of existing buildings built before 1978 per year;

- promoting the modernization of existing power plants and the development of decentralized power plants and high-efficiency combined heat and power generation;

- review of funding criteria in the Act on the cogeneration of heat and power on the **basis of the monitoring report;**

- **support of European energy efficiency initiatives and work in relation to the European program "Top Runner";**

- **support** for initiatives by the German Energy Agency DENA on energy efficiency in such areas as buildings, electricity use (for example, standby mode) and transport.

Regional and local governments develop their own plans to implement energy efficiency measures within the approved federal priorities.

For example, since 2007 the administration of Berlin buys for its needs only those cars that consume not more than 6.5 liters of gasoline per 100 kilometers using urban cycle. Prior to 2011, the limit of the allowable costs had to be reduced to 5 liters. When purchasing computers and other electronic devices, administrative officers in Berlin should stop the choice on products consuming the least amount of electricity.

Germany is one of the recognized world leaders in the area of energy efficiency in buildings.

The first in EU "passive" house with low-power consumption, heated by heat generated by its inhabitants, appliances and by alternative energy sources, appeared in Germany about 20 years ago through the efforts of the founder of the Institute of "passive" houses in Darmstadt. Now there are more than two thousand "passive" houses in Western Europe - newly built and reconstructed.

Germany and the UK are the leaders in the implementation of certification of buildings. In Germany alone, there are requirements for energy efficiency, providing the optimum level of the minimum cost for a 30-year life cycle of the buildings.

#### **1.5.4 . The UK Public policy for energy efficiency improvement. Basic approach, goals and achievements**

There is no frame law on energy efficiency. Legislation is mostly based on the transfer of EU directives on energy efficiency into national legislation. Policies and measures in the field of energy saving are outlined in the Action Plan for Energy Efficiency (2007), Program on climate change mitigation of 2006 and the White Paper on Energy. According to the National Action

Plan on energy efficiency, the consistent promotion of energy efficiency in business, public sector and households is the policy priority.

Reaching targets on reducing carbon emissions under the Plan to reduce carbon dioxide emissions for 1980-2050 envisages that the total energy consumption in 2050 should not exceed the level of 2011.

In October 2008, the Department of Energy and Climate Change Mitigation (The Department of Energy and Climate Change - DECC) was created. It is assigned the general functions of promoting energy efficiency and coordinate policies to prevent climate change. It is important to note that the governments of Northern Ireland and Scotland have a considerable autonomy. These regions have their own bodies responsible for policies to improve energy efficiency, which implement regional energy efficiency programs.

To improve policy coordination in the areas of energy efficiency and climate change mitigation the Department revised previously adopted plans and programs, and in July 2009 it was approved The UK Low Carbon Transition Plan - LCTP, and in March 2010. - Household Energy Management Strategy.

In February 2012, there was created the Agency for the Implementation of Energy Efficiency Policies, which is responsible for ensuring consistent implementation of energy efficiency policies for final consumers and supply chain, removing obstacles and gaps, searching for new opportunities, as well as for effective methods and successful examples of their application.

The main objectives of the UK in the field of energy efficiency and the transition to a "low-carbon" economic model:

- development of a distributed system of power generation, including "low-carbon" heat generation;
- more active development of municipal systems, including combined heat and power generation systems;
- active participation in the European carbon trading;
- increasing the share of renewable energy consumption;
- support and development of alternative fuels for transport.

Basic tools to achieve these goals:

- broad information campaign;
- tightening of standards to "washout" inefficient products from the market;
- participation in the carbon trade and encouraging the use of instruments of the Kyoto Protocol;
- conducting activities in the governmental buildings in order to make them "carbon neutral" by 2012;

- implementation of energy efficiency programs in the transport sector ;
- introduction of new standards for large consumers of energy in the industrial sector ;
- implementing energy certificates;
- improving energy efficiency in existing buildings and the implementing "carbon- neutral" building standards by 2016 ;
- increasing energy efficiency standards for electronic appliances and using energy-saving lamps by 2012;
- implementation of the " low-carbon " transport strategy ;
- development of bioenergy.

**Existing instruments:**

- “Green Deal” Utilities and liabilities (ECO);
- CRC Energy Efficiency Scheme - energy management program, implemented within the framework of the commitments to reduce greenhouse gas emissions;
- agreement on human impacts /taxes on anthropogenic impacts;
- Salix Finance Limited Company;
- Green Investment Bank
- scheme of increasing tax deductions related to capital expenditures;
- use of "smart" meters at the national level;
- information hotline on energy saving issues;
- standards for products, buildings and transport;
- of the energy efficiency passports of buildings;
- demonstration certificate for energy efficient buildings in the public sector
- “The Golden Rule” of Green Deal program

In November 2012 a Strategy in the field of energy efficiency was published. Strategy was designed to maximize the impact of existing policies and provide a more complete implementation of the potential of the British economy.

**Main areas** of activities according to the Strategy:

- Advice on reducing energy consumption
- Guidelines on financing for energy efficiency measures in the public sector
- Launching the program RE: FIT at the national level
- Conformity assessment of energy efficiency investments into the public sector to the consolidated budget
- Analysis of results of innovative products implementation and their credibility

- Publication of three new reports on assessment of technological innovation needs (TINA) for energy efficiency;
- Assistance in training of senior managers for Buildings Management Services;
- Determination of the actual operation cost over the building lifetime;
- Directive on energy efficiency: energy efficiency audit for companies that are not small or medium size business;
- Accreditation of the Department of Energy and Climate Change in accordance with ISO 50001;
- Support of the establishment of knowledge data base in the field of modernization of existing residential buildings;
- coordination of activities of Energy Consumption Research Centers from the Association of Research Centers of the UK (RCUK);
- Data collection strategy of the Department of Energy and Climate Change;
- Organizing public information campaign about the "Green deal" program and about "smart" meters;
- Monitoring the effectiveness of consultation regarding the use of heating controls during the examinations of water heaters performance;
- Information campaign about the upcoming adoption of the Energy Consumption Strategy for communities by the Department of Energy and Climate Change;
- Launching the program of population support in matters related to energy efficiency.

System of national, regional and local funds and agencies to support energy efficiency has been developed. Energy Saving Fund work to promote, , sustainable and efficient use of energy in the household sector and small businesses, through the partnerships, promoting energy efficiency through advertising programs, a network of consulting centers and recommendations for energy efficient products. Fund also has the support of the Scotland's executive authorities.

There is a set of specific methods for promoting of energy efficient appliances. So, in the framework of Partnerships for Energy efficiency there are the working parties which link energy efficiency with health protection for example, taking into account the existence of large scale health problems due to the low quality of housing.

Carbon Fund, created in April 2001, supports the efforts of business and public sector in transition to the new "low-carbon" technologies. There are a number of specific methods of promotion of energy-efficient appliances. Thus, within the Partnership for Energy Efficiency in residential sector there are working groups which integrates energy efficiency with, for example, health, taking into account the large-scale health problems caused by low-quality housing.

*Energy Saving Trust* applies a separate labeling “Energy Saving recommended” which complements the EU energy labeling and placed on a variety of products, including refrigerators, freezers, dishwashers, washing machines, drum type dryers, light bulbs, light fixtures, gas water heaters and heating controls.

Interactive database of the Energy Saving Trust allows consumers to obtain any available information with a complete description of the product and the manufacturer. Consumers can search for information by product, brand and even its model number.

The Market Transformation Program (MTP) assists in achieving sustainable consumption and production, particularly by the means of policies and implementation of programs aimed at encouraging competition and innovation activities in the area of environmental performance of the products and services offered.

Within MTP guidance on trademark strategies and newsletters, which set out the measures necessary to reduce the energy consumption of household appliances, are published. Such papers are the information documents for the population, which explain the decisions of the Government of the United Kingdom on the commodity policy.

MTP also envisages publishing of the explanatory notes, which provide:

- the background to the newsletters;
- basic arguments and definitions used for the purposes of newsletters;
- assumptions for modeling the potential impact of measures taken under the implementing policy;
- detailed information about new and emerging technologies;
- the results of energy efficiency tests of products.

Chapter 5 of the Market Transformation Program covers the products that are characterized by high energy and water consumption of at the point of use, and products which cause a significant amount of waste and hazardous materials at the end of life cycle:

- all major energy- consuming appliances (lamps, heaters, cooling units, humidifiers , kitchen appliances and consumer electronics) ;
- commodity products for service industry (office equipment, motors and drives, lighting, refrigeration and air-conditioning installations for commercial enterprises);
- sanitary equipment for domestic and non-domestic use ( showers, toilets and other equipment).

Britain implemented new excise rates on vehicles for the period of 2009-2010 in order to encourage the purchase of the most efficient and environmentally friendly vehicles.

The government also pays great importance to the implementation of the program “Warm Front” and sped up its implementation (£ 150 million are allocated for insulation and heating

improvements for low-income households for the period 2008-2010). The Government has also allocated an additional 660 million pounds to improve energy efficiency and heating in social housing in the frame of accelerated program of decent housing.

“**Green Deal**” program allows to pay fully or partially the cost of energy saving and energy efficiency measures (e.g. insulation) of premises owned by the payer, by savings on electricity bills.

“Green Deal” is closely related with the program "Energy Commitment Utilities" (ECO).

"Green deal" allows residential property owners and businesses to pay for the energy efficiency improvement of buildings, such as insulation, from savings on fuel bills.

Существует три основных типа участников программы «Зеленая сделка», предоставляющих услуги потребителям, однако возможностей для предприятий любого размера принять участие в осуществлении программы намного больше.

There are three main types of "Green Deal" program participants providing services to consumers, but there wide opportunities for businesses of all sizes to participate in the program.

- ✓ Independent **Consultants** recommend clients the necessary measures;
- ✓ **Providers of services** set the project cost for the client, provide funding and organize works;
- ✓ **Implementing organizations** are conducting works on the installation of systems aimed at improving energy efficiency;
- ✓ Clients pay in installments to **Service Provider** for works conducted from savings on electricity bills;
- ✓ **Implementing Organization** receives payment from the **Service Provider** immediately upon completion of work.

"Green Deal" is a part of the whole complex of the government's activities related to energy consumption for domestic purposes and there is a continuing work to integrate these mechanisms and programs:

- ✓ «Energy Commitment Obligations» (ECO) allows to provide additional financing for high-cost EE improvements and to support low-income households most in need of funding;
- ✓ Feed in Tariffs (FITS) designed to stimulate small-scale electricity production from renewable sources
- ✓ Renewable Heat Incentive (RHI) is designed to promote the use of renewable sources of heat in a small scale;

- ✓ “Smart” meters - enable to get a real-time information on energy consumption by customers;
- ✓ Performance Standards - establish requirements for energy efficiency appliances;
- ✓ Building codes - set standards for new buildings and modernization of existing ones;
- ✓ Detailed information in invoices and more understandable tariff calculating scheme help consumers to understand better for what they pay.

In 2014, the activities of the Office for energy efficiency policy implementation will include:

- Guidance on the implementation of the EU Directive on energy efficiency;
- Collaboration with other government bodies and decentralized authorities in order to expand the knowledge base;
- Development of guidelines for describing the energy efficiency benefits for consumers in each of the industries;
- Ensuring coherence of the programs to allow to coordinate effectively "the way the consumer" on the market of energy efficiency;
- Considering opportunities to further enhancing the effectiveness of existing programs and work with identified additional potential in the field of energy efficiency;
- Providing a report on the implementation of the Strategy in the field of energy efficiency in accordance with the Annual Report on electricity consumption in 2013.

## **1.6. State policy of Norway to improve energy efficiency . Basic approaches , achievements and prospects**

Despite the fact that Norway has no special energy saving law and only one section of the Energy Act of 1991 covers the issues of energy efficiency , the country takes a leading positions in energy efficiency and energy saving in the world.

Provisions of the Energy Law and of the Law on planning and construction, labeling requirements and standards for appliances is the legal basis for policies aimed at achieving rational use of energy.

Norway is not a member of the EU, however, is closely coordinating its policies with the EU and participating in EU programs and initiatives on improving energy efficiency. In particular, Norway is a member of the EU Framework Program in the field of energy efficiency.

Implementation of energy efficiency policy is the function of the Ministry of Oil and Energy. Department for water resources management and energy (NVE) monitors the rational use of energy. There are regional centers for energy efficiency.

The main activities and results of the state policy aimed at improving energy efficiency, are the following :

1. With the introduction of higher taxes on fuel, Norway, like many developed countries has reduced energy intensity of transport by almost 17 %.
2. Projects to develop alternative fuels are actively funded.
3. Technologies of industrial production of biogas from waste and of the production of ethanol from wood waste are widely introduced.
4. There is a steady decline in energy intensity of GDP.

In connection with the signing of the Kyoto Protocol, the Government decided to reduce the use of oil products in the municipal sector by 25% during 2008-2012 as compared with 1996-2000. It is assumed that biofuel may replace the forced out oil products. Today, biofuel takes 6.1% in the country's energy consumption and according to the experts estimates it will be the leader on fuel market of the EU by 2020.

In order to implement energy efficiency policies and programs the state enterprise ENOVA under the Ministry of Oil and Energy was established in 2001. Its main objective is to promote environmentally friendly production and energy efficiency by the means of financial instruments and incentives for energy market participants and mechanisms for achieving national goals of energy policy. ENOVA seeks to become a leader in the development of new energy solutions by providing investments for commercialization of new energy technologies.

The main objectives of ENOVA:

- increasing use of renewable energy in district heating up to 4 TWh by 2010;
- increasing the production of electricity from renewable energy sources up to 3 billion kWh by 2010;
- saving of 18 billion kWh by the end of 2011.

To achieve these goals there were developed:

- 1) The program aimed at introducing measures to reduce energy consumption and/or transition to renewable energy on the continental part of the country.
- 2) The program of wind energy development.
- 3) Program of implementation of new technologies.

Non-governmental organizations and private companies play a major role in improving the energy efficiency in Norway.

1. *Norway Energy Corporation (NEE)*. NEE specializes in improving energy efficiency and developing renewable heat production for professional market participants. Main activities: energy research; feasibility studies and analysis; energy efficiency in buildings; production and distribution of heat; training and information.

2. *Group on Renewable Energy and the Environment in Oslo (OREEC)*. OREEC is financed by both the state and legal entities. The main role of OREEC is advising on renewable energy, bioenergy, energy efficiency analysis.

3. *Energy Norway* - the union of about 260 manufacturers, suppliers, wholesalers and contractors in the field of power energy. EN members produce about 130 TWh per year, representing 99% of total electricity production in Norway.

EN does not only generate and supply electricity and work on R&D in the field of energy efficiency. In particular, of a plan ENCL (16.03.2009) developed by EN jointly with the European Union for Norway was adopted. According to ENCL Norway should reduce the CO<sub>2</sub> emissions, increase energy efficiency and the share of renewable energy sources until 2020.

The plan envisages the following measures:

- gradual refusal of oil-based heating;
- electrification of 20% of all passenger cars;
- electrification of 25% of the activities on the continental shelf;
- active development of hydropower and wind power, the increase of hydropower and wind power exports up to 12 TWh;
- an increase in heat production from renewable energy sources by 3 TWh mainly through the use of heat pumps and biomass;
- production and import of biofuels (250,000 tons per year).

## **1.7. Energy saving policy in Eastern Europe and Baltic States**

Since the 90s of the last century the countries of Eastern Europe and the Baltics took the course of integration into the European Union and so they formed the energy policy and energy saving policy based on the standards and requirements of the EU.

In particular, it is possible to consider the approaches of the Czech Republic and Estonia in the field of energy efficiency and renewable energy development. Czech Republic after the joining the EU is largely kept its industrial potential and energy-intensive industries still play a significant role in its economy. In this regard, an urgent problem is to improve energy efficiency.

The Ministry of Industry and Trade of the Czech Republic is responsible for national energy policy, including the implementation policy in the field of energy efficiency and renewable energy sources (RES).

Czech energy efficiency policy includes a long-term target of reducing energy consumption, the level of consumption of raw materials and increasing the share of renewables

in total energy consumption of the country, as well as bringing these indicators in line with the performance of the advanced countries.

In the structure of the energy policy of the Czech Republic renewable energy resources are very important, in particular for the electricity and heat production, and transport fuels. There are a number of programs to promote renewable energy, including state subsidies.

In accordance with the Directive on Renewable Energy (Directive 2009/28/EC) Czech Republic should provide 13% share of renewables in total energy consumption by 2020 (compared with 6.1% in 2005), including the obligation to provide 10% share of renewable energy in total energy consumption by the transport sector. In July 2010, in order to achieve these indicators National Renewable Energy Action Plan of the Czech Republic was adopted. In accordance with the Plan the Czech Republic aims to achieve 13.5% share of renewables in total energy consumption and the 10.8% share in the fuel for transport. It is also projected that final energy consumption in the Czech Republic in 2020 should be on the level of 34 128 thousand tons of oil equivalent (an increase of 11.4% as compared to 2010) and 32 531 ktoe (an increase of 8.5% as compared to 2010) in the case of implementation of energy efficiency and energy saving measures. According to the European Commission data in 2010 in the Czech Republic has produced 31.17 million toe of energy. However, about 70% of the energy in the Czech Republic is produced from solid fossil fuels (23% from coal, 22.6% - nuclear power, 0.7% - oil and LNG, 0.5% - natural gas). In 2009 the share of renewables in total energy production in the Czech Republic was about 8% (2.59 Mtoe). Total dependence on energy imports was about 26.9%.

Czech Republic ranks third in the Europe on combined electricity and heat production after Denmark and Finland (30 % of all electricity and about 40 % of the total heat production).

According to the existing energy strategy of Czech Republic, the share of nuclear energy in total electricity production is expected to increase up to 47 % by 2050, while the share of coal should be reduced to 12% by 2050 and the share of renewable energy in total electricity production should be increased up to 30 %. Currently, however, there are discussions about the revision of the existing strategy.

In accordance with the National RES Development Plan, since 2011, the Czech government support the utilization of unused arable land (977 hectares) for energy purposes, including through financial support and subsidies for plantations of trees with short rotation periods in the frame of Program for rural development in Czech Republic.

Energy efficiency in buildings is in the focus of national policy. Potential for energy savings in buildings is estimated at 175 petaJ per year or 60% of the current consumption of the country. A study conducted by the Czech consulting company “Porsenna”, showed that energy

efficiency potential in residential sector and public office buildings is 46% of the total energy savings potential in Czech Republic.

Building owners are mostly aware of the advantages and benefits of insulation (and technically it is quite easy to realize these benefits) and how to reconstruct the building to achieve a very low power consumption (30 kWh/m<sup>2</sup> for heating per year). The most important aspects are careful insulation of external walls roofs and floors (or bases) and installation of high quality windows with low heat transfer. Besides insulating materials should be tightly sealed, it is necessary to install a mechanical ventilation system with efficient heat recovery, and modify the heating system. Experience shows that even small projects of thermal insulation, realized in the Czech Republic, can reduce heat consumption by about one third. Reconstructing panel apartment buildings, which are very important for the central heating industry, we can achieve much better results.

According to the Law 406/2000, since 01.01.2013 in Czech Republic the obligatory energy certification of buildings was introduced. All owners must provide energy certificates for buildings when they are sold. The owner of the building or a separate entity shall get at its expense an energy certificate and attach it to the announcement about the sale of real estate. Then, at the moment of conclusion of the contract of sale with the buyer, it must pass this document in the original or in certified copy.

In other cases, the obligation to obtain and provide the energy certificate rests with the developer to prove that all technical requirements have been met during construction.

The Energy Performance Certificate should not be made earlier than 10 years ago. This document should be attached since 01.01.2013 in the following cases:

- construction of new buildings;
- sale of an apartment or other real estate property
- after significant renovation when the base of the building is more than 1000 m<sup>2</sup> and it could affect the energy consumption of building;
- for rental homes;
- for renting an apartment or a separate part of the property - from 01.01.2016.

An apartment owner in case of sale before 2016 can replace the energy certificate with energy bills for the past 3 payment period. If it cannot show the invoice data, it should take measures for the production of an energy certificate. For cooperatives this duty comes into force 01.01.2016.

Duty to expose energy performance certificate for free access belongs to administration or the owners of schools, health organizations, cultural institutions, sports facilities, shops, hotels

and catering establishments, tourist centers, institutions of transport, energy, telecommunications and public administrations with a total base area building over 1000 m<sup>2</sup>.

Apartment owners who will not offer energy performance certificate the sale announcement or to the sale contract will have to pay penalties of 50,000 crowns.

Owners of apartment buildings and commercial properties in case of the absence of energy performance certificate should pay up to 100,000 crowns of penalties. If the owner is an entrepreneur or a legal entity, the penalties increase up to 200,000 crowns.

If the owner of the apartment will not attach energy performance certificate to the contract for sale of the property, the buyer after agreement still has the right to terminate it. Along with this new owner is entitled to claim from the previous owner to get an energy performance certificate, if the contract of sale was concluded not earlier than three years.

Exception for energy performance certificate applies to small area accommodations that do not exceed 50 m<sup>2</sup>, as well as real estate for recreation, cottages, etc. There are also exceptions for cultural monuments and architecture, religious sites.

Energy Performance Certificate for buildings, according to Law 406/2000, §10, is provided by energy auditor or other authorized person who can deal with this issue due to his specific activity: construction, technological maintenance of buildings and technical space developments.

In Estonia, the "National Action Plan for Energy Efficiency for 2009-2013" includes the following priorities:

- Improving energy consumer's awareness about the importance of improving energy efficiency;
- Increasing a number of people able to implement energy-saving activities, such as promoting energy audit on the market, the development of know-how, energy service practices;
- Improving the efficiency of consumption, production and transfer of fuel and energy;
- Implementation of EU directives.

Issue of reducing energy consumption in the country has been recognized by government as priority. Since 2022 in Estonia it will be allowed to build the houses only with zero energy consumption. This decision was approved as part of an energy efficiency program, adopted by the European Commission. For new public and administrative buildings, this requirement will come into force from 2019. Experts note that these houses will be more expensive than usual by 20-30%.

As a result of gradual modernization of housing Estonia plans to keep in 2020 the energy consumption level of 2010, despite the annual increase in the number of sites with energy consumption. In April 2011, the government approved a program of national competitiveness "Estonia - 2020" with the goal to increase energy efficiency mainly through energy savings in

residential sector, as it consumes 37% of total energy (mainly - the apartment buildings), according to the Department of Statistics Estonia.

The state has the responsibility to implement energy saving program and to encourage people to use the appropriate subsidies. The aim is to reduce significantly the energy losses in distribution networks and to reduce energy consumption in transport sector through the use of public transport vehicles.

In 2020, total energy consumption in the EU should decrease by 20% as compared to 2010. If no action is taken, the energy consumption in Estonia on the contrary should increase by 15% in 2020. In 2010, the share of households accounted for 42%, industry and transport - 42%, private transport - 14 %, agriculture - 3% of total energy consumption of Estonia.

In case of implementation of program for renovation of apartment buildings with financial support from the EU funds, this measure alone will reduce the energy consumption of households by 25-50%. Measures for the efficient use of energy can reduce the power consumption in the industry by 10% and heat consumption - 30%. Activities aimed at improving energy efficiency in the transport and industrial sectors are also under implementation.

## **1.8. Conclusions**

CIS member-states should actively use and adapt to their own conditions the experience of the countries that have achieved the most impressive results in improving energy efficiency.

In particular, it seems appropriate to use the experience of energy efficiency improving and renewable energy development in the following areas:

- establishment and improvement of the legal framework (the EU directives and the experience of Norway);
- organization of energy management system based on experience of the separation of power and responsibilities between the national and local levels (experience the UK, Germany, USA is relevant);
- mobilization of the whole society to achieve the objectives announced in the field of energy saving (build public-private partnerships, cooperation with non-governmental organizations, financing from commercial banks and large corporations - of special interest is the experience of the U.S., Japan, UK, Germany);
- organization of the energy management in companies/enterprises (particularly interested in the experience of Japan);
- encouraging the development and implementation of energy efficient technologies (the experience of Japan, USA, UK);

- establishment of regional EE centers and involvement of NGOs and private companies in this area (the experience of Norway);
- implementation of technologies biogas production from waste and of bioethanol production from wood waste (the experience of Norway);
- implementation of energy efficiency programs for home appliances, electronics and lighting equipment, adaptation to local conditions of the Japanese initiative " Top Runner";
- attracting investments into the development and introduction of modern technologies for utilization of new and renewable energy sources;
- adaptation of the regulations, standards, economic incentives in order to enhance energy-saving activities and implementation of renewable energy projects;
- involvement of public companies as well as banks and financial-industrial groups, which could become an example for introduction of energy-efficient production for private companies, including those with subsidiaries in third countries into various programs and initiatives (important for Moldova, where 3 out of 5 electricity distribution networks are owned by the Spanish company);
- cooperation governments with national industrial unions, associations, non-governmental organizations in order to promote voluntary mechanisms to improve energy efficiency (for example, the USA and Switzerland);
- organization of energy audit and control over energy consumption mechanisms (Japanese experience);
- organization of public information campaigns, work with the population at different levels, starting with the schools and involving the media.

## **Chapter 2. Policy recommendations in the field of improving energy efficiency and shaping national energy-management system**

Experience shows that at the initial stage of energy saving policy implementation, even in the countries with developed market economies, the state plays the crucial role. The primary role of government is to form strategic goals, legislative and regulatory framework, the implementation of state programs and creation of funding mechanisms to reach the assigned tasks.

Economic conditions and financial incentives are important prerequisites for the successful implementation of new technologies. It is important that policies aimed at improving energy efficiency and renewable energy development, would provide the minimum necessary guarantees of investments return in results of energy saving projects implementation.

At all stages of implementation of the state policy in the field of energy efficiency and realization of renewable energy potential, the campaign to raise awareness among decision-makers on how to implement energy saving measures and on existing incentives to stimulate energy efficiency and renewable energy is crucial.

International experience in the implementation of energy saving policies proves that in all countries there are legal, economic, technical, informational and other constraints preventing the improvement of energy efficiency. Access to financing for energy efficiency projects and the availability of incentives and financial mechanisms for the implementation of energy saving measures in the public and housing sectors are extremely important.

Identifying, eliminating and overcoming these constraints often require significant and sustained efforts from the government, as well as the presence of organizations and professionals interested in the implementation and further advancing technologies to improve energy efficiency and to develop renewable energy.

In the majority of CIS countries there are no comprehensive and consistent approaches to the implementation of policies in the field of energy efficiency up to date: as a rule system of energy saving targets, is insufficiently developed; monitoring and evaluation mechanisms are absent or poorly developed; system of collecting statistics is not effective; there are no medium-term objectives adjustment mechanisms and mechanisms to achieve them; system of bylaws and standards is insufficiently developed, as well as mechanisms of economic incentives for energy efficiency investments are too sophisticated for practical use.

The main barriers to the implementation of energy saving measures can include: inadequate tariff policy and practice of cross-subsidization, undeveloped market of energy

services and energy-saving technologies, the uncertainty regarding budget support of energysaving in future, high investment risks, low skill level of local management, inadequate culture of rational use of energy, insufficient level of market relations development, the lack of effective economic incentives for investments into fixed assets and for the implementation of energy-saving projects, inadequate governance and regulation in the field of energy saving, especially at regional and local levels, including the lack of regional EE centers.

The greatest success have been achieved by the states, which along with an elaborate legal framework and the necessary institutional infrastructure (separate body of public administration responsible for energy saving is of crucial importance), carried out clear objectives and planning (with the release of key indicators, which will be achieved by a certain date), as well as a system for monitoring progress in the implementation of state policy in the field of energy efficiency. Moreover, even in the developed system of economic incentives, in the first phase of energy efficiency policy implementation the availability of budget financing for energy efficiency projects is crucial.

Almost in all CIS countries unresolved funding issues act as one of the main obstacles to the implementation of energy saving policy.

Currently, in all CIS countries, the challenge is to increase the rate of introduction of new facilities while increasing efficiency in addition to modernization of existing generating capacities and networks.

Development of cooperation within the CIS would allow reducing total costs in energy sector, improving the competitiveness of the economies of the Commonwealth and the reliability of power supply.

## **2.1. Recommendations to develop legal and institutional framework**

All CIS countries recognize the importance of renewable energy and work under creation the necessary legal and institutional framework.

However, one of the most important factors of success of support policy of renewable energy producers is its incorporation into long-term planning, along with other political and strategic decisions.

In general, all CIS countries except Turkmenistan and Azerbaijan, have laws on energy saving, regulatory framework for energy saving designed to provide a framework for the implementation of policies in the field of efficient use of energy resources is already formed or in the process of development: laws on energy saving and improving energy efficiency are adopted, strategic documents on the development of national economies, which reflected the

goals and objectives to improve energy efficiency in all CIS countries have been developed, national strategies and action plans are approved, separate sectoral and specialized programs in accordance with national priorities are formed.

However, in some countries the legal framework has rather declarative character. In most countries, laws do not contain energy saving mechanisms of direct action and weakly linked to other legislation, governing the various issues of energy, environment and other. Norms of the legislation often are not compatible with each other; there are gaps and unresolved issues. However, almost all countries are actively studying the international experience and working on adapting it to national circumstances. In particular, we note the trend of harmonization of legislation in the field of energy efficiency with the EU legislation.

With regard to national programs for energy efficiency, it is advisable to adopt a comprehensive program that could include detailed subprograms for separate directions, reflecting national priorities and peculiar features of development. Energy efficiency programs should be based on the system of long-, medium- and short-term objectives and should contain:

- clear priorities;
- comprehensive system of indicators to assess the achievement of goals;
- built-in system of regular monitoring results and adjusting tasks.

It is important that the program contain a specific list of activities and supported by adequate financial resources.

Good results are achieved in the case of forming a multi-level system, where national programs are complemented by relevant local and sectoral energy efficiency programs.

Governments may be advised to conduct an audit of short-term goals and parameters of these activities (sequence, timing, amount of financing, etc.) based on consideration of changes in the external and internal circumstances.

It is reasonable to carry out ongoing analysis of the barriers to the implementation of state policy in the field of energy efficiency, to develop and implement quickly the measures to overcome them, and to analyze the effectiveness of individual incentives and mechanisms, to continue the work on improvement of legal acts and to study international experience in energy efficiency and renewable energy area.

It is advisable to establish a national body responsible for implementation of the state policy in the area of improving energy efficiency and renewable energy development.

The functions of such body should include the development of state energy efficiency and renewable energy development programs, including programs of research and development (R&D), marketing research on domestic and foreign markets, the promotion and popularization

of energy saving, development of legislative initiatives in this area as well as coordination of cooperation at the regional and international level.

Legislation development objectives regarding the introduction of market mechanisms and improving tariff policy, creating conditions for cooperation between the state and business remain highly relevant.

## **2.2 Recommendations on financial and economic incentives for improving energy efficiency**

Strategy to support the implementation of energy saving measures should be simple and provide low administrative costs. However, it should be flexible enough to win the market and to ensure cost-effectiveness.

International experience of economic incentives for energy saving and renewable energy (see Chapter 1), must be adapted to the conditions of the CIS countries. For this purpose it is necessary to organize institutionally a permanent dialogue of authorized government bodies responsible for energy saving with public organizations, industrial associations and expert community to prepare recommendations for the incorporation of the most promising measures into national legislation.

Almost all CIS countries are striving to achieve the elimination of cross-subsidies in the energy sector, which is a big problem and causes significant distortions in the market. Subsidies for energy are a traditional remedy for social policy implementation. As a result, low energy prices do not provide sufficient motivation for power saving and investing in energy-saving equipment.

Given the need to ensure socially acceptable level of payment for the consumed energy it is possible to recommend a gradual optimization of energy tariffs, including:

- transition to different tariff rates for electricity for consumers for different times of the day,
- creation of economic incentives for using energy-saving technologies in production processes and saving energy by consumers;
- formation and establishment of tariffs for electric energy by activity (generation, transmission, distribution, marketing );
- gradual elimination of cross-subsidies in tariffs for energy, including for population.

The practice of granting preferential tariffs and continuing cross-subsidizing of energy-intensive industries leads to further use of non-competitive production technologies. Lack of motivation for energy efficiency and investments into energy efficiency increase the social costs.

One of the main incentives to improve the energy efficiency of natural monopolies and municipal organizations is the use of long-term methods of tariff regulation, including, primarily, the method of return on invested capital with the obligation for companies on quality, reliability and the development of services provided. Within this regulation, companies have incentives to reduce costs, including for energy resources, and to use resources more efficiently, as the resulting savings retained by the company and could be used for any purpose.

As part of stimulating the processes of energy consumption, energy saving and of renewable energy development are noteworthy the following aspects:

- experience in energy rationing, when higher tariffs for energy consumed over the established norms are set for businesses and individuals;
- establishment of preferential taxation for enterprises that have implemented the energy saving program or introduced the renewable energy installations and achieved results above the minimum limit set;
- introduction of a bonus system for managers and employees of state-owned enterprises / public-sector organizations for the achievement of certain results in the field of energy saving and renewable energy generation and consumption.

Presence of incentives for owners of individual houses or apartments in apartment buildings that have implemented energy efficiency measures at their own expense plays an important role in engaging communities into the activities to improve energy efficiency. The first experience with the population in the CIS was obtained in the course of the campaign to ensure that all households have installed the meters to account consumption of hot and cold water.

An important impediment to the improvement of energy efficiency and energy saving is the lack of financial resources for implementation of energy efficiency projects.

At the initial stage, budget subsidies for the implementation of priority energy efficiency activities play an important role in promoting EE activities on a competitive basis. They can cover 100% of the costs of implementing energy-saving measures, or some part of costs.

It is possible to recommend the creation of special funding mechanisms for energy saving projects, such as revolving fund, budgetary allocations on the terms of reimbursement and timing, and a mechanism of providing government guarantees of interest repayment to commercial banks for the loans to implement energy-saving projects.

Effective mechanisms to support and stimulate energy savings are the following:

- implementation of specific programs and demonstration projects;

- preferential loans for the purchase of energy-efficient equipment and technologies;
- accelerated amortization of EE equipment;
- tax exemption and reducing individual tax rates for investors;
- the establishment of special tariffs for guaranteed purchase of electricity produced from renewable energy sources, as well as commitments of transmitting companies to buy this electricity;
- subsidies for investments into energy efficiency and renewable energy;
- state funding of research and development works in the field of energy efficiency and renewable energy;
- support to non-governmental organizations and educational institutions, which are aimed at increasing energy efficiency and use of renewable energy sources.

Choosing of type of mechanism is determined by the objectives and the type of investments.

In the medium term, it is necessary to consider the possibility of establishing the special funding mechanism (fund) for the projects in the field of energy efficiency and renewable energy in the framework of cooperation development among the CIS member-states.

It is important to promote the development of energy services market and to encourage in greater extent the creation and activities of ESCOs and other market mechanisms for attracting investments into energy efficiency.

It is important to form a stable macroeconomic situation and clear rules to ensure return on investment into implementation of energy efficiency projects for all sectors of the economy, both on the basis of long-term tariff regulation and mandatory participation and state participation where appropriate, which will allow establishing clear criteria for attracting private investments and eliminating risks of investing into energy efficiency.

### **2.3. Recommendations in the field of science and technology development for improving energy efficiency**

#### ***Research and commercialization***

Research works usually require significant investments. Almost all CIS countries are suffering from the deficit of funding for R&D and it would be rational to explore the possibilities of co-financing R&D in order to minimize the cost for each state and to obtain a synergistic effect in this area.

At the initial stage it is advisable to exchange information on the main areas of national research and to identify the opportunities for synergies; to identify the priority areas and forms of

cooperation as well as to consider the allocation of targeted budget funding for R&D and attracting private investment.

CIS member-states could choose different forms of cooperation:

- implementation of joint projects and programs funded from a specially created fund for research in the field of energy efficiency;
- creation of common information data base, libraries of handbooks and normative literature, performing analytical reviews of best practices to improve energy efficiency and to develop renewable energy in other countries;
- scientific exchange and training of specialists;
- publication of scientific journals (including in electronic form), the working out the regional guides, handbooks and brochures on the development of renewable energy sources;
- organization of conferences and seminars (also using the web-technologies) for experts, professionals and the public, emphasizing the forms of training for professionals and employees of public authorities, as well as forms of broad cooperation with representatives of science, education, civil society and the media;
- scientific cooperation;
- commercialization of R&D using the industrial potential of the CIS member-states.

In order to commercialize the successful developments it is advisable to make an inventory of industrial capacities and to compile a list of companies and organizations capable to manufacturer the respective devices, machines, installations and other equipment, and to establish the collaboration of enterprises with research organizations at least in the form of an exchange of views and information.

### ***Development of education and training***

Training of experts in the field of renewable energy sources is essential to solve the problems of EE and renewable energy development. Training course on energy efficiency and renewable energy sources should be conducted in all educational institutions of the corresponding profile. The level of details depends on the specialization of students and professionals.

CIS countries are recommended to expand cooperation in the field of education and to provide individual cooperation program on training and retraining of specialists in the field of energy efficiency and renewable energy, including the exchange of textbooks and methodological handbooks for students and professionals in the field of energy efficiency and renewable energy.

In addition, it is necessary to compile and disseminate the best educational experience in the field of energy efficiency and renewable energy, to use more actively the basic education schools in the field of energy efficiency and renewable energy.

It is necessary to promote actively the international cooperation in training and retraining of professionals working in the field of energy saving and renewable energy. It is recommended to use widely for seminars and for advanced training the demonstration platforms and sites with renewable energy installations as well as the training base of leading higher education institutions in the CIS, with possible involvement of qualified people from other foreign countries.

International cooperation in this area should also be developed through joint participation in appropriate educational programs.

### ***Development of advanced energy efficiency technologies and equipment for the production of renewable energy***

Lack of modern technologies and equipment is one of the major technical barriers to energy efficiency and renewable energy development in the CIS countries. In this connection it is useful to organize the development of a unified database of equipment that meets modern standards of energy efficiency and is produced in the CIS member-states, its suppliers and prices.

## **2.4. Recommendations for raising public awareness**

Lack of awareness among the business leaders and heads of public administrations, insufficient level of professional development of specialists, lack of knowledge among the population on possibilities to improve energy efficiency and to save energy resources, applicable to specific conditions, are the significant barriers to realize the energy-saving potential.

Active participation of experts and population is necessary required to reach the national targets in the area of energy efficiency and energy saving, increasing the utilization volumes of available in CIS member-states renewable energy sources, understanding the role and potential economic and environmental benefits.

In addition to the measures at the national level, it is important to develop and implement systematically the activities, to clarify and provide guidance to local authorities, businesses and individuals (involving the media), as well as to support community organizations and initiatives.

It is important to organize the work in order to clarify the legislative framework, existing regulations, defined benefits in energy efficiency and development of renewable energy, methods of technical and economic calculations, procedures, financial support procedures for

businesses and individuals interested in implementing energy-saving measures; to provide guidance and advice; to assist in the preparation of projects, adapted to the specific conditions of the site.

As a specific mechanism for implementation of this kind of cooperation within the CIS, it could be proposed to create a single web-portal for energy saving, energy efficiency and use of renewable energy sources on the basis of the UN ECE or CIS Secretariat, or using the capacity of one of the national bodies responsible for energy saving in some CIS country.

The specified web-portal should generate actual databases on:

- specific projects and technical solutions
- policies and measures implemented in the countries participating in the project in order to promote energy saving and renewable energy development;
- legislation in the field of renewable energy, the development of relevant standards and regulations;
- assessment of the impact of renewable energy facilities on the environment;
- implementation of an appropriate tariff policy;
- cooperation with relevant international organizations;
- national assessments of the effectiveness of selected technologies and equipment based on results of project implementation;
- development and implementation of new technologies in the field of renewable energy;
- analytical studies, etc.

### Chapter 3. Possible approaches to the development of regional cooperation and elaboration of Joint Action Plan

UNECE is currently completing the implementation of two projects:

- *the project "Enhancing synergies of national programs of the CIS countries on energy efficiency and energy saving to strengthen their energy security "*  
*and*
- *the project "Analysis of the development and dissemination of advanced technologies in the field of energy efficiency and renewable energy within the framework of the project "Global Energy Efficiency 21 " with the focus on Central Asia"*

and considers possible approaches to the realization of the project "Assistance to the CIS member-states in the successful implementation of the "Global Action Plan", developed for the initiative "Sustainable Energy for All" proposed by the Russian Federation.

The results obtained during the realization of the projects "Enhancing synergies of national programs of the CIS countries on energy efficiency and energy saving to strengthen their energy security" and "Analysis of development and dissemination of advanced technologies in the field of energy efficiency and renewable energy in the framework of the project "Global Energy Efficiency 21" with the focus on Central Asia" should form the basis of a new large project to be implemented throughout the "Decade of Sustainable Energy for All" in the period 2014 - 2024 (UN General Assembly has adopted the resolution A/RES/67/215 declaring 2014-2024 as the "Decade of Sustainable Energy for All", stressing the importance of modern services in the field of sustainable energy for poverty eradication and development as a whole).

The proposed project "Assistance to the CIS member-states in the successful implementation of the "Global Action Plan", developed for the initiative "Sustainable Energy for All" should become the first stage of this new large project.

As a result of researches fulfilled in the frame of two above mentioned finalizing projects it is possible to make the following conclusions.

Currently, the CIS member-states have considerable potential of energy savings and utilization of renewable energy sources. According to the experts and to the national energy efficiency programs data, the unused energy saving potential of CIS is approximately 450 million toe.

The greatest technical potential to improve energy efficiency is in such sectors as buildings (including the sector of housing and communal services in general), the production of heat and electricity, industry and transport sectors.

It is important to note that in all states except Belarus and Ukraine, the potential of low-cost energy efficiency measures still is not realized (for details - see the Regional Study "Analysis of the policy of the CIS member-states in the field of energy efficiency and possibilities for cooperation in the CIS region in order to obtain a synergetic effect").

The CIS member-states also have significant potential for renewable energy development, but it is not used enough. The share of renewable energy in the total energy mix of the Commonwealth is less than 5%, 85% of which is biomass energy and hydropower.

One of the main factors affecting the assessment of the cost-effectiveness of renewable energy projects, is the installed capacity utilization rate (load factor), which characterizes the cost of energy production. Thus, for the solar energy generation facilities, load factor is ranging from 8.5% (cost about 40 rubles/KWh) to 17% (cost of 13.1 rubles/KWh). The average load factor of thermal power plants is more than 50%, nuclear - more than 80%.

Currently the technologies to use renewable energy resources in the CIS member- states – participants are created and the cost of implementation of "clean" technologies is gradually aligned with conventional energy sources.

Increasing the share of generating capacity on renewable energy sources will help to reduce the impact of fuel and energy complex on the environment situation in the CIS member-states and to reduce the cost of waste neutralization of energy facilities.

Promising areas for application of renewable energy installations are the sites located in remote and sparsely populated areas without centralized energy supply. High cost of energy delivery to these areas or creating infrastructure to connect them to the grid determines the advisability of renewable energy use.

Now in the CIS member-states bioenergy is most widely developing: there are low-cost and well-mastered technologies. This is mainly wood, with particularly large reserves in Belarus and Russia. Wind turbines on land and offshore, solar energy, energy of small rivers also have good development prospects.

Taking into account the accepted currently measures for the development of renewable energy it is possible to forecast that the share of renewables in total energy consumption in the Commonwealth could be more than 15% by 2030. Increasing use of renewable energy sources will ensure the modernization, diversification and reorientation of the resource-based economies of CIS countries.

Analysis of the situation with renewable energy development in the CIS member-states identified a number of similar problems, which need to be considered in the drafting documents on cooperation among CIS member-states in this area, including :

- lack of own funds and, as a consequence, the need to attract foreign investment;
- absence or lack of domestic high-efficiency equipment and technologies to utilize several kinds of renewable energy sources;
- lack of a common information base;
- organizational and institutional barriers;
- lack or inadequate legal framework.

Experience of RES utilization in the world confirms the need for public support for renewable energy development, especially at the national level.

The efforts made by CIS countries at the national level in the field of energy efficiency and realization of potential of renewable energy resources indicate their interest in strengthening regional cooperation in these areas.

The issues of renewable energy development in the countries of Central Asia were studied in details in the framework of the project "Analysis of the development and dissemination of advanced technologies in the field of energy efficiency and renewable energy within the framework of the project "Global Energy Efficiency 21" with the focus on Central Asia".

In 2011, the UN Secretary-General has launched an initiative "Sustainable Energy for All» (SE4All), which is aimed at reaching three interdependent targets to the 2030:

1. ensuring universal access to modern energy sources
2. doubling the level of energy efficiency and
3. doubling the share of renewable energy in the global energy mix.

According to the UN data, 2.6 billion people in developing countries still use a traditional biomass for heating and cooking and 1.3 billion people have no access to electricity.

Such CIS countries as Armenia, Kyrgyzstan, Tajikistan and Moldova have officially joined the initiative SE4All. The Russian Federation also supported the initiative.

Project "Assistance to the CIS member states in the successful implementation of the "Global Action Plan", developed for the initiative "Sustainable Energy for All" should contribute significantly to the information, analytical and organizational support of international cooperation for the implementation of "Global Action Plan" developed for realization of initiative "Sustainable Energy for All" in terms of the following tasks:

1. Analysis of the existing strategies, energy programs and concepts in the CIS member-countries in terms of achievement by 2030 of main three objectives of the Initiative.

2. Assistance in the development of energy policies, programs or concepts for countries which have officially confirmed their participation in the Initiative (currently - Armenia, Kyrgyzstan, Moldova and Tajikistan), to contribute to full implementation of three main goals of the Initiative by 2030.

3. Facilitating analysis in the CIS member-states in order to identify a quantity of citizens without access to modern energy services in each of the countries participating in the initiative.

4. Promoting the development of new approaches to remove barriers for expanding sustainable network of energy services and technologies; ensuring their affordability and reliability, as well as the development of measures to stimulate innovation material.

5. Assistance in the development of human and institutional capacities, and to adopt successful strategies, proving the possibility to be used in any CIS country.

6. Within the framework of participation of the CIS member-states in the elaboration of international policies on sustainable development, environment protection and climate change mitigation – the definition and theoretical justification of balanced approaches to sustainable energy development, taking into account economic, social and environmental factors; opportunities for energy cooperation in the framework of integration initiatives near the borders of the CIS region in order to increase the efficiency of energy resources use, as well as assistance in the implementation of specific scientific, educational and other projects in line with the proposed paradigm of energy cooperation. Assistance in finalizing the draft Convention on international energy security and Protocols to the Convention, promotion of Convention in international organizations and other platforms for implementation; identification of partners to promote Convention in other regions.

7. Promoting the development and introduction of innovative technologies in energy sector, attracting investments and realization of investment projects in the CIS member-states. Use of external financing and advanced financial mechanisms for the implementation of projects in the energy sector of the region.

In this regard, it seems appropriate while developing a Regional Action Plan to consider the prospects for the implementation of initiatives SE4All and to identify priority objectives and areas of cooperation.

As it was indicated in the Regional Study "Analysis of CIS policy in the field of energy efficiency and possibilities for cooperation in the CIS region in order to get synergy effect" energy efficiency potential in end-use sectors is significantly higher than in the energy production sector. In particular, the financial potential in end-use sectors is estimated to be four times higher than in electricity generation and heat supply systems combined. Moreover, the

energy savings on the side of consumers is accompanied by an additional reduction of primary energy consumption for the whole system of production and transmission of energy.

CIS countries have tremendous potential for energy savings in housing sector (about one third of the total energy saving potential, or up to 70% of total energy consumption in this sector).

In general, about 10% of the housing stock in the CIS countries is in need of urgent repair. From year to year, there is an increase of amount of the old and dilapidated housing with wear factor of more than 60% a significant portion of the housing stock in the cities takes the most energy-intensive in the world – houses made from precast concrete. The actual heat losses of buildings are much higher the standard because of poor quality of their construction and operation. Level of physical deterioration is high: for water supply networks it is more than 50%, for the heating facilities - more than 50%, for electricity networks - more than 65%, and for engineering utilities - more than 60%).

Most of energy savings could be achieved as a result of energy efficiency measures in heating and hot water supply systems.

It should be noted that in the CIS region, a significant share of costs for energy supply has been covered from budget. In this regard, it seems appropriate to identify improving energy efficiency in buildings (residential, commercial, including schools, hospitals and other buildings which belongs to social services sphere) as the priority area of cooperation in broader context – including the adoption of the necessary measures throughout the supply chain from the generation of heat and electricity and to final consumption.

Further it would be advisable to follow a complex approach proposed in the concept of so-called "smart city" within the project development.

Main directions of energy saving in the residential sector are the following:

- optimization of heating schemes, modernization of power plants and refusal from inefficient boilers;
- use of energy efficient design and engineering systems;
- organization of good governance of available residential buildings;
- implementation of projects for construction of energy-efficient residential buildings with controlled ventilation, with utilization of ventilation emissions, with one coolant entering into a separate apartment for the organization of heat metering and heating regulation in every apartment;
- design and construction of buildings using energy-saving technologies;
- thermal rehabilitation of buildings and residential houses;

- implementation of energy efficient lighting systems, including the street lighting;
- creation of a complex technological equipment and the development of technological solutions for the typical use of heat pumps in heating systems;
- creation of a low-temperature combined heat technology with quantitative and qualitative regulation of the heat load, heating decentralization;
- improving energy efficiency of home appliances and office equipment;
- public involvement into the process of energy saving and increasing efficiency of using energy resources in the residential sector.

Emphasis on improving energy efficiency in buildings (both residential and office as well as social facilities) and in the housing sector as a whole complies with global trends.

The EU Commission believes that the savings in the sector of office buildings, for example, could be 30% (even higher than in the residential buildings sector, which is estimated at 27%). National studies confirm these estimates of savings. In one review on public buildings in Luxembourg it was announced that the potential savings in public buildings could be 30-50%.

One of the factors that have great potential in relation to office buildings is lighting. Currently, approximately 1% of offices and buildings in the EU are equipped with some type of a dimmer switch. For example, dimmers, responsive to movement could give up to 30% of savings. Widespread use of dimmers can also contribute to significant savings in schools and hospitals.

Noncommercial services sector, including schools and hospitals, also provides savings that generally reflects the large potential of buildings. State vehicle fleet and public transport system also offer some possibilities: the total potential reduction in the EU transport sector, for example, is estimated at 26%.

In Russia, the share of district heating accounts for 40% of total energy consumption of the country and district housing heating accounts for 6% of GDP. In general, increasing the efficiency of district heating in the countries with economies in transition to the level of developed countries would save over 80 billion m<sup>3</sup> of gas per year.

Installation of metering and control units in offices which are still not equipped as such, could provide substantial savings by reducing the temperature in the afterhours. General regulations designed to promote energy efficiency of government office buildings include construction standards and regulations that can affect energy consumption in offices, as well as regulations on logistical support and labeling affecting the energy consumption of office equipment.

Such direct measures as metering and regulation, as well as involvement of the energy manager in the field of heat consumption, could be very effective in achieving savings because

of the possibility to minimize excessive heat supply, and (as in the case of offices) lowering the temperature at night and on weekends, when the buildings are empty. Where district or mini-heating network is applicable or where it is no longer present, the creation of "heat distribution points" could contribute to significant energy savings. Use of effective lighting, insulation, thermostatic valves and replacement of windows may also provide a significant reduction in energy consumption.

Better insulation, higher efficiency of appliances and broader measures of reconstruction of worn housing belongs to the activities usually carried out in the sector of residential buildings. In some countries the implemented programs also provide for the construction of energy efficient public housing with elements of "passive" design and technologies to reduce energy consumption, including through the use of renewable energy sources.

In the CIS countries during the period of 1991-1999 it was privatized about 20-60% of housing fund. The share of privately owned housing has increased over the period from 1990 up to 12% in Poland and 49% in Latvia.

In some countries, housing is partially privatized, as result there are in buildings both the apartments owned by persons living in, and social housing (flats rented by inhabitants from the municipal authorities). In such cases, implementation and financing of energy efficiency measures in public places could be difficult and requires the detailed study and testing in practice of developed approaches to address energy efficiency.

Within the project "Analysis of the development and dissemination of advanced technologies in the field of energy efficiency and renewable energy in the framework of the project "Global Energy Efficiency 21" with the focus on Central Asia" to the end of 2014 it should be fulfilled an investigated in order to identify the existing problems of these countries with access of population to modern and safe sources of energy and sustainability of energy supply. It is necessary to assess the level of coverage by centralized and decentralized energy supply, as well as the degree of its reliability, safety and environmental friendliness.

It is also necessary to examine what should be the criteria of "sustainability" of energy supply in the region, taking into account local conditions, what energy sources and technologies could be considered as modern and what – could not. According to the research's results, it is necessary to gain a holistic view of the situation with respect to the challenges facing the Central Asian region in terms of the goal №1 of the initiative SE4All – providing a universal access to modern energy sources.

**All these results should become the starting point for the project "Assistance to the CIS member-states in the successful implementation of the "Global Action Plan",**

**developed for the initiative "Sustainable Energy for All "as the first stage of joint actions to implement the initiative of UN Secretary General SE4All in CIS region.**

Taking into account the results achieved as a basis for the development of cooperation in the region it is possible to offer the following plan of actions which will be revised and updated in the process of implementation of the new project.

The priority areas for further cooperation include:

- improving energy efficiency in buildings (residential and administrative);
- improving energy efficiency of centralized heat and power supply systems and of housing sector as a whole;
- • improving energy efficiency of lighting (currently Russia and Kazakhstan have already executed the UNDP/GEF projects "Transforming the Market for Efficient Lighting");
- analysis of the efficiency and the development of proposals for using decentralized energy sources, with special emphasis on the development of renewable energy potential;
- improving energy efficiency in transport sector, including consideration of using liquefied natural gas and alternative fuels;
- encouraging people to the rational use of energy, shaping of relevant behavior of citizens;
- transition to implementing the concept of "smart city", which is a comprehensive approach to ensuring high standards of space planning, energy efficiency and environment protection in order to improve the quality of life and to reduce the anthropogenic pressures on ecosystems of respective territories.

## Regional Action Plan of the CIS member-states in the area of improving energy efficiency and RES

№	Action	Dates
<b>1.</b>	<b>Assessment of the situation with respect to the tasks of the CIS region in terms of achieving the goal № 1 of SE4All Initiative and correction of Action Plan for 2014-2016</b>	2014
<b>2. Improvement of the communication and coordination mechanisms among the CIS member-states</b>		
2.1	At the initial stage within the CIS framework it is required to analyze the accumulated experience about improving energy efficiency in buildings and to prepare: - a set of recommendations for creation of national strategies to increase energy efficiency in buildings, including both office buildings and social facilities and whole the whole sphere of housing and communal services; - suggestions for improvement of the regulatory framework in the field of energy efficiency in buildings and utility networks	2014
2.2.	Development of a Roadmap for the CIS member-states on priority areas of cooperation in improving energy efficiency and renewable energy use	2014
2.3.	Considering the feasibility of establishing Coordination and Analysis Center of the CIS on RES utilization	2014
2.4.	Analysis of existing economic, legislative and administrative barriers for the technologies exchange between the CIS member-states and development of a set of measures to address them	2014
<b>3. Establishing the necessary regulatory environment</b>		
3.1.	Carrying out the unification of technical regulations and standards in the area of energy efficiency, with particular emphasis on energy saving in buildings and municipal services sector	2014 and subsequent period
3.2.	Analysis of the global experience and preparation of proposals adapting it in the CIS member states in terms of implementation of economic incentives and mechanisms of energy efficiency	2014 and subsequent period

№	Action	Dates
	improvement in all sectors of the economy, including buildings.	
3.3.	Development of economic incentives for implementation of energy-saving projects in the housing sector	2014-2016
3.4.	Analysis of administrative, legislative, economic and financial barriers to improving energy efficiency in buildings and in housing sector in general, and exchange of experiences in order to overcome them	2014-2016
3.5	Development of recommendations for improvement of the regulatory framework in the area of using the renewable energy sources in the light of experience gained	2014-2016
3.6.	Work over the unification of technical regulations and standards in the area of using renewable energy sources	2014
<b>4. Development and implementation of joint projects</b>		
4.1.	Creating joint ventures to produce power machine engineering products in the CIS member-states	2015 and subsequent period
4.2.	Development and implementation of programs to improve the energy efficiency of household appliances and office equipment	2014 and subsequent period
4.3.	Development and implementation construction programs of energy efficient and “energy passive” buildings	2014 and subsequent period
4.4.	Development of proposals for economic stimulation of production and consumption of electricity and heat from renewable energy sources	2014-2016
4.5.	Elaboration and implementation of a set of measures for the development of service maintenance of renewable energy installations	2014-2016
4.6.	Preparation and adoption of a set of measures to stimulate the production and consumption of equipment for renewable energy	2014-2016
4.7.	Implementation of pilot projects to improve energy efficiency in	2015-2016

№	Action	Dates
	order to demonstrate effective prototype solutions based on technologies and equipment produced in the CIS (including in the sphere of thermal rehabilitation of buildings, modernization of networks, improving energy efficiency of lighting, etc.)	
<b>5. Methodological support of energy efficiency</b>		
5.1.	Preparation of proposals to improve the methodology of state statistical reporting system and target indicators for energy efficiency	2014-2016
5.2.	Adopting measures for improvement of the regulatory, technical and procedural documentation for design, construction and operation of buildings	2014 and subsequent period
5.3.	Examination and evaluation of technological developments for the construction of energy efficient buildings, lighting and municipal networks, available in the CIS	2014 and subsequent period
5.4.	Measures to improve the regulatory, technical and procedural documentation for the design, construction and operation of renewable energy installations	2014 and subsequent period
5.5.	Providing expertise on technological developments in the field of renewable energy available in CIS member-states with recommendations for their implementation	2014 and subsequent period
5.6.	Development of legislation aimed at the improvement of energy efficiency and economic stimulation of energy saving activities	2014-2016
<b>6. Development and implementation of R&amp;D programs</b>		
6.1.	Developing a network of energy efficiency demonstration zones (polygons) with the use of advanced technologies, including ones for renewable energy, in order to share experiences	2015 and subsequent period
6.2.	Generalization of the experience gained by the CIS member-states in the area effective methods of construction and modernization of buildings, including the purchase of equipment and appliances, labeling in order to reduce the need in for heat and possibly for cooling, with possible the preparation of recommendations by the countries	2014 and subsequent period

№	Action	Dates
6.3.	Organization of visiting of demonstration projects by CIS member-states' specialists in order to learn and consider the results of the implementation of different approaches to improve EE and get new experience in using advanced technologies to improve energy efficiency and RES utilization	Constantly
6.4.	Development and implementation of programs to disseminate knowledge and skills in the field of energy efficiency and renewable energy	2014 and subsequent period
<b>7. Information exchange and knowledge base creation</b>		
7.1.	Creating an information resource (web site), reflecting the experience of implementation of energy efficient approaches and using technologies of improvement the energy efficiency and RES	2014-2015
7.2.	Organization of seminars, conferences, exchange of experience and knowledge in the field of energy efficiency and renewable energy, including : <ul style="list-style-type: none"> <li>- promoting energy efficiency and renewable energy;</li> <li>- referencing to the demonstration sites, including the exchange of experience on construction and modernization of energy-efficient generating units in housing sector;</li> <li>- application of renewable energy technologies;</li> <li>- using the database of manufacturers of energy efficient equipment and RES installations with indication of their characteristics</li> </ul>	On a regular basis

It is possible in future to develop the special programs for priority areas of inter-regional It is possible in future to develop the special programs for priority areas of inter-regional cooperation.