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Overview of Implementation of Effective Energy-Saving Policy in the EU and Opportunities for Ukraine

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List of Abbreviations and Glossary

CEE – Central and Eastern Europe

CMU – Cabinet of Ministers of Ukraine

CDM – clean development mechanism

CHP – combined heat and power plant

DH – district heating

EBRD – European Bank for Reconstruction and Development

EC – European Commission

ESCO – energy-saving company

FSU – Former Soviet Union

GHG - greenhouse gases

IEA – International Energy Agency

JI – joint implementation (projects)

MENR – the Ministry of Environment and Natural Resources

toe – ton of oil equivalent

TPES – Total Primary Energy Supply. It is made up of indigenous production + imports - exports - international marine bunkers ± stock changes.

UKEEP – Ukrainian Energy Efficiency Programme

UNDP – United Nations Development Program

USAID – United States Agency for International Development

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Introduction

Gas price shock of January 2006 brought energy efficiency on top of the policy agenda in Ukraine. High energy intensity of the Ukrainian economy not only makes it uncompetitive on the global markets, but also hurts country's security and environment.

This paper presents an overview of the situation with energy efficiency in Ukraine, draws lessons from the Eastern European experience and looks at the potential for energy efficiency improvement and sources of its financing.

The paper does not present a comprehensive analysis, but rather highlights some major issues. It is expected that a deeper analysis will be developed in further research.

1. Background on energy efficiency in Ukraine

Ukraine is one of the least energy efficient countries in the world. In terms of its energy use per unit of GDP it is better to only a dozen countries in the world, the majority of them being oil producers (see Graph 1 in Appendix A1). Ukraine is 2.5 times less energy efficient than the world on average.

Causes of inefficiency

In order to be able to figure out how to improve energy efficiency in Ukraine, it is worth looking at the causes of why Ukraine ended up being so energy inefficient. The majority of causes come from the Soviet legacy, with its planned economic system and particularities of energy and industrial policies. These are typical not only for Ukraine, but for all post-soviet countries.

- In the planned system, prices did not reflect resource scarcity, therefore making it very difficult to adequately reflect the energy price in product prices.
- Absence of metering devices, lump-sum payments (notably, for gas, heat and hot water), together with subsidized energy prices, discouraged energy saving in the communal sector. Also, the prices for households and communal sector were as a rule lower than those for the industrial sector, resulting in cross-subsidization.
- Due to its emphasis on the extensive mode of development (i.e. based on increasing volumes of production, especially of capital goods) and the need to equip its army, the Soviet economy ended up with a large heavy industry, which tends to be the most energy intensive. Added to this should be the effect of industrial concentration, so that some countries ended up with large heavy industry sectors and, thus, high energy intensity of the economy. This is the case of Ukraine, but also of many other Eastern European countries.
- Abundance of cheap energy supplies from Russia allowed sustaining the inefficient use of energy resources.

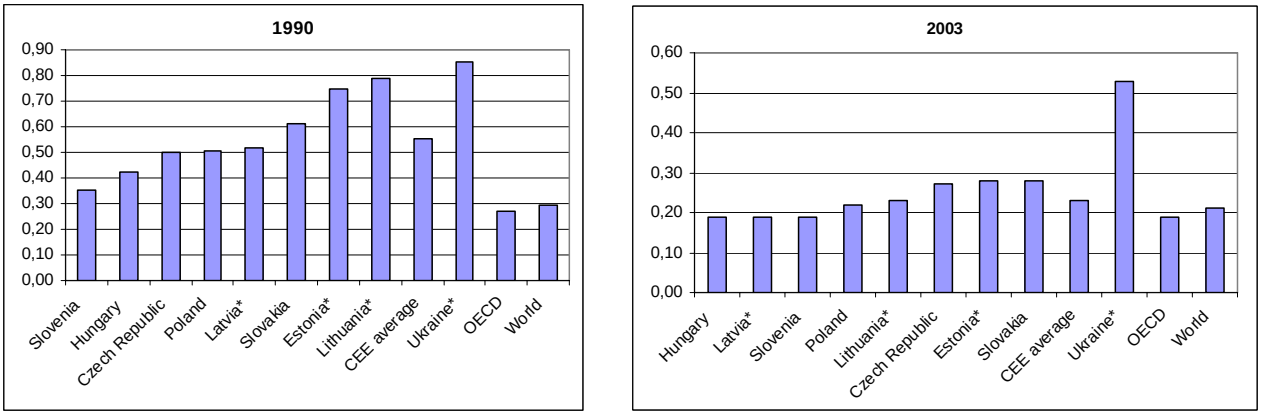
As it can be seen from the list above, the majority of problems with energy use came from the absence of the right signals – the kind of signals the market would provide. Therefore, one can suppose that transition from a planned to a market economy would be the major single factor that would help correct the inefficiencies in the energy use. Introduction of market prices would allow for proper coverage of energy costs and would penalize inefficiency. Market price formation, together with cessation of energy subsidization by Russia, would result in higher energy prices, which will force the industry to restructure. Also, higher prices would necessitate implementation of market mechanisms in the communal sector, first of all, introduction of metering. Of course, all this should be accompanied by specific reforms in different sectors and the energy sector in particular.

2. Development and implementation of energy saving technologies in Central and Eastern Europe

This section reviews the experience of CEE countries with improving energy efficiency. These countries had similar starting conditions to those of Ukraine; moreover, they are developing along the path that Ukraine strives to follow, i.e. European integration. Therefore, it makes sense to see if Ukraine can draw any lessons from their experience.

Over the decade of transition, CEE countries reduced the energy intensity of their economies: while in 1990 energy intensity in some of these countries was almost 3 times higher than in OECD countries, in 2003 the largest excess over OECD indicator was only 22% - in Slovakia (see Graph 1 below and Table A1 in Appendix A1).

Graph 1. Energy intensity in CEE in 1990 and 2003, TPES/GDP at PPP[1]



Source: Table A1 in Appendix A1

Hungary, Latvia and Slovenia were the most energy efficient in 2003, notably as efficient as the OECD on average. Estonia, Czech Republic and Slovak Republic were the least efficient. Compared to 1990, Latvia and Lithuania improved substantially their comparative position, while Czech Republic and Slovakia lagged in their efficiency improvements compared to others.

Factors of energy intensity reduction

Economic restructuring, energy sector reform and European integration are the main factors that underlie the improvement of energy efficiency in CEE.

- *Economic restructuring*

Transition to market economy relations and privatization were the two major underlying forces that fostered energy efficiency in CEE. The first decade of transition saw a large decline in output, mostly in the industrial sector. This drove many inefficient enterprises out of business and resulted in the change of the structure of the economy: the share of industry in GDP fell from 45% to 33% between 1990 and 1998, while services grew from 41% to 53% (World Bank, 2002). These sectoral shifts resulted in lower energy intensity of the economy. Privatization further helped to introduce right incentives in energy consumption.

[1] Numbers between the two graphs are not comparable, as they are calculated using PPP for different base years.

- *Reform in the energy sector*

CEE countries followed different paths of the energy sector restructuring: Poland, for example, first liberalized its energy market and then privatized it, while Hungary did the reverse, i.e. first privatized it and then liberalized.

- *European integration*

Integration of CEE countries in the EU has been a major factor in the restructuring of their energy sector. The effect of the EU integration was especially strong on the electricity sector. In particular, CEE countries had to fully liberalize their electricity markets, to create an independent regulator, to unbundle different parts of the sector (generation, transmission, distribution and retail) and ease the third-party access to the sector.

Some empirical evidence

The European Bank for Reconstruction and Development (EBRD) has conducted a study (Cornillie and Frankhauser, 2002) that analyzed main factors that have driven improvements in energy intensity in CEE and FSU. The main conclusion of the study is that prices and progress in enterprise restructuring were the two most important drivers for more efficient energy use.

The study also found that dynamics of energy intensity was very unequal in the CEE group: in one group of countries, which includes Hungary, Latvia and Slovenia, the energy intensity of industry came down sharply, but that of the rest of the economy (including residential sector) decreased less or remained stable. In the second group of countries, including Poland, Romania and the Slovak Republic, the picture is the opposite: the energy intensity of industry remained constant, but that of the rest of the economy improved.

The authors relate such differences to the sequencing and timing of reforms: the countries in the first group moved fast on privatization, price liberalization and corporate restructuring; as a result, their industrial output and energy use was de-coupled early on and the industrial energy intensity began to decrease; the energy intensity in non-industrial sectors of these countries declined or remained constant. The second group of countries was normally characterized by a large share of heavy industry in GDP and slower pace of industrial restructuring.

Notably, the study finds that in the CIS, the energy intensity of both industry and the rest of the economy increased in the course of transition. The authors suggest that the delay of privatization and enterprise restructuring, soft budget constraints and non-payment of energy bills were the main culprits for persistent energy inefficiency in these countries.

Policies to improve energy efficiency

CEE countries have a mixed record of success with energy efficiency policies. Overall, according to the European Commission's assessment as of 2003, the candidate countries' progress in the field of improving energy efficiency was reasonable, yet that of the Czech Republic, Poland, Romania and Slovakia was found to be unsatisfactory (Energy Charter Secretariat 2003, p. 45). Despite the mixed record, there are many examples of successful policies on which Ukraine could draw.

The energy efficiency policies can be divided in broad categories: demand-side measures (improvement of end-use energy efficiency) and supply-side measures (improvement of efficiency of energy production).

Demand-side measures include:

- *Taxes on energy:* The majority of CEE countries charge taxes on energy. Normally this is VAT, while Poland also charges an excise tax.
- *Tax incentives:* Czech Republic used to have tax reductions for energy efficient goods and services, but this was discontinued after EU accession.
- *Performance standards in industry:* Hungary, Poland and Slovakia introduced minimum efficiency standards on industrial equipment
- *Building codes*
- *Appliance labeling*
- *Energy efficiency in public procurement:* The Slovak Republic has energy efficiency provisions in its public procurement laws.
- *Preferential loan schemes*
- *Provisions on performance contracting/ facility management:* Czech Republic has an energy audit obligation for buildings and production sites and all facilities consuming energy above a specified limit and an obligation to implement low-cost measures recommended by the audit[2].
- *ESCOs* – Energy Service Companies – have been one of the most successful CEE demand-side initiatives in the area of energy efficiency. ESCO is a company that offers energy services which may include implementing energy-efficiency projects and renewable energy projects, usually on a turn-key basis. These companies' services include: energy analysis and audits, energy management, project design and implementation, maintenance and operation, monitoring and evaluation of savings, property/facility management, energy and/or equipment supply, provision of service (space heating, lighting, etc.).[3] What distinguishes them from consultants or equipment suppliers is that they can finance or arrange financing for the operation, with their remuneration being directly tied to the energy savings achieved. The case of the Hungarian ESCOs is described in Box 1.

Among **supply-side policies,** one can name such examples as:

- *Combined heat and power (CHP): Poland, Hungary and Czech Republic are the examples*
- *Use of CHP in district heating*

[2] It should be noted that the bulk of the above measures came as a part of the approximation of the legislation and regulations with the EU's *acquis*
[3] http://energyefficiency.jrc.cec.eu.int/ESCO/esco.htm

Box 1. Case study: Role of energy service companies (ESCOs)

One of the policies on the energy efficiency in which CEE countries were quite successful is operation of the energy service companies (ESCOs). The most successful case is Hungary, which actually surpassed many other EU countries in this area.

The Hungarian energy efficiency industry is one of the oldest, more competitive and more mature than those of other CEE countries and also of some Western European countries. There are about two dozen companies specializing in the provision of energy services in Hungary with another 200 companies engaging in some activities in this field. More than two-thirds of ESCO customers are municipalities, and most projects target district heating systems and public lighting.

Why have ESCOs been such a success in Hungary?

1) Early and extensive energy and banking sector reforms

Hungary proceeded quickly with the market-oriented reforms in general and in the electricity sector in particular: by the late 1990s it conducted unbundling, price liberalization and privatization, lifted the majority of subsidies and discontinued cross-subsidies. Equally important was the banking sector reform and liberalization, as banks later became very active in the financing of ESCO projects. For example, OTP Bank (the largest Hungarian bank) had 20 million Euro worth of lending through ESCOs in 2003; it is also among the founders of some ESCOs (EC, 2005).

2) Significant budgetary and legal autonomies of local administrations allowed ESCOs to enter into performance contracts directly with public institutions.

3) Partial liberalization of the heat price (through introduction of a price cap formula) provided a strong incentive for operators to reduce their costs.

4) Initial international donors' support for several large-scale ESCOs had large spin-off effects.

European Bank for Reconstruction and Development (EBRD), International Finance Corporation/Global Environment Facility (IFC/GEF), European Commission, U.S Agency for International Development (USAID) were among the largest contributors to ESCO development.

5) State and donors support schemes for ESCOs and third-party financing

IFC in cooperation with the GEF have implemented an innovative program - the guarantee support scheme for financing energy-efficiency projects called the Hungarian Energy Efficiency Co-Financing Program (HEECP) that provides partial guarantee support for banks that finance ESCOs. This program proved to be very attractive: the banks that participate in HEECP represent over 90 % of the Hungarian banking sector (EC, 2005).

6) Favorable feed-in tariffs for CHP

There were also some country-specific factors, such as:

- Large and sudden increases in fuel oil prices, combined with the gas sector privatization, made fuel switching in old DH boilers very attractive.

- Expansion of ESCOs came, in part, due to the specificity of the Hungarian electricity market. Electric utilities have territorial monopolies in electricity supply but not for ESCO services, which means that utilities can provide ESCO services outside of their service territory. Therefore, ESCO projects become the only way for the electric utilities to increase their business and to service the territory of another utility.

To conclude, the Hungarian experience demonstrates that early energy sector reform, together with effective institutional and banking sector reforms and well-designed aid programs can make energy performance contracting business a success in the transition economies.

3. Improvement of energy efficiency in Ukraine and sources of its financing

3.1 Energy saving potential

Energy saving potential is enormous in Ukraine, considering high energy intensity of Ukraine's economy.

Ukraine was one of the first among post-soviet countries to develop and adopt the Law "On Energy Conservation" (1994). The law outlines the institutional, regulatory and economic mechanisms for energy conservation. Pursuant to the law, the state should stimulate the energy efficiency by providing preferential financing for energy-saving projects and by approving tax privileges for renewable energy. Other policy documents defining energy saving measures are "Comprehensive State Program on Energy Conservation" approved in 1997 and "Energy Strategy of Ukraine till 2030" adopted in 2006. They identify energy-efficiency potential and list a number of energy-efficiency technologies. The key problem about the documents is a poorly defined implementation mechanism, which makes them rather declaratory (IEA, 2006).

The projected measures on energy efficiency outlined in "Energy Strategy of Ukraine till 2030" (see Table 2 below) are supposed to conserve 318 toe by 2030. Structural changes, i.e. shift from industrial sectors towards service-oriented ones the in economy's structure, imply to save 62.2% of energy. Technical changes, which mean increase of production, processing, transportation and consumption efficiency of energy resources and implementation of energy saving technologies, are supposed to conserve 37.8%.

Table 2. Energy saving potential of Ukraine, 2010-2030, million toe

	2010	2015	2020	2030
Technical changes, including saving of:	**66.36**	**109.81**	**137.47**	**198.06**
Fuel	42.85	71.28	98.38	128.42
Electricity	15.75	24.84	24.63	9.21
Heat	7.76	13.69	17.46	33.76
Structural changes, including saving of:	**7.94**	**25.30**	**54.37**	**120.30**
Fuel	6.08	20.00	45.31	102.88
Electricity	0.94	2.76	4.69	9.21
Heat	0.92	2.54	4.37	8.21
Total energy saving	**74.30**	**135.11**	**191.84**	**318.36**
Total investment needed*	**30.6**	**53.7**	**69.0**	**102.3**

* Investment is supposed to be used only for technical changes. Structural changes derive from structural changes in the economy (shift towards service-oriented sectors)

Source: Energy Strategy of Ukraine till 2030

The declared energy saving targets are quite ambitious. However, they lack concrete policy measures, resources and mechanism of their implementation, which may prevent achieving the result.

The communal sector is one of the major energy-loss-making sectors: according to the World Bank, energy losses in the communal sector constitute about 30%, the main reason being the low quality of construction materials and absence of regulating equipment. Yet, attraction of investments in this sector is complicated because local budgets are unreliable borrowers as

they do not have a stable source of tax income; therefore, the problem requires a complex solution.

3.2 Sources of investment in energy efficiency

The projects on energy efficiency are financed primarily from enterprises' own funds (see Table 4), though the companies often attract loans from banks and international organizations or use the Kyoto mechanisms.

Table 4. Investment in energy efficiency, 2002-2004, million USD

	2002	2003	2004
Enterprises funds	142.7	204.0	154.2
Loans, foreign investment	36.1	63.6	40.9
Local budgets	13.9	21.8	52.5
State budget	0.3	1.3	1.2
Total	**193.0**	**290.7**	**248.8**

Source: IEA (2006) - according to the State Committee for Energy Conservation

Below we review different sources of financing in more detail.

3.2.1 Commercial funding

The increase in energy resources prices boosted enterprises to introduce energy saving technologies to reduce energy costs.

Energy efficiency measures introduced by the enterprises are usually directed at the reduction of gas and electricity consumption. The most gas intensive among industries are chemicals, metallurgy and machinery. However, energy saving projects are the most popular in metallurgy sector, because metallurgy enterprises are owned primarily by big business that invests in energy efficiency and in this way reduces energy costs. Metallurgy consumes about 30% of gas used in industrial sector of Ukraine (up to 10 billion cubic meters per year); gas costs account for 10-15% on average in metallurgy enterprises' costs structure (compared to 3-7% in the EU countries). According to the estimates of the Ministry of Industrial Policy of Ukraine, the industry may reduce gas consumption to 4.6 billion cubic meters per year along with yearly metallurgy output of 40 million tons[4].

The examples of energy saving projects implemented by enterprises grouped by industries:[5]

Metallurgy

- *Avdiivka Coke-Chemical Plant (Donetsk oblast).* The plant invested USD 250,000 in the new energy-efficient outdoors lighting systems and USD 120,000 in the modernization of steam pipelines. In addition, the Board of Directors of the Coke Plant decided to install a co-generation system with a total capacity of 15 MW. The company is searching for financing to implement this measure and is conducting negotiations with potential investors.
- *Donetsk Metallurgy Plant.* The plant intends to install additional electricity generating capacities at the plant's CHP. Annually, the measure will save 35% of electricity,

[4] http://www.eizvestia.com/articles/39/0/10899/

[5] Sources: Agency for Rational Energy Use and Ecology (ARENA ECO), Ukrainian media

9.8% of heat and 13% of gaseous fuel consumed by CHP-PVS. The monthly energy costs reduction will equal USD 3.1 million.

- *Interpipe Steel.* Interpipe Group is going to build a new electric steel smelter with annual capacity of 1.32 million ton of steel on the base of Nyzhniodniprovsky Pipe Plant (is incorporated in Interpipe Group). The cost is estimated at USD 600 million. The new steel plant is expected to cover the pipe plant's need for steel and decrease gas consumption by the company in 8 times. The annual gas saving will account for 87 million cubic meters.
- *Istil Metallurgy Mini-Plant (Donetks oblast.)* Istil obtained a USD 85 million loan from EBRD under the Kyoto mechanisms after it had introduced a number of energy-saving measures. Besides, EBRD bought a right to resell the quota released (as a result of energy-saving measures) of 130 CO_2 ton to the Netherlands during 2008-2012.
- *Novolypetsk Metallurgy Plant.* The plant reduced electricity consumption by introducing new electricity generating equipment (by 2012 plant's own electricity production is expected to cover 60% of electricity needs). The generating equipment is working on the gas, released in the process of metal production, which allow reducing electricity cost by 30%.
- *Zaporizhstal Metallurgy Plant.* The plant invested EUR 20-30 million in the equipment for blowing pulverized-coal into the blast furnace. The implementation of the technology will allow refusing from gas utilization in blast-furnace production (335 million of cubic meters per year), as well as decrease coke rate by 23%. In addition, the new technology will decrease CO_2 emissions. The expected yearly return of the project is EUR 24 million, which allow paying back the investment in three years.
- *Zaporizhzhya Ferro-Alloy Plant.* The plant invested USD 170,000 in energy efficiency, and intends to further invest USD 2.9 million of its own and to attract funds to upgrade steam-condensing system and install modern boilers. These measures are expected to result in annual 3% electricity saving and 11% gas saving.

Chemical industry

- *Rosava Tire Plant (Bila Tserkva, Kyiv oblast)*. The plant is going to attract financing from UkrESCO, as well as its new Austrian investor to introduce energy saving measures. The preliminary energy audit revealed USD 4 million of cost-effective energy efficiency opportunities.
- *Impuls Shostka State Plant.* The plant is actively introducing energy saving technologies, which in 2000-2007 decreased plant's energy costs from 30.7% to 10.6% in the cost structure along with the increase of total output 5 times. These measures saved USD 178.2 million in 2006.

Construction

- *Kryvyi Rig Cement (Dniprodzerzhynsk).* The company intends to implement a project on replacing natural gas by pulverized coal. On the one hand, this will reduce energy costs, but on the other hand, it will increase the harmful emissions by 500 ton per year.
- *Gostomel Glass Plant (Kyiv oblast).* Gostomel Glass Plant has invested $750,000 in energy efficiency and has attracted external investment from the Western NIS Enterprise Fund and UkrESCO in an amount of USD 3.88 million**.** Under the project, a modern new glass furnace, heat recovery boilers, efficient compressors were installed.

Coal industry

- *Zasyad'ko Coal Mine.* The mine has implemented one of the largest energy saving projects in Ukraine at USD 150 million in 2003-2005. The company installed co-generation equipment with 36 MW and 35 MW capacities of electricity and heat production respectively. The CHP uses methane released in coal production as fuel, and fully covers the mine's electricity and heat needs. As a result, annual CO_2 emissions decreased by 2.5 ton CO_2, which allowed selling under the Kyoto mechanism the quotas released to Austrian and Japan companies for EUR 2.5 million.

Food industry

- *Rosich Food Processing Plant (Bila Tserkva, Kyiv oblast)*. The implementation of energy efficiency measures resulted in annual saving of USD 23,000. The plant has installed steam traps and a steam recovery system, and invested USD 10,300 in elimination of air inflow in gas ducts.

3.2.2 International institutions funding

EBRD and the World Bank are the major international investors in energy efficiency in Ukraine. They not only disburse loans for implementation of energy efficiency improving projects, but also trade in emissions units.[6] Other players include USAID, UNDP and European Commission, but the scale of their financing is smaller.

EBRD

Energy efficiency has recently become the priority area of EBRD investments. In particular, at its annual meeting in 2006, the bank launched a sustainable energy initiative and decided to double its financing for energy efficiency and renewables. EBRD plans to lend at least EUR 250 million for energy efficiency projects in Ukraine in 2007.

One channel of EBRD's investment is loans to particular projects. An example of such project is modernization of the Alchevsk steel plant. It will involve the modernisation of blast-furnaces and steel-smelting and rolling shops and the construction of two CHP for electricity production. The reconstruction is expected to result in the decrease of gas consumption by 5 times and reduction of emissions in several times. The project was launched in December 2006 and is expected to be completed by 2009. EBRD provided USD 150 million of investments out of total required USD 363 million.

Second type of the EBRD financing is targeted at smaller projects (under USD 5 million) and is implemented through special programs, in which EBRD delegates loans distribution to local banks and companies. So, in March 2006, EBRD approved a loan of USD 20 million for energy efficiency projects at small and medium enterprises. The loan is managed by UkrESCO, a company created with donors' help for the purposes of energy efficiency projects implementation (more on it below). In April 2007, the EBRD launched a new program, called UKEEP. The program is financed by the Swedish government, with the total of EUR 100 million available. The loans are disbursed through Ukreximbank and Creditprombank.

EBRD together with the TACIS program of the European Commission was instrumental in establishing of UkrESCO, a Ukrainian Energy Saving Company[7]. TACIS contributed EUR 6 million to the launch of the company. UkrESCO, which was created in 2000, follows

[6] See Chapter 4 on emissions trading.
[7] http://www.ukresco.com/

many of the principles of ESCOs elsewhere in the world. The company investigates energy-saving potentials of prospective clients, chooses a technical solution, develops design documents and selects suppliers of equipment and works, and provides financing. Clients pay ESCOs through the savings they make from using their commissioned energy-saving technology. By now, the company has already implemented several initiatives, such as tanneries, dairies and machine building plants. The major technologies proposed by UkrESCO are the reconstruction and modernization of heat production and transmission equipment, rebuilding of cold rooms with improved air cooling systems, introduction of automatic energy metering systems, installation of co-generation and heat utilization equipment.

EBRD has also become the first to purchase GHG emissions units from Ukraine, when in February 2007 it bought from Istil Ukraine (a metallurgical plant in Donetsk) emissions quotas worth EUR 3 million on behalf of the Netherlands Carbon facility (Pysarenko, 2007).

The World Bank

The World Bank is another major investor in the Ukrainian energy sector, in particular, energy efficiency. One of its most known energy saving projects in Ukraine was Kyiv Public Buildings Energy Efficiency Project, implemented over 2000-2005. The project cost USD 24 million and involved installation of heat meters and conduct of other saving measures at 1,302 public buildings in Kyiv. According to the World Bank estimates, the implementation of the project allowed saving 26% of the heat, which would allow saving 45 million cubic meters of gas per annum (World Bank, 2005 and 2006). Implementation of similar projects in residential multi-apartment buildings (through the replacement of group heat substations with individual substations) over Ukraine would allow saving about 2 billion cubic meters per year (Ibid.). In addition, the project contributed greatly to the development of the local market of services on energy efficiency, as the majority of contracts for services and equipment supplies were implemented by local Ukrainian companies.

The World Bank is also buying emissions reduction units from Ukraine under the Kyoto arrangements. In September 2006, the World Bank and UkrHydroEnergo signed an agreement for the purchase and sale of 1,000,000 Emission Reduction Units under the Joint Implementation mechanism of the Kyoto Protocol[8], which became the first emission reduction purchase agreement signed by World Bank in Ukraine. The World Bank acted in this deal as a trustee of the Netherlands Carbon Facility. The emissions reductions will come from the Hydropower Rehabilitation Project through the replacement of fossil fuel based electricity generation by increased generation of zero emission hydropower electricity. The project will rehabilitate 46 hydroelectric units at nine hydropower plants.

3.2.3 Sources of financing, available in the Kyoto Protocol

Mechanisms of the Kyoto Protocol, although not targeted at improving energy efficiency per se, may be in fact very conducive to the cause of energy efficiency. The Kyoto Protocol, together with the UN Convention on Climate Change, aims to prevent climate change that results from green house gases (GHG) emissions. As energy consumption in many cases involves GHG emissions, improving energy efficiency becomes one of the major means of meeting the Kyoto goals. More than that, Kyoto Protocol mechanisms allow attracting

[8] Source: World Bank website http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/ECAEXT/UKRAINEEXTN/0,,contentMDK:21051756~menuPK:50003484~pagePK:2865066~piPK:2865079~theSitePK:328533,00.html

investment into the energy efficiency/GHG emissions reduction projects, and in case of Ukraine the benefits from such mechanisms could be substantial.

Ukraine signed Kyoto protocol in 1999 and ratified it in 2004. According to the Protocol classification, Ukraine is an Annex I party, which means that it has binding commitments on the emissions reduction, but also can participate in the flexibility mechanisms - emissions trading, the clean development mechanism, and joint implementation (see background information on Kyoto Protocol in Appendix A2). The Ministry of Environment and Natural Resources of Ukraine is appointed to be a coordinator of activities on compliance with UNCC and Kyoto protocol (President, 2005).

According to the Protocol, over 2008-2012 Ukraine's GHG emissions should not exceed the 1990 level. The choice of 1990 as a base year appeared to favor Ukraine, as at that time Ukrainian industry worked at full capacity and, therefore, made a lot of emissions. Due to a major fall in the output in the 1990s, GHG emissions shrank from 926,2 million tons of CO_2 in 1990 to 413,7 million tons CO_2 in 2004 (MENR, 2005). If Ukraine does not catch up with the 1990 emissions level by 2008 it will be able to sell emissions units to other Annex I parties through the emissions trading mechanism. Moreover, if it manages to achieve emissions reductions, it will be able to get additional income by selling additional emissions units. Ukraine can also benefit from participating in joint implementation projects, as its economy is very inefficient in its energy use, so that it is easier to achieve emissions reductions in Ukraine than in other Annex I parties. Companies from other Annex I parties (which are OECD countries, several Eastern European countries and Russia) will then be interested to make investments in the Ukrainian industry that would bring reductions in GHG emissions and would allow counting these reductions towards the emissions reductions targets of those countries. Below these opportunities are explored in more detail.

Meeting eligibility requirements

To be eligible to participate in the Kyoto mechanisms, Ukraine, with help of technical assistance projects, is putting in place a national registry to record and track the creation and movement of emissions units. In 2005, the government adopted a plan of activities on implementation of Kyoto requirements (CMU, 2005).

To date, Ukraine's progress on meeting Kyoto eligibility requirements includes:

1) Four reports on the results of GHG inventories were submitted (for 1990, 1990-1998, 2001-2002 and 1990-2003);
2) Two annual National Communications on climate change submitted (the last one for 2005)
3) The Ministry of Environment has adopted the order of creation and functioning of the national GHG inventory (MENR, 2005, part 1 p. 33)

JI projects

In February 2006, the Ukrainian Government adopted a Decree (CMU, 2006) that defined the rules for approval of JI projects, which made it possible to launch JI projects in Ukraine. Furthermore, in July 2006, the Ministry of Environment adopted requirements to JI proposals (MENR, 2006).

The first JI project was approved on 27 March 2006. It is a project on coal-bed methane utilization at Zasyadko coal mine (Donetsk). The project is to last until 2012 and is supposed to reduce coal-bed methane emissions by 3.8 million tons of CO_2. The project will cost UAH 761 million (EUR 120 million) and will bring EUR 60 million from the JI mechanism.

As of February 2007, 52 projects received a preliminary approval (a letter of support from the Ministry of Environment), and 6 out of them got the final approval and started to be implemented (Pysarenko, 2007).

Examples of projects include:[9]

- Reconstruction of the 9th block of Zmiivska thermal power station
- Collection and utilization of methane at the waste ground in Kremenchug
- Collection and utilization of dump gases at the waste ground in Dnipropetrovsk
- Utilization of methane at the Holodna Balka coal mine (Donetsk oblast)
- Collection of gases at the waste ground and electricity production in Lugansk
- Collection of gases at the waste ground and electricity production in Poltava

Emissions trading

Thanks to the favorable allocation of emissions quota, Ukraine can benefit from emissions trading under Kyoto by selling emissions units. According to estimates, Ukraine has a reserve of 1.7 billion tons of CO_2, which may bring it about USD 9-17 billion depending on the carbon price.[10] In 2006, CO2 was traded at around EUR 16.5 per ton[11].

The international carbon market has been expanding fast in 2005, spurred by the entering into force of the Kyoto Protocol in February 2005. In 2005, the volume of trade at the market totaled 799 Mt CO_2 equivalents worth about EUR 9.4 billion, which is 8.5 times increase compared to 2004 (with 94 Mt CO_2 equivalents traded worth EUR 377 million).

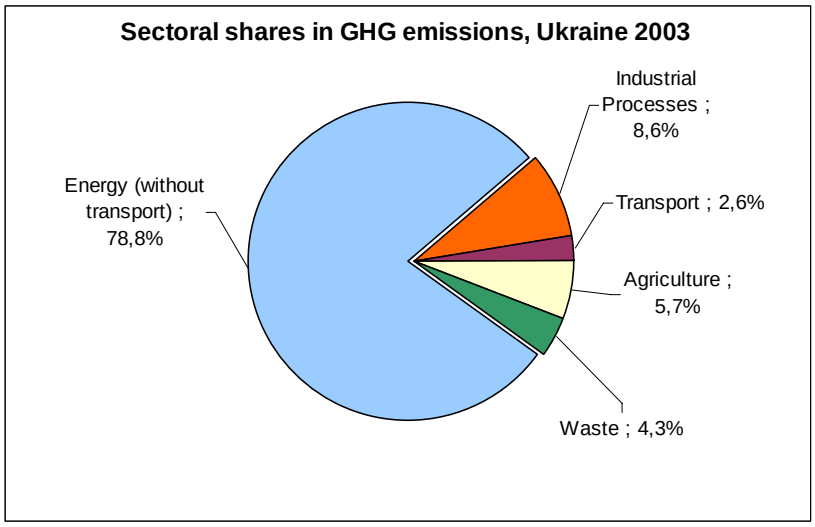
PointCarbon (2006, p.8) estimates that given current emissions reduction programs major buyer countries still exceed their Kyoto target by 9.5% or 2,740 Mt for the commitment period (2008-2012). This clearly means an opportunity for Ukraine; at the same time, it is twice as less as the estimated Ukraine's emissions reserve (1.7 billion tons). Moreover, the competition at the carbon market is rather strong, so Ukraine will have to be very competitive to realize the potential of the emissions trading.

Sectoral breakdown

Energy production generates the bulk of GHG emissions in Ukraine – almost 80%. The rest comes from industry, agriculture and waste (see Graph 2). Therefore, these sectors have the biggest potential for emissions reduction and, by implication, for Kyoto-related investment attraction.

[9] Source: Gagurin, 2006
[10] Speech by Paul Bermingham, the World Bank Director for Ukraine, Belarus and Moldova; Kyiv, 24 March 2006. Source: http://www.tek.web-standart.net/news0$n!315371.htm
[11] Source: www.pointcarbon.com

Graph 2. Sectoral shares in GHG emissions, Ukraine, 2003



Source: UNCC

According to the estimates of Yermilov (2006), Kyoto mechanisms can finance about 26-33% of the needed investment in the ferrous metallurgy sector (Table 3). The major opportunities in terms of Kyoto financing in this sector lie in the installation of continuous molding machines and usage of accompanying gases in gas turbines (Kyoto mechanisms can finance about 50% of these investments).

Table 3. Opportunities for investment in energy efficiency in the enterprises of ferrous metallurgy of Ukraine through the Kyoto mechanisms

Directions of modernization	Total volume of investments	Volume of reduction of CO_2 during 2008-2012	Investment from Kyoto mechanisms (optimistic scenario: CO_2 price is 20 Euro per ton)	Coverage from Kyoto mechanisms
Replacement of open-hearth furnaces	2,111 million Euro	10 million tons	200 million Euro	9.5%
Bringing continuous molding machines	980 million Euro	21-30 million tons	420-600 million Euro	43-60%
Usage of accompanying gases in gas turbines	1,352 million Euro	35 million tons	700 million Euro	52%
Construction of new agglofactories	1,038 million Euro	10 million tons	196 million Euro	19%
Reconstruction of blast-furnaces and other equipment	1,907 million Euro	19-39 million tons	387-774 million Euro	21-40%
Total	7.4 billion Euro	95-124 million tons	1.9-2.5 billion Euro	26-33%

Source: Yermilov, 2005

Conclusion

Ukraine is one of the least energy efficient countries in the world. Low efficiency of energy use has its routes in the Soviet economic system, notably, absence of market mechanisms that would assign the right price to energy. In case of Ukraine, other factors were added, such as strong bias of the economy to the heavy energy-intensive industries.

A quick look at the experience of the countries of the Central and Eastern Europe suggests that the overall economic restructuring and privatization are the main factors in improving energy efficiency of the economy, as they introduce the right signals. These were accompanied by reforms in the energy sector and European integration. The empirical evidence suggests that privatization, price liberalization and corporate restructuring are positively correlated with improvements in energy efficiency.

One of the most successful experiences in the energy efficiency policies in CEE has been establishment of the Energy Service Companies (ESCOs). Hungarian ESCOs were especially successful. The key factors of their success are early energy sector reform, effective institutional and banking sector reforms and well-designed aid programs.

Ukraine has quite ambitious energy saving laws and programs, yet their realization has been sluggish. The envisaged measures require vast sums of money, but the state is unprepared to provide them. The main source of financing for the energy saving measures has been enterprises' own funds. Metallurgy has been the most active in investing in energy saving, in particular, in co-generation systems, replacing natural gas by pulverized coal and, generally, installation of new equipment.

International organizations have also provided substantial funds for energy saving projects. The World Bank and the EBRD are the most active in the field. While the World Bank does mainly large projects, the EBRD in addition to large loans, has special schemes for small and medium projects, which are administered through local companies and banks. One of such companies, UkrESCO, was established with the help of the European Commission.

Mechanisms of the Kyoto protocol are yet another potentially substantial source of financing for energy saving. First, due to favorable quota allocation, Ukraine ended up having excess emissions units, which it can sell. Second, very low efficiency of the Ukrainian economy makes it easy for other countries to earn emissions reductions units by implementing energy saving projects in Ukraine (Joint Implementation Projects), which means additional financing for Ukrainian enterprises.

In sum, there are all preconditions in Ukraine to achieve substantial energy savings: on the one hand, the very low current energy efficiency means that even simple improvements can bring large benefits; on the other hand, the growing energy process makes enterprises and creditors more willing to invest in energy efficiency improving projects. Finally, the concerns about the global warming give additional reasons and funds to save energy.

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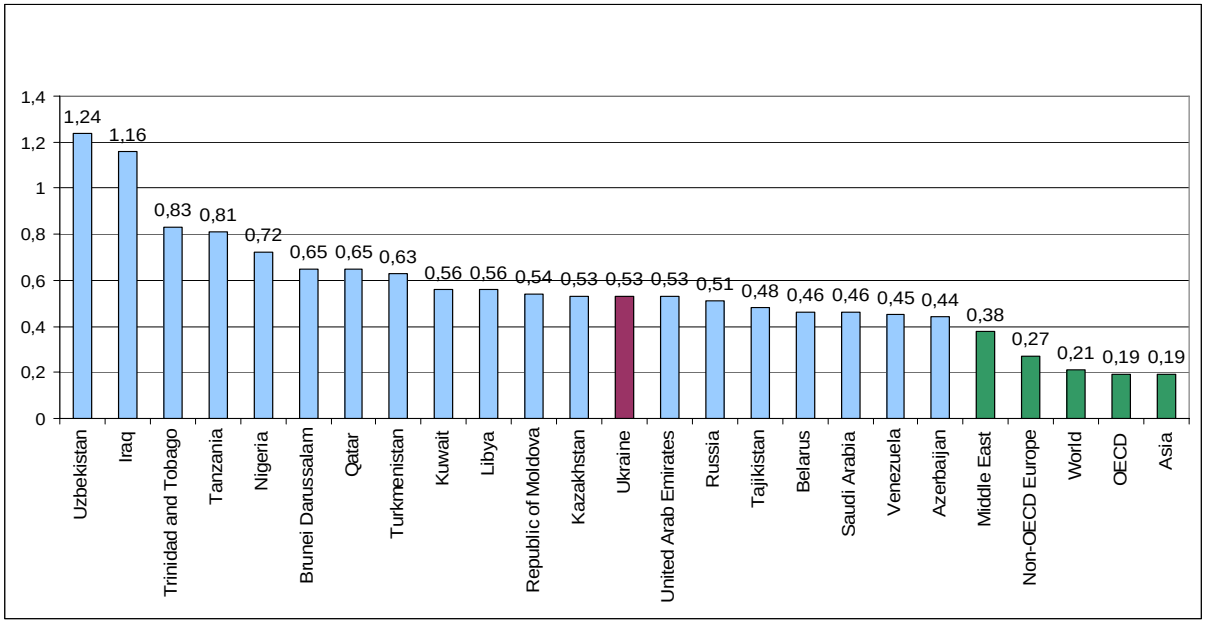
Appendix A1. Tables and graphs

Graph 1. Energy efficiency in selected countries, 2003, TPES/GDP (PPP), in toe/1000 in 2000$ PPP



Source: Source: Key World Energy Statistics. 2005. – International Energy Agency, 2005, pp. 48-57

Table A1. Energy intensity in 1990 and 2003, TPES/GDP at PPP **

	1990	2003
	toe per thousand 1990 USD PPP	toe per thousand 2000 USD PPP
Czech Republic	0.50	0.27
Estonia*	0.75	0.28
Hungary	0.43	0.19
Latvia*	0.52	0.19
Lithuania*	0.79	0.23
Poland	0.50	0.22
Slovak Republic	0.61	0.28
Slovenia	0.35	0.19
CEE average	0.56	0.23
Ukraine*	0.85	0.53
OECD	0.27	0.19
World	0.30	0.21

* - data for 1992 instead of 1990
** - data between 1990 and 2003 is not comparable, as different GDP base years used in ratios

Sources:
Energy statistics and balances of non-OECD countries 1994-1995
Energy statistics and balances of OECD countries 1993-1994
Energy statistics and balances of OECD countries 1994-1995
Key World Energy Statistics. 2005. – International Energy Agency, 2005. – P. 48-57

Appendix A2. Background on Kyoto Protocol

The Kyoto Protocol is an international legally binding agreement to reduce greenhouse gases (GHG) emissions. The greenhouse gases covered by the Protocol include: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6).

The Protocol establishes targets for GHG emissions reductions to be met over 2008-2012. If a country fails to meet its emissions target, it must compensate the difference in the second commitment period and to make an additional reduction of 30% of the difference. The Protocol entered into force on 16 February 2005 and as of July 2006 it was signed by 164 countries. The signatories of the Kyoto protocol are divided into three major groups:

- Annex I Parties: industrialized countries that were members of the OECD in 1992, plus Eastern European countries with transition economies, including Baltic and Western NIS countries. Annex I Parties are required to reduce their greenhouse gas emissions below the levels specified in Annex B to the Protocol (see Table 1). The total reduction in GHG emissions of these countries adds up to a total of 5% from 1990 levels in the commitment period 2008-2012.
- Non-Annex I Parties: mostly developing countries. These countries are not legally bound by the commitments of GHG reductions, as they could find it economically difficult to implement them. There are special provisions that envisage activities that help these countries address climate change, such as investment, insurance and technology transfer.

Table A2. Countries included in Annex B to the Kyoto Protocol and their emissions targets

	Target (1990 - 2008/2012)
EU-15, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland	-8%
US*	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia*	-5%
New Zealand, Russian Federation, Ukraine	0
Norway	+1%
Australia*	+8%
Iceland	+10%

* - these countries have not ratified the protocol as of July 2006.

Source: http://unfccc.int/essential_background/items/2877.php

The Kyoto agreement offers countries some degree of flexibility in how to meet their targets. Apart from the direct reduction of emissions, the parties may use other instruments such as sink activities, and three flexibility mechanisms: emissions trading, the clean development mechanism, and joint implementation.

- ***Sink activities*** are domestic policies and measures that help remove GHG from the atmosphere. According to the Protocol, the eligible activities are: afforestation, reforestation, deforestation, forest management, cropland management, grazing land management and revegetation. Greenhouse gases removed from the atmosphere through sink activities generate credits called removal units.

- ***Emissions trading*** is a mechanism for transfer of emissions among Annex I Parties. It allows a country that finds it relatively easy to meet its target to transfer some of its emission units to another party that finds it relatively more difficult to meet its emissions target. In order to prevent over-sale of units, the Protocol establishes a minimum level of emissions units that cannot be traded. To facilitate the trading, Emissions trading schemes may be established as at national, so at a regional level.
- The ***clean development mechanism (CDM)*** allows Annex I Parties implementing projects in non-Annex I Parties that reduce emissions and use the resulting emission reductions to meet their own targets. The CDM also helps non-Annex I Parties reduce theirs emissions and to achieve sustainable development.
- ***Joint implementation (JI)*** allows an Annex I Party to implement a project that reduces emissions (or increases removals through sink instruments) in the territory of another Annex I Party, and then count the resulting *emission reduction units* against its own target.

To participate in the mechanisms, Annex I Parties must meet before 1 January, 2007 eligibility requirements: to ratify the Kyoto Protocol; to calculate their assigned amount; to put in place a national system for estimating emissions and removals of GHG; to create a national registry to record and track the creation and movement of emissions units; and to annually report information on emissions and removals to the secretariat.

Moreover, to be able use a flexibility mechanism, an Annex I Party should provide evidence that the use of the mechanism is supplemental to domestic action and constitutes a significant element of its effort to meet the Kyoto commitments.

The responsibility for the implementation of the Kyoto targets, as well as management of flexibility mechanisms, lies within the government. The government of each country establishes rules under which legal entities, such as businesses and NGOs, can participate in the flexibility mechanisms.