

**INCREASING INVESTMENTS IN SUSTAINABLE ENERGY**

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**Scientific problem.** Ukraine is an energy deficit country with import share of energy sources up to 70%. At the same time efficiency of energy usage is pretty low, thus making energy consumption in Ukrainian industry in 3-4 times higher than in developed countries (Ukraine in 2012 produced only PPP GDP<sup>1</sup> 3.1 per one kilogram of oil-equivalent, compared with PPP GDP 9 per kg of oil-equivalent in Poland, 11.5 – in Turkey, 12.4 – in UK and PPP GDP 9.58 per one kilogram of oil-equivalent average in the World) [1].

Ukraine set targets of achieving 11% share (8590 thousand ton of oil-equivalent (toe)) [2] of renewable energy in final energy consumption by 2020 and reduction till 2035 energy usage by 30-35% [3]. Achievement of these objectives can be provided only by sufficient public and private investments. Energy Strategy of Ukraine till 2030 foresees attracting around USD 200 billion of investments in energy sector [3]. Contrary decreasing lending capacity of Ukrainian financial system and willingness to invest in the sustainable energy sector, liquidity problems of commercial banks as well as lack of trust of investors in banking system caused uncertainty and low financeability of the sustainable energy sector. As shows experience of past years financing of measures within National Energy Efficiency and Renewable energy Development Program equaled to only 20% of planned/needed figures (in 2010-2011 investments equaled to USD 1.2 billion, while planned figure was around USD 5.7 billion) [4]. That's why innovative mechanisms, measures, instruments and tools should be proposed for Ukrainian market to attract investments in sustainable energy.

**Analysis of recent researches and publications.** International Energy Agency (IEA) emphasized, that energy efficiency has played, and continues to play, a large and valuable role in the sustainable development of the global economy. The energy demand that is avoided as a result of steady improvements in the efficiency of energy-using stock such as buildings, cars and appliances is larger than the total final consumption from coal, oil or gas in IEA member countries. The market for energy efficiency investments is very large – estimated between USD 310 billion and USD 360 billion in 2011 – and this market is producing results: total final consumption in IEA countries is estimated to be 60% lower today because of energy efficiency improvements over the last four decades. Since 2001, investments in energy efficiency in 18 IEA countries have helped to avoid over 1 700 million toe from being consumed [5].

As calculated by Frankfurt School-UNEP Centre global investment in renewable power and fuels (excluding large hydro-electric projects) was USD 270.2 billion in 2014, nearly 17% higher than the previous year. A key feature of 2014 was the continuing spread of renewable energy to new markets. Investment in developing countries reached \$131.3 billion – almost level of developed economies (USD 138.9 billion). Indonesia, Chile, Mexico, Kenya, South Africa and Turkey invested in renewables more than billion of dollars in 2014, and investments in Jordan, Uruguay, Panama, the Philippines and Myanmar were in the USD 500 million to USD 1 billion range. In 2014 the most attractive for investments was solar energy sector with USD 149.6 billion, while that

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<sup>1</sup> GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to current international dollars using purchasing power parity rates based on the 2011 ICP round. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States.

in wind reached a record \$99.5 billion. In biofuels investments equaled to USD 5.1 billion (a 10-year low), in biomass and waste-to-energy – USD 8.4 billion, small hydro – USD 4.5 billion, and geothermal – USD 2.7 billion. The biggest location for renewable energy investment last year was in China (USD 83.3 billion). Investments in China raced up from just USD 3 billion in 2004 to USD 83.3 billion in 2014. In second place came the US, at USD 38.3 billion, well below its all-time high, reached in 2011. Third came Japan, at USD 35.7 billion, a tenth higher than in 2013 and its biggest total ever. India was at USD 7.4 billion, and Brazil at USD 7.6 billion. The two biggest categories of renewable energy investment were asset finance of utility-scale projects, at USD 170.7 billion and investment in small distributed capacity, largely rooftop solar, at USD 73.5 billion. Equity raising by renewable energy companies on public markets increased to USD 15.1 billion, research and development spending – to USD 11.7 billion (with governments contributing USD 5.1 billion and companies a record USD 6.6 billion) [6].

Increasing investments in sustainable energy is provided and helped by supportive government policies aimed to boost alternative energy generation and demand, energy efficiency measures, and to lower pollution.

The US Climate Action Plan includes measures addressing the high costs of some types of technology development, such as carbon capture and storage, promoting widespread investment in appliance and equipment efficiency, and overcoming barriers to incentivizing private-sector action (and wisely using government resources that avoid duplicating or crowding out private-sector investments). The plan is designed to help meet the US commitment to reduce emissions by 2020 in the range of 17% below 2005 levels, as agreed in the United Nations climate negotiations as well as to double renewable electricity generation by 2020 [7].

European Union member states, including Ireland, Italy and the Netherlands are putting in place a mix of policies that includes standards, grants, tax deductions, market-based instruments and approaches that leverage public funding with private third-party finance. As mentioned by IAE Chinese government policies include a variety of administrative programmes, such as mandatory energy savings agreements with large and medium-sized enterprises. India is increasingly implementing market-based approaches, whereas Indonesia is putting in place basic market-setting standards and labeling programmes [5].

Ukraine as well as other post-Soviet countries is pretty far from such indicators. As emphasizes IAE, most of the countries in the Eastern Europe, Caucasus and Central Asia have been moving up the World Bank's rankings for the Ease of Doing Business (in the case of Georgia improvement has been outstanding); however, foreign direct investment has only been in up- and midstream actors, mainly from oil and gas majors. On the other hand, investment in fixed energy infrastructure, including upgrades and maintenance, is carried out with the help of donor agencies and international financial institutions. The impediments for attracting investments in upgrading and maintaining these existing systems were due mainly to tariff structures, where energy tariffs remained below cost-recovery levels, and to energy subsidies, which do not provide any investor with the chance of recouping their investment. Those who have undergone a number of cycles of commercialization and privatization of their national companies have opted for restructuring and selling parts of their energy infrastructures to potential investors in an exchange for system rehabilitation and system reliability. Those countries that have opted for regulatory reforms, in addition to privatizing their energy sectors, have seen greater benefits to the population and industry at large [8].

**The objective of the article.** Ukraine has great potential in reducing energy usage during relatively short period, as was achieved by Eastern European countries (Slovakia from 0,3 toe per USD 1000 GDP (constant 2011 PPP) in 1992 to 0,22 toe per USD 1000 GDP in 2000 – for the 30 % in 10 years. Poland from 0,27 toe per USD 1000 GDP (constant 2011 PPP) in 1990 to 0,16 toe per USD 1000 GDP in 2000 – almost twice in 10 years) [1]. Fulfillment of such achievements is a question of favorable investment climate and attractive mechanisms for financing energy efficiency (EE) and renewable energy (RES) sectors. The main objective of the article is to explore and to summarize the best international practice on attracting investments in sustainable energy sector, to evaluate financial models, instruments and mechanism already used in countries, to carry critical comparative review of financial instruments implemented in Ukraine. Conclusions of the study may

be transferred to the measures for improvement the financeability and attractiveness of sustainable energy investments.

**Statement of the main results of the study.** As a result of intensive public policies, greater range of financial products and models EE and RES financing has moved worldwide to an established financial market segment.

Important channel for public finance to energy efficiency is through the development aid programmes of bilateral and multilateral agencies. Multilateral Development Banks (MDBs) provided USD 23.8 billion in financing in 2013 to address the challenges of climate change and, since 2011, have provided over USD 75 billion in climate finance to developing and emerging economies. Of the total commitments, 9%, or USD 2.2 billion, came from external resources, such as bilateral or multilateral donors, including the Global Environment Facility and the Climate Investment Funds. The regional coverage for 2013 is quite balanced with two regions (East Asia and Pacific, Non-EU Europe and Central Asia) each receiving roughly 20% of total climate finance provided and four regions (South Asia, Sub-Saharan Africa, Latin America and Caribbean, EU New Member States) 10-15% each. As to sector coverage, 22% of finance went to “Coastal and riverine infrastructure, 30% – to the category comprising “Energy, transport, and other built environment and infrastructure” and 25% – to the renewable energy [9].

Another method of investments – working out and implementing special governmental policies for developing renewable sector and increasing financeability and attractiveness of EE and RES investments. Financial vehicles within such policies have been developed to make energy efficiency more attractive to investors. The most common financial vehicles and measures include the following.

**Specialized entities such as ESCOs**, which are becoming more active in many countries and implementing new financial models such as energy performance contracting. ESCOs first emerged in the United States in the 1980s, and the market there is already worth more than USD 5 billion a year. The largest market is currently in China, representing over USD 12 billion in 2013 [5].

**Clean energy bonds**, green bonds, climate bonds and others create new capacity for energy efficiency investment by tapping into fixed income markets. Until late 2013, the green bond market was dominated by MDBs, but corporate green bond issues are now growing very rapidly. For the moment definitions vary widely, but standards and voluntary principles are being developed. Transparent and independent rating systems will be important for further market development [5].

**On-bill financing programmes**, such as Property Assessed Clean Energy (PACE), have achieved significant uptake, including in the United States, Mexico and Europe [5].

PACE is a specific bond, issued by municipal governments to investors and then loan the money to consumers and businesses to put towards an energy retrofit. The loans are repaid over the assigned term (typically 15 or 20 years) via an annual assessment on their property tax bill. PACE can pay for new heating and cooling systems, lighting improvements, solar panels, water pumps, insulation, and more for almost any property – homes, commercial, industrial, non-profit, and agricultural. One of the most notable characteristics of PACE programs is that the loan is attached to the property rather than an individual. PACE let home and business owners pay for the upfront costs, which the property owner then pays back by increasing property taxes by a set rate over about 20 years. This allows property owners to begin saving on energy costs while they are paying for their solar panels. This usually means that property owners have net gains even with increased property tax. Several problems have been raised regarding residential PACE during last years in the USA, while commercial PACE is completely unaffected. Estimated market of both PACE in the USA is around \$1 billion [10, 11].

As well as financial vehicles many countries are **developing institutional base for boosting investments in EE&RES**. Many countries mobilize financial resources through specialized state funds. For instance, the National Environment Fund of Benin (Fonds National pour l'Environnement – FNE) was originally designed to mobilize and blend national and international funding sources for national environment projects (in 2013 turned into the FNEC (National Fund for the Environment and Climate). In 2003 the Government of Thailand launched the Thai Energy Efficiency Revolving Fund (EERF) as part of its Energy Conservation Programme. To kick-start the EERF, the Fund's initial capital was solely derived from Thailand's government budget via the

revenues from a petroleum tax that were channeled via the ENCON Fund. Thai fund is a combined subsidy and liquidity instrument. There is also Energy efficiency Fund in Bulgaria, Climate Change Trust Fund in Indonesia [12, 13].

Another kind of widespread mechanisms of attracting investments - *mechanism of public guarantees* to compensate payment to a lender or an investor in case of default of obligations that another party is committed to. This mechanism is known as PBG and used in USA, UK and other developed countries.

For instance, in UK Enterprise Finance Guarantee (EFG) scheme was set to encourage more banks lending to SMEs, under which, the government guarantees 75% of an SME's bank loan, with the lenders covering the remaining 25%. Firms can seek to use EFG to access new loans, refinance existing loans, convert overdrafts into loans, gain a new overdraft or extend a current one, and cover cash flow shortages. It is available for all sectors of the economy except the coal industry and makes billions of pounds available to business [14].

In the USA there is a loan guarantees program, which allows to guarantee up to 80% of the eligible project costs of a project, aimed to utilize a new or significantly improved technology, avoid, reduce, or sequester greenhouse gases. Besides there is a ATVM loan program for direct loans to automotive or component manufacturers for reequipping, expanding, or establishing manufacturing facilities in the United States that produce fuel-efficient advanced technology vehicles (ATVs) or qualifying components or for engineering integration performed in the United States for ATVs or qualifying components [15]. Besides, there is a Business & Industry Loan Guarantees, which also enables business to attract loans for EE&RES projects development.

In France FOGIME is promoting investments in EE&RES by granting loan guarantees to SME.

One more tool for EE and RES projects is *direct public financing or investments through specialized institutions*. In the European Union, the European Structural and Investment Funds allocated EUR 5.6 billion to energy efficiency over the period from 2006 to 2013. During the new programme period from 2014 to 2020, energy efficiency funding is expected at least to double [5].

Green investment banks (GIBs) or other specialized banks are being established in several countries and are using public capital to leverage private capital, including from institutional investors. Energy efficiency is a target sector for finance in GIBs established in the United Kingdom, Malaysia, South Africa, Australia, Japan, the United Arab Emirates and the United States. For instance, Germany's public investment bank, KfW, committed a total of EUR 16 billion to energy efficiency in Germany in 2013, and the European Investment Bank (EIB) provided EUR 2.1 billion across the European Union. France's Caisse des Dépôts committed EUR 453 million to energy efficiency in 2012 and the United Kingdom Green Investment Bank provided EUR 181 million [5].

In the USA Department of Agriculture implements several programs (like Advanced Biofuel Payment Program, Rural Energy for America Program (REAP) Renewable Energy & Energy Efficiency Loans & Grants, Energy Efficiency & Conservation Loans) which provide additional financing for business.

Often direct financing is provided for specific sectors with huge energy economy potential, like residential and commercial buildings. IEA experts reported, that market for energy efficiency improvements in the buildings sector has seen significant government support over the past few years in Ireland, Italy, the Netherlands, Canada and Japan [5]. In Ireland, the Better Energy Homes programmes provide financial support to households for energy efficiency investments. These programmes resulted in average annual investment of EUR 230 million in energy efficiency-related construction over the five years (2009 to 2013). Italy offered a 55% tax deduction for energy efficiency investments in the residential sector (starting in 2014, the tax deduction has since been increased to 65% for some measures). Between 2007 and 2013, more than 1.8 million applications were approved and around EUR 23 billion of investments were leveraged by households, at a cost of about EUR 13 billion in undiscounted foregone tax revenue. In 2012 alone, more than EUR 2.8 billion was invested in 265 500 energy efficiency measures, which included 2.3 million square meters (m<sup>2</sup>) of window replacements and 1.2 million m<sup>2</sup> of rehabilitated solid surfaces. Investments in building insulation in the Netherlands have also been growing rapidly at a rate of

10% per year, reaching a value of EUR 680 million in 2012. Canada released the Model National Energy Code for Buildings in 2011, which would lead to a 25% energy efficiency improvement compared to the current code for commercial and multi-storey residential buildings, and is predicted to save CAD 70 million for occupants [5].

In Germany a special program is implemented for EE measures in buildings (heating with wood pellets and other biomass, solar panel, isolation etc.). Within this program subsidised credits are provided for 4-30 years with 1.4-1.6% credit rates. In 2010-2011 around EURO 7,3 billion were granted for 165000 buildings/flats [16].

***Standardization and audit system as well as teaching/learning improvements highly contribute to the development of EE&RES projects.*** International experience proves effectiveness of national advisory and training system (especially for small and medium-sized enterprise - SME), which has benefited from government support in many countries.

In the USA, Energy Audits & Renewable Energy Development Grants assist rural small businesses and agricultural producers by conducting and promoting energy audits, and providing renewable energy development assistance [17].

In Ireland, between 2007 and 2011, the programme of the Sustainable Energy Authority of Ireland supported over 1 470 companies employing the equivalent of approximately 130 000 staff through advice, mentoring and training. In 2012, over 200 SMEs with 2 000 employees and a total annual energy bill of EUR 19.7 million were supported to achieve savings of EUR 2 million. Two schemes in the Netherlands, VAMIL and MIA, had budgets of EUR 24 million and EUR 101 million respectively in 2013. The programmes benefit SMEs in particular, with an average investment size of EUR 150 000 for both MIA and VAMIL. Between 2005 and 2010, MIA and VAMIL projects received over 57 000 applications. In Korea the government has committed to implement measures to promote the market for smart appliances, energy storage and energy management systems (EMS) using cutting-edge information and communications technology [5].

Considering international experience among all energy efficiency options the most relevant for Ukraine seems to be EE technologies in thermal modernization and retrofitting of buildings and among RES options – the most potential for deployment has the substitution of natural gas. This obviously is due to the energy balance.

In Ukraine the largest contribution in final energy consumption was provided by natural gas – 34.8% in 2012 [18], of which more than half is usually consumed by households (e.g. in 2013 homeowners consumed for heating 25 billion m<sup>3</sup> of 50 billion m<sup>3</sup> total consumption). Thus one of the biggest potential in decreasing the amount of energy used can be found in retrofitting residential buildings or building more efficient homes – in residential buildings expected energy consumption reduction may represent 2304 thousand toe, while in commercial buildings reduction will equal to 104 thousand toe. In industry reduction may account to 2773 thousand toe [4].

By sectors the highest energy consumption in 2012 was in industry (42.3%) and housing (32.1%) – in housing Ukraine consumes 2-2,5 more gas than in European countries. Transport consumed 15.7% of total energy, agriculture – almost 3% [18].

Implementation and development of financial models and investment mechanisms anticipate involvement of national and local authorities and policy makers (state agencies on energy efficiency, ministers, regional administrations etc), financial institutions (state and private banks, credit unions, venture and investment funds etc), legal and physical entities.

In 2014 Ukrainian Government assessed costs of renewable energy measures plan for the 2015-2020 in 22.6 billion USD (for wind electricity generation – USD 3.1 billion, hydro generation – USD 4.1 billion, photovoltaic – USD 2.1 billion, biomass – USD 2.5 billion. For the development of biomass heat-generating capacities predicted additional USD 7.6 billion, for bioethanol and biodiesel production – USD 0.2 billion) [2]. Calculation of financial costs of EE measures for 2016-2020 is still in the progress.

In 2015 in accordance with Governmental expectations total financing of EE&RES measures will amount to almost USD 5 billion, of which only USD 75 million (mostly for houses thermal insulation of external walls and roof as well as for heating system improvements) will provide National Budget, USD 157 million – local budgets and USD 4.7 billion – is supposed to

come from other sources, which seems to be more than optimistic nowadays without essential legislation improvements.

As shows experience of previous years Governmental financial targets are fulfilled only by 20-30%. This year results may be even weaker due to economical and social stagnation and low financial possibilities of business, population and government. Capital investments in 2014 decreased by 24%. All kinds of business are facing profit squeeze (in 2014 more than 40% of enterprises suffered net financial losses. Overall financial result of Ukrainian enterprises activities in 2014 equals to minus UAH 408 billion (approximately USD 34 billion) comparing with profit almost UAH 38 billion (approximately USD 5 billion) in 2013) and lack of credit opportunities, while physical persons are suffering from lower salaries (minus 6,5% in 2014 and minus 24% in Jan-June 2015) [19]. At the same time higher energy prices are becoming burden for many of legal and physical persons, thus deteriorating situation and creating a circle of problems.

To raise attractiveness of EE&RES investments Ukrainian Government introduced several stimulation mechanisms, like taxes and duties exemptions, special tariffs on electricity, compensation of credit payments and expenditures on energy efficient measures. Besides, to accelerate development of sector of sustainable energy currently national legislation regarding investigated areas (EE/RES) is passing through actualization process following EU legislation related to most effective energy use and RES popularization. Meanwhile there are still many missing points in legislation and instrumental basis to have better performance of mentioned above actualization process. On the one hand some of legislative acts have significant drawbacks and need proper amendments, on the other hand – existing mechanisms of direct public funding of energy efficiency and alternative energy seem to be inefficient and/or insufficient. The most common “missing points” in ongoing policies are as follows.

**Lack of co-integration and multiplication effect of national and local programmes.** In 2010-2014 Ukraine adopted 15 branch programmes on energy efficiency, besides there were regional programmes in every region. At the same time efficiency of these programs is very arguable. Despite the growing number of Governmental programmes and financial mechanisms on EE&RES issues, Ukrainian authorities as well as citizens are lacking profound and consolidating information on possibilities and efficiency of these programmes. For instance, national government introduced financial compensation of homeowners’ credit payments and expenditures on energy efficient retrofits. Simultaneously some local authorities have the same instrument (compensation of credit payments) from local budget – but low financial possibilities of local authorities provoke difficulties of meeting financial obligations thus sowing disbelief and reducing confidence of citizens in such programmes. Besides governmental financing is provided to the regions without dependence on local financing.

Meanwhile sub-national or local governments can drive energy efficiency markets. Much of Canada’s efficiency programmes and activity occur under provincial government purview. As of 2011, over 200 efficiency programmes and policies were offered through the ten provinces and three territories [5].

**Missing potential of governmental investment multiplier value.** Today state investments or financial resources are allocated among different institutions – there are several EE&RES governmental programmes financed by Ministry of Regional Development, Construction and Housing of Ukraine, Ministry of Energy and Coal Industry of Ukraine, State Agency on Energy Efficiency and Energy Saving of Ukraine, municipalities etc., which prevent investing with multiplier value. Creation of specialized national financial institution in the form of the Ukrainian Energy efficiency fund, allocation through it governmental expenditures on EE&RES projects with co-financing from local budgets and private resources could highly contribute to meet investment challenges in Ukraine and raise efficiency of public investments.

**Lack of new innovative mechanisms of attracting investments in EE&RES.** Much of public finance is used for direct public funding of energy efficiency and alternative energy, which seems to be less efficient comparing with mechanisms of attracting private investment for EE measures or replacement of natural gas. Bond or security markets are poorly linked with sustainable energy sector. Besides credits on EE measures are attached to the individuals rather than on property (which could be implemented through special property taxation) thus discouraging from

profound investments (particularly considering 2-3 times higher average heating energy consumption in many-flat buildings in Ukraine comparing with European standards).

One of the tools that could positively influence the situation at the market of heat generation from RES is premium for municipal heat generating companies and organizations in the public sector. Such mechanism has a number of significant advantages for the state budget, and for the energy industry as a whole. The general concept of the mechanism lies in the principle that a premium is provided at the end of heating season for heat generating company that substituted natural gas. In particular, it foresees abolishment of existing inefficient mechanisms of direct public funding of energy efficiency and alternative energy. The advantage of the proposed mechanism is stimulation of investments in this sector by awarding investors for actual reduction (substitution) of natural gas without state intervention in economic activities of the private investor. An important feature of this tool is transparency and overcoming administrative barriers and corruption risks by simplifying procedures for state support of investments in substitution of natural gas.

Adoption of such mechanisms will implement transition model from subsidies in the gas sector to investment in energy efficiency and renewable energy, which is a key factor in ensuring energy independence and economic stability in Ukraine

**Unobligatory pre-usage efficiency control and insufficient energy audit of programmes and financial mechanisms.** In some cases budget finance on EE&RES are used inefficiently. Besides, programmes don't set minimum energy efficiency criteria for participants. Effectiveness of governmental scheme of compensation homeowners' credit payments and expenditures on energy efficient retrofits like houses thermal insulation or RES usage for heating system is questionable due to absence of links with energy/finance savings after retrofitting. Besides, financing is often provided for equipment purchase and installation without profound obligations on energy usage reduction (and without pre and post auditing of energy saving effects).

**Lack of standardized financial products and models for EE&RES projects, their stress testing and risk mitigation.** Financial institutions providing credits for EE&RES measures as well as recipients need better methodologies and well-grounded models for decision making, for measurement calculations of energy efficiency improvements, projects preparation and development advisory and support.

**Inadequate informational background and support to EE&RES measures.** In many cases citizens are not aware of possibilities. And public bodies are not enough informed about RES potential, for instance about energy crops growing and biomass fuels production potential in Ukraine.

**Requirements of legislation improvements for better performance of financial programmes on value added basis.** First of all, further legislation improvements should be addressed to feed in tariff mechanism (Green Tariff), taxation, ESCO mechanism, guarantees schemes, bond markets, securitization etc. At the same time shortage of government expenditures raises value and potential of public-private partnership in financing EE and RES measures. This mechanism is even more important due to political and macroeconomic instability in Ukraine, substantial decrease of private crediting, salaries and profits (overall outstanding amount of credits on the March, 2015 equaled to USD 43 billion - only half of the amount on the end of 2013 [20]. Such decrease is a result of national currency devaluation as well as problems in Ukrainian banking system.

**Lack of energy labeling/standardization system for objects and products.**

For instance, Japan has continued to expand the Top Runner programme, strengthen energy auditing, certification and labeling of buildings, implement more stringent energy performance requirements for new buildings and scale-up efforts to improve the efficiency of the existing building stock [5].

**Insufficient fuel economy standards in Ukraine for vehicles.** Adopted in 1998 by the Ministry of Transport of Ukraine (Order # 43) fuel usage standards don't meet present requirements and are higher than in developed countries.

OECD/IEA experts emphasized, that fuel expenditure is a key driver of transport efficiency investment, with global expenditure expected to reach USD 2.8 trillion in 2020. Annual investments in energy efficiency in passenger light duty vehicles (LDVs) consists approximately USD 80

billion. The most important short-term driver for energy efficiency investments in passenger vehicles is vehicle fuel economy (VFE) standards. Brazil, Canada, China, the European Union, India, Japan, Mexico, Korea and the United States have implemented or updated VFE standards for passenger LDVs that will increase average fuel economy to a range of 3.9 liters to 6.7 liters of gasoline equivalent per 100 kilometers. Energy efficiency improvements in the transport system could reduce fuel expenditure between USD 40 billion and USD 189 billion annually by 2020 depending on the adoption of new policies and scale of market implementation they achieve [5].

The U.S. Environmental Protection Agency (EPA) and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) are jointly proposing a national program that would establish the next phase of greenhouse gas (GHG) emissions and fuel efficiency standards for medium- and heavy-duty vehicles. The proposed standards are expected to cut fuel costs by about USD 170 billion, and reduce oil consumption by up to 1.8 billion barrels over the lifetime of the vehicles sold under the program. The agencies estimate the proposed standards would result in approximately USD 230 billion in net benefits over the lifetime of the vehicles sold in the regulatory timeframe, while costing the affected industry less than one-tenth that amount (about USD 25 billion over the same period) [21].

China issued its fuel economy standards for passenger LDVs in September 2004, which ranks were third globally, following the Japanese and European standards. As a result at the national level average fuel consumption per 100 km of all passenger vehicles was 9.11L in 2002 and dropped to 8.27 L/100km in 2006 [22].

**Obstacles for 3-5 years budget planning for budget institutions**, which intend to introduce EE measures with credit resources. Nevertheless that Budget Codex allows the multi-year planning financing is provided only on yearly basis after approval of Cabinet of Ministers of Ukraine and adoption by the Parliament. Development of ESCO system in Ukraine for implementing EE projects with financial resource of EE service companies could enable the country to conduct large-scale thermo modernization in budgetary institutions and provide refund guarantees to investors. It is foreseen by the Laws that funds saved by the budget institutions due to thermal modernization will be returned to investor and constitute investor's profit. But budget process is still inappropriate for this mechanism. Meanwhile in Ukraine currently about a thousand of budget institutions require thermal modernization, which will allow to save hundreds of millions of cubic meter of natural gas till 2020, and require billions of US dollars of investments, compared with around USD 75 million allocated through National Budget for the Energy Saving Programme in Ukraine in 2015 [23].

Abovementioned issues preclude establishment of incentives for investment boom in EE&RES segment. Facing these challenges demands different and efficient solutions, which than could be transferred to additional investments in sustainable energy.

**Conclusions.** Despite ambitious targets for energy savings and RES Ukrainian sustainable energy sector is facing scarce financial resources due to undeveloped legislative, organizational and institutional framework, unfavorable macroeconomic situation, shortage of credit resources. Considering this an innovative approach for Ukraine should be proposed to attract private investments in the replacement of natural gas as well as for EE&RES projects development. Improvement of legislation due to actualization to EU Directives as well as potential new developments of financial mechanisms is crucial for implementing EE/RES measures for reaching targets by the 2020 and for attracting investments for EE and RES projects.

The general objective of politicians, civil society organizations, business, investors, policy makers and finally consumers should be to create national financial platform for providing essential investments in sustainable energy in Ukraine through improving legislative framework, implementing new financial mechanisms, promoting better EE practice and stimulating EE and RES measures.

Synergy and thus more efficient EE&RES investments should be provided by raising EE&RES awareness of public bodies, business, associations, citizens as well as establishing mechanism of permanent collaboration of policy makers, financial institutions, energy service companies, business, residential and commercial buildings owners and other stakeholders for developing legislative framework and EE&RES projects.



Innovative for Ukraine and based on international practices financial instruments and products in EE&RES sector should be introduced and represent mix of policies that include standards, grants, subsidies, tax deductions, market-based approaches as well as new regulations.

The most promising for Ukraine instruments seem to be:

establishing a specialized financial institution like National Energy Efficiency Fund;

development of ESCO system and legislative framework;

gas substitution premium mechanisms;

mechanism of support for producers of biomass fuels and energy crops;

Initial Public Offering of bonds to raise capital from various investors to fund EE&RES plans;

public backed guarantees schemes;

securitization development;

new fuel efficiency standards for vehicles;

PACE mechanisms as a means of financing energy efficiency upgrades or renewable energy installations for buildings through offering a specific bond to investors and then loan the money (for 15 or 20 years) to consumers and businesses to put towards an energy retrofit.

Establishing favorable investment climate in the sector requires deeper involvement of local authorities and local budgets in abovementioned schemes.

Besides, essential attention should be provided for improvement of methodologies and practices in EE&RES sector, which should include:

- methodology for measurement calculations of energy efficiency improvements for investing and/or loan purposes;

- developing energy auditing system;

- developing energy labeling system (developing and implementing special criteria for equipment, buildings, technologies etc.);

- improving energy certification of buildings in accordance with European requirements;

- standardization of administrative services in cogeneration and alternative fuel sectors;

- specific EE and financial modeling of projects to stimulate private investments. Models of optimum costs/revenues in sustainable energy should be introduced which could be used by consumers for implementing. Development of Energy saving cost curve;

- stress testing of high and low case risk scenarios, assessment of all the project risks;

- integrating EE&RES credits in sustainable banking product;

- development of national advisory and training system.

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## **Нарощування інвестицій у сталу енергетику**

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Проаналізовано світовий досвід залучення інвестицій у сталу енергетику. Наведено міжнародну практику, державні механізми та програми зі збільшення капіталовкладень в альтернативну енергетику та енергоефективні заходи. Надано оцінку ефективності політики щодо залучення приватних інвестицій в енергозбереження та віднолювальні джерела енергії в Україні.

## **Увеличение инвестиций в устойчивую энергетику**

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Проанализирован мировой опыт привлечения инвестиций в устойчивую энергетику. Приведена международная практика, государственные механизмы и программы по увеличению капитальных вложений в альтернативную энергетику и энергоэффективные мероприятия. Дана оценка эффективности политики привлечения частных инвестиций в энергосбережение и возобновляемые источники энергии в Украине.