
Energy Efficiency Finance

Task 1 Energy Efficiency Potential

Country Report: UKRAINE

Prepared for OeEB by Allplan GmbH

in cooperation with Frankfurt School and Local Partners

Vienna, October 2013

ALLPLAN GmbH

Address: Schwindgasse 10, 1040 Vienna, AUSTRIA
Tel.: +43-1-505 37 07-94; +43-1-505 37 07-55;
Fax: +49-1-505 37 07-27
Web: www.allplan.at

Dep. Energy & Environment: Dr. Helmut Berger, helmut.berger@allplan.at

Content

1	EXECUTIVE SUMMARY	6
2	AIM AND SCOPE OF THIS REPORT.....	7
3	STUDIES AVAILABLE.....	7
3.1	OVERVIEW.....	7
3.2	MAIN RESULTS OF EXISTING REPORTS.....	10
4	STATUS OF ENERGY EFFICIENCY	11
4.1	ENERGY SUPPLY	11
4.1.1	Electricity supply	12
4.1.2	Thermal energy.....	12
4.2	ENERGY DEMAND.....	13
4.3	GREENHOUSE GAS EMISSIONS.....	14
4.4	ENERGY EFFICIENCY OVERVIEW.....	14
4.5	ENERGY EFFICIENCY IN THE INDUSTRIAL SECTOR.....	15
4.6	ENERGY EFFICIENCY IN SMES.....	16
4.7	ENERGY EFFICIENCY IN THE RESIDENTIAL SECTOR	17
4.8	ENERGY EFFICIENCY IN THE AGRICULTURAL SECTOR.....	19
5	FRAMEWORK FOR ENERGY EFFICIENCY	19
5.1	LEGAL AND POLICY FRAMEWORK.....	19
5.2	TECHNICAL FRAMEWORK	21
5.3	ECONOMIC FRAMEWORK.....	21
5.4	AWARENESS AND INFORMATION LEVEL	23
6	CONCLUSIONS	23
7	RELEVANT INSTITUTIONS.....	24
8	LITERATURE	25

List of figures

Figure 1: Energy flow Ukraine, 2007	11
Figure 2: CO ₂ emissions per sector.....	14

List of tables

Table 1: Overview of available reports	8
Table 2: Electricity production shares.....	12
Table 3: Data on the state of (centralized) heat generation capacities	12
Table 4: Structure of energy consumption by industrial sectors, PJ	13
Table 5: Energy supply and demand according to the energy strategy until 2030	14
Table 6: Summary energy status and potential in the industry	15
Table 7: EE potential in industry subsectors	15
Table 8: Small and medium enterprises in Ukraine.....	17
Table 9: SME shares in sectors of the economy.....	17
Table 10: Energy prices comparison.....	21
Table 11: EE measures and average payback periods.....	22

Abbreviations

BAT -	Best Available Technologies
CHP -	Combined Heat and Power
EE -	Energy Efficiency
HPP -	Hydro Power Plant
IFI -	International Financing Institutions
LULUCF -	Land Use, Land-Use Change and Forestry
NEFCO -	Nordic Environment Finance Corporation
NERC -	National Energy Regulatory Commission
NKP -	National Utilities Regulatory Commission
NPP -	Nuclear Power Plant
RE -	Renewable Energy
RES -	Renewable Energy Sources
SAEE -	State Agency on Energy Efficiency and Energy Saving
SME -	Small and Medium Enterprise
TPP -	Thermal Power Plant
VAT -	Value Added Tax
VSD -	Variable Speed Drive

1 Executive Summary

Ukraine's energy supply is characterized by a strong import dependency on fossil fuels, especially natural gas. Electricity generation is mainly covered by nuclear power plants, coal fired power plants, gas fired CHPs and some contribution from hydropower plants. Heat is to a large extent provided via district heating networks. On a general level, the status of all generation facilities and also distribution lines is in a very bad condition.

The biggest energy consumer is the **industrial sector** (including transformation processes), which accounts for more than half of final energy demand. On a general level, the overall saving potential is deemed to be huge and amounts to more than 72%. Biggest shares within the industrial sector are held by the primary sector (with more than half of overall energy consumption). Biggest savings (in relative terms) are expected in the chemical and petrochemical industries (70%, about 79 PJ), biggest savings (in absolute terms) are expected in the iron & steel industry with about 232 PJ, which is about one third of currently used energy.

The **residential sector** is also responsible for about one third of overall final energy consumption (approximately 1,000 PJ). The saving potential is estimated at about 380 PJ, where the biggest share is attributable to heating. Electricity consumption so far plays a minor role, however, it has to be stated that the current extent of use of electric appliances lags far behind EU habits. Both the efficiency of heating supply (centrally and decentrally provided) and demand (bad insulation) needs to be improved.

The energy consumption in the agricultural sector (about 100 PJ) is comparable to some industrial sub-sectors. Despite the fact that energy consumption per hectare is almost comparable to the EU average the energy efficiency in agriculture (output compared to energy input) is three times lower than the EU average. Thus, energy efficiency gains could be achieved via investing in more productive agricultural technologies.

As shown in the **Energy Strategy until 2030** focus is still on growing energy consumption, on the development of fossil fuels and nuclear energy generation. Despite the declared target of energy efficiency improvement by 40%, the document lacks mechanisms to finance energy saving and incentives to promote energy efficient technologies. All funding mechanisms are aimed at increasing generation. Currently, the National Agency on Energy Efficiency and Energy Saving (SAEE) focuses on the possibility to increase the share of renewable generation in the Energy Strategy of Ukraine. The **Law of Ukraine "On Energy Saving"** No.74/94-VR is dated 1 July 1994. In order to support energy saving in Ukraine, the Cabinet of Ministers approved the **State Target Economic Program of Energy Efficiency and Development of Energy Generation from Renewable Sources** for 2010-2015. The document defines three objectives: reduction of GDP energy intensity by 20% as compared to 2008, minimum 10% of country's energy balance from renewable sources, reduction of imported gas by 25%.

From technical perspective most of the relevant energy efficient technologies are available in Ukraine, however not all are already established on the market. Little experience is currently attributable to solar water heating, heat pumps, biogas and flue gas utilization, long term experience is available for biomass boilers, production of pellets, automatization and pre-insulated pipes.

Energy prices for households are kept extremely low compared to the EU average. Such state approach makes energy saving projects highly unattractive for this sector in economic terms. Despite this fact, the population pays more and more attention to energy conservation due to relatively low income. For the industrial sector, investments in energy saving measures with short payback periods (until 3 years) are attractive.

2 Aim and Scope of this Report

The Development Bank of Austria (OeEB) aims at increasing its activities in the field of energy efficiency in selected countries via dedicated credit lines, but also via supportive programs for selected financial institutions and project developers. The present study is part of the overall study, which analyzes the status of energy efficiency in the countries Turkey, Ukraine, Armenia and Azerbaijan.

The Study is carried out in cooperation of ALLPLAN GmbH. and Frankfurt School and is based on the latest available information collected directly in the country by local experts in June 2013.

This report focuses on Task 1, “Potential of the Energy Efficiency Market” in Ukraine and analyzes the following questions:

- How is the Status of Energy Efficiency in different economic sectors?
- In which sectors is the efficiency potential considered to be highest?
- How can local framework for energy efficiency be characterized in terms of legal, economic and technical aspects?

3 Studies Available

3.1 Overview

There are a number of publicly available studies on the EE/RE situation in Ukraine. The majority of them were financed by international organizations. Also Ukrainian statistics gather some information relevant for this topic, however the data quality and calculation methodology are considered not comparable to EU standards. The problem of limited transparency of governmental institutions and business leads to the situation that some information is not disclosed or contradicting. Ukraine only started publishing its energy balance according to IEA methodology in 2012.

A summary of the reports identified for this study is presented in Table 1. If not otherwise specified, inputs for the present report are based on the below reports and on the local expert’s analysis.

Table 1: Overview of available reports

Report/Author/Date	Scope	Brief description
<p>Energy Policies beyond IEA Countries - Ukraine 2012</p> <p>IEA Publication http://www.iea.org/publications/freepublications/publication/UK_Summaryplus.pdf</p>	<p>This publication analysis the major challenges of Ukrainian energy policy. One major issue covered is the considerable and mostly untapped energy efficiency potential.</p>	<p>Ukraine's energy sector faces unprecedented challenges, from a heavy reliance on expensive fossil-fuel imports to inefficient infrastructure and markets. Yet there is also potential for Ukraine to experience an energy revolution, one that could boost employment, lift economic growth and enhance energy security according to the report. Modernisation of Ukraine's energy-supply sectors has only begun and will require investment on a huge scale, complemented by a fundamental reform of the business environment.</p> <p>This review analyses the large energy-policy challenges facing Ukraine and provides recommendations for further policy improvements. It is intended to help guide policy makers in the country towards a more secure and sustainable energy future.</p>
<p>KPMG Energy Survey 2013</p> <p>KPMG Publication www.http://www.kpmg.com/UA/uk/IssuesAndInsights/ArticlesPublications/Documents/KPMG_Energy_Survey_11012013.pdf</p>	<p>The report includes interviews with 34 experts from the sectors: production, transportation and energy.</p>	<p>The main topic of the study is the energy situation in the Ukraine and their challenges. Main problems identified are the excessive use of energy, the low efficiency as well as the dependence of energy imports. The results of the study have been compared with the KPMG study "Energy survey 2012".</p>
<p>Ukrainian Energy Index 2012</p> <p>Analytical center "BEST" Publication http://www.energy-index.com.ua/uk/</p>	<p>The second edition of the Ukrainian Energy Index (UEI-2012) analyzes energy efficiency at the regional level from 2007 to 2010. While the previous UEI-2011 contained only an analysis of energy efficiency in 2008, UEI-2012 not only explains why some regions are more energy efficient than others, but also examines the dynamics at the regional level by sector.</p>	<p>The UEI-2012 methodology is based on the IEA method of final energy consumption decomposition by sectors and sub-sectors. The authors of the study used the average intensity of the corresponding industry in the EU as a benchmark for efficient energy use. The result of the study was a ranking of the energy efficiency of Ukrainian oblasts.</p> <p>Vinnitsia, Kherson, and Zakarpattya oblasts are the top three regions in the UEI-2012. Their respective energy efficiencies amounted to 65.5%, 64.7%, and 62.4% of the EU level.</p>
<p>Summary of GHG Emissions for Ukraine 2010</p> <p>UN Climate change secretariat Publication. http://unfccc.int/files/ghg_emissions_data/application/pdf/ukr_ghg_profile.pdf</p>	<p>The amount of greenhouse gases and the share caused by different sectors is published in the study.</p>	<p>The report provides information about GHG emissions in the Ukraine according to their sources. In the frame of this report the industrial sector is described in more detail than the other sectors.</p>
<p>Revision of Energy Strategy of Ukraine 2012 (draft)</p> <p>Ministry of Fuel and Energy of Ukraine http://ec.europa.eu/energy/international/bilateral_cooperation/doc/ukraine/20130225_mou_progress_report7_en.pdf</p>	<p>EU-Ukraine Energy Cooperation. Seventh joint EU-Ukraine Report. Implementation of the EU Memorandum of Understanding on Energy Cooperation during 2012.</p>	<p>The Strategy describes various scenarios of energy sector development and energy balances until 2030. The report also includes road maps for:</p> <ul style="list-style-type: none"> • Nuclear safety • The integration of electricity and gas markets • The security of energy supplies and the transit of hydrocarbons • The coal sector • Energy efficiency and renewable energies.
<p>Energy Efficiency: A new resource for sustainable growth</p>	<p>The survey assesses how industrial enterprises in each of the survey</p>	<p>This report summarizes and analyzes the results of energy efficiency surveys undertaken by IFC in the industrial sectors of six countries: Armenia, Azerbaijan, Belarus, Georgia, Russia, and Ukraine (the "survey countries"). The</p>

<p>IFC Publication www1.ifc.org/wps/wcm/connect/RegProjects_Ext_Content/IFC_External_Corporate_Site/UE_EP_Home</p>	<p>countries prioritize, understand, plan, finance, and implement energy efficiency investments. The resulting analysis is intended to help governments, financial institutions, companies, donors and private investors to identify opportunities for offering goods and services that improve energy efficiency.</p>	<p>survey assessed how industrial enterprises in each of the survey countries prioritize, understand, plan, finance, and implement energy efficiency investments. The resulting analysis is intended to help governments, financial institutions, companies, donors, and private investors identify opportunities to provide goods and services that improve energy efficiency. The industrial sectors surveyed were the food, chemical, building materials, metal processing, and machine building industries.</p>
<p>Ukraine and Energy Community: two years of suspense “Vidrodzhennya” fund publication. http://euinfocentre.rada.gov.ua/euinfocentre/doccatalog/document?id=48382</p>	<p>The publication describes issues in collaboration between Energy community and Ukraine</p>	<p>Main fields covered in the analysis are: natural gas situation, electricity, renewable energy, environmental impacts and energy efficiency.</p>
<p>State Target Economic Program on Energy Efficiency and Development of Energy Generation from Renewable Sources for 2010-2015 Decree of the Cabinet of Ministry of Ukraine. http://zakon2.rada.gov.ua/laws/show/243-2010-%D0%BF/paran14#n13</p>	<p>The main objectives of the program are improvement of legislation and standardization in the field of energy efficiency, renewable energy and alternative fuels.</p>	<p>This program evaluates financial sources, expected results and specific measures to increase the energy efficiency situation in Ukraine. These measures are for example: development of technical specifications and standards in EE and RE and alternative fuels; adaptation of national legislation in the field of EE, RE and alternative fuels to the European Union; reduction of technological losses and non- energy losses as a result of equipment upgrades and improving governance and promoting energy efficiency. Particular measures presented in the report are: update and upgrade of energy-intensive manufacturing equipment industry; rehabilitation of residential buildings, social facilities and building institutions which are fully financed by the state budget, including the development of design and estimate documentation. Those measures are enabling approximation of the gross domestic product of Ukraine to the level of developed countries and the EU standards , while reducing the energy intensity of gross domestic product over the life of the program by 20% compared to 2008 (3.3% annually), reaching a more efficient use of energy resources, optimizing the structure of energy balance (renewable energy sources and alternative fuels in 2015 should amount to 10%), by reducing the share of imported fossil fuels , particularly natural gas, and their replacement by alternative types of with adequate financing.</p>
<p>State Program on Energy Saving until 2010 (published in 1997) Decree of the Cabinet of Ministry of Ukraine http://www.mtu.gov.ua/repository/11557/file/ko_pleksna_prog_1997-2010.doc</p>	<p>The report describes the current situation in the country and provides a comprehensive analysis of the energy efficiency situation afterwards.</p>	<p>The energy intensity of gross domestic product in Ukraine today is more than twice as high as the power consumption of the industrialized countries of Western Europe and it is still growing. According to the report the main strategic areas of energy efficiency and energy saving potential are structural and technological restructuring of the economy and the creation of administrative, legal and economic mechanisms that improve energy efficiency and energy conservation. The report also describes the State Energy Conservation Program.</p>

Forecasts on the development of the energy sector in general can be derived from the Updated Energy Strategy of Ukraine until 2030. The main focus is still put on energy generation from conventional sources, while further development of renewable energy sources is very limited. In the view of local experts, scenarios for the further development of energy consumption rates as well as associated investment in the energy sector are overestimated.

3.2 Main results of existing reports

For a long time, the existing studies comprised both an analysis of the existing energy situation and estimations on energy efficiency potentials; however, the studies did not work with comprehensive benchmarks. The main energy efficiency indicator in Ukraine was the specific energy consumption of goods produced. This indicator has to be submitted via statistic reporting form to the Central Statistics Authority (State Committee of Statistics) for enterprises with more than 8,130 MWh annual energy demand. The Statistics Authority processes the submitted data and publishes aggregated numbers by regions and industries. However, no findings of statistic observations were published and problems with errors and low accuracy were reported. For example, a benchmarking analysis for the agro-industrial sector (canned food and meat processing sub-industrial sector) demonstrated that the data varies 12-16 times in various regions (GEF/UNIDO 2013).

In 2012, however, a comprehensive study on energy efficiency ranking of the regions of Ukraine was published, which analyzes the energy efficiency status both on a country wide level and on a regional ("oblasts") level. The publication (*Energy Efficiency Ranking of the Regions of Ukraine - UEI-2012*) was initiated and financed by System Capital Management. The Analytical Center BEST developed the methodology and prepared the report. This study based on 2007-2010 data comprises the sectors agriculture, mining, manufacturing, construction, services and residential and analyzes energy efficiency and energy saving potential at the regional level by taking the region's energy consumption structure into account. Changes in the energy consumption of a certain region are attributed to aggregate changes, structure effects, activity effects and energy efficiency effects.

UEI-2012 also quantitatively measures the major changes in the energy consumption of a certain region over four years – changes in the energy intensity by sector, structural changes in the region's economy, and the rise/decline in business activity. One conclusion of this study is the fact that major changes in the energy consumption have not been linked to active energy efficiency activities, but rather due to external effects (e.g. higher demand results in higher production and thus better efficiency of plants) or due to economic reasons (e.g. lower energy consumption due to less economic activity in times of economic crises). EU consumption figure averages per sector are used as benchmarks.

4 Status of Energy Efficiency

4.1 Energy supply

Energy supply in Ukraine is characterized by the dominance of fossil fuels and the high dependence on imports, especially gas. The following chart provides a good overview of the energy flow in Ukraine. Despite the fact that it depicts the situation in 2007 it is still considered a valuable document, as it highlights the main factors of energy supply and its use at one glance. In the meantime the share of renewable has slightly increased mainly due to solar, hydro and wind power plants, but the overall structure remained the same.

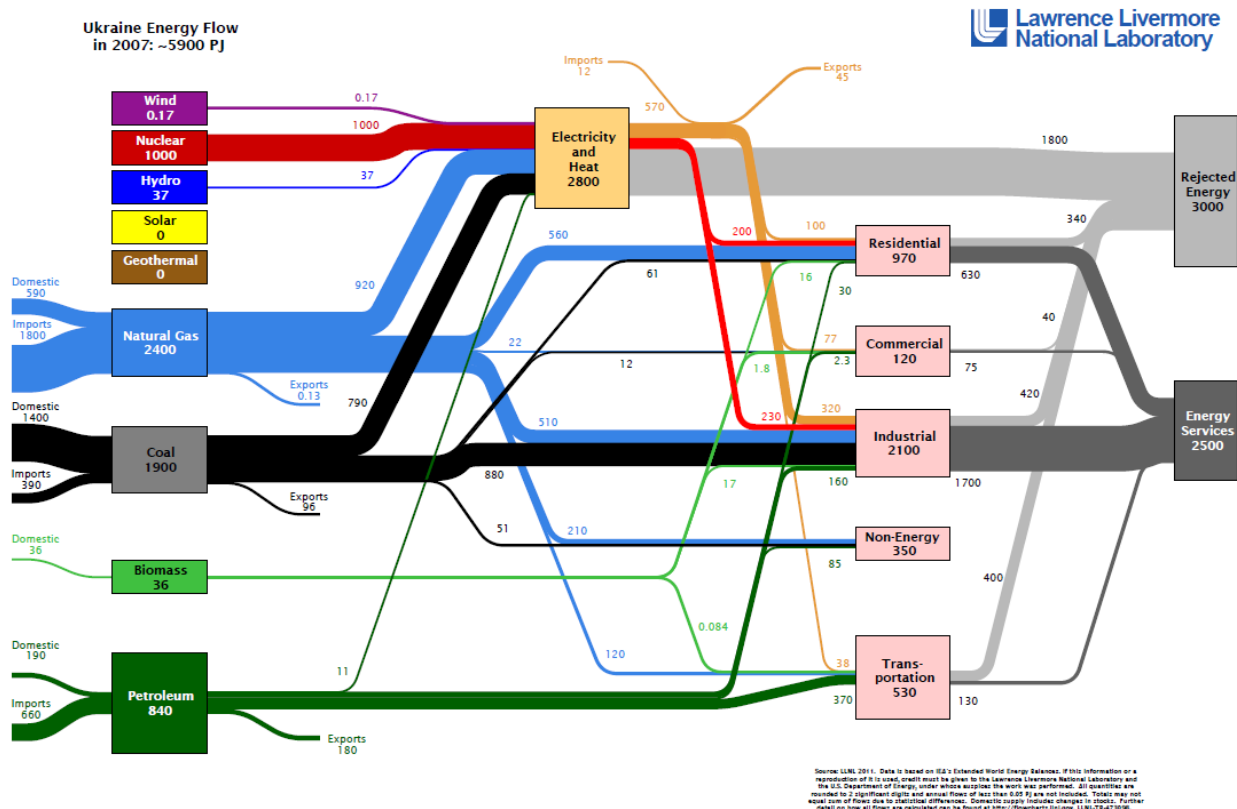


Figure 1: Energy flow Ukraine, 2007
 Source: Lawrence Livermore Laboratories (2011)

From the chart above, which shows about 5,900 PJ primary energy input the following conclusions can be derived:

- High dependence on imported fossil fuels, especially natural gas
- Dominance of natural gas as a fuel and still considerable share of (mainly domestic) coal fired power plants
- Huge amount of currently “rejected” energy, especially due to losses from electricity and heat generation and distribution (around 64 % - the comparable 2007 Austrian figures show a value of 36 %)
- Most important energy consumer is the industrial sector (including transformation processes), which accounts for more than half of final energy demand (2,100 PJ from overall 4,070 PJ)

According to latest figures (Energy Balance of Ukraine 2011) Ukraine only produces 37% of the oil and 33% of the natural gas consumption domestically. Although Ukraine produces almost half of its electricity demand at NPPs and has its own uranium reserves, all nuclear fuel is imported, since Ukraine does not have a domestic production of fuel cells. Only for coal, Ukraine can deliver the main share from within the country's borders, using mostly low quality coal for electricity generation resulting in high emissions and environmental impacts accompanied with lower electrical efficiency values. Despite vast potentials in the field of biomass, but also considerable potentials for other types of renewable energy, these energy sources are currently used on a very low level, apart from some applications for electricity supply.

4.1.1 Electricity supply

Electricity supply is almost fully covered by generation facilities in the country with dominance of NPP (45 %) and coal fired PPs (35 %). A smaller percentage is delivered by gas-fired CHP (15 %) and by hydropower (6 %). NPPs and especially coal fired power plants are old and in a very bad condition. As of 2011, 95% of the thermal power units reached their designed useful life (100,000 hours), with 65% of them depleting the life limit (170,000 hours) and even the physical wear threshold (200,000 hours). Due to the limited availability and high price of fuel oil, oil-fired units are used only to a minimum. However, oil- (and gas-) fired units are needed to balance the supply/demand as they show a much more flexible part-load performance compared to coal-fired ones. In the current situation coal fired power plants are often used for peak load purposes. This fact further reduces their efficiency, accelerates the rate of accidents and reduces their life time. The following table shows the shares of the electricity production of Ukraine.

Table 2: Electricity production shares

2012	Capacity of power plants, MW	Share of total, %	Electricity production, MWh	Share of total, %
Total	55,001	100.00	198,877	100.00
Including:				
TPP	35,128	63.87	97,125	48.84
NPP	13,835	25.15	90,137	45.32
HPP	5,470	9.95	10,993	5.53
Wind	247	0.45	288	0.14
Photovoltaics	319	0.58	333	0.17

Source: www.ukrstat.gov.ua

In Ukraine, the potential of renewables is considered to be good. The share of wind energy increased three times and the share of solar energy eleven times within one year. The installed capacity of power plants increased from 89.5 to 228.2 MW for windmills and from 30.1 to 333.3 MW for PV plants.

Losses in power grids amount to 10.9%, the own consumption of power plants make up 14.1%. At the same time, electricity losses in transmission and distribution power lines in many countries are considered satisfactory where they do not exceed 6%. The power losses of 10% may be deemed maximum permissible in terms of physics of electricity transmission via grids (www.energobit.net/poter.htm)

4.1.2 Thermal energy

The existing (centralized) thermal generation in Ukraine is delivered by thermal power plants and boiler houses owned by public utilities as shown in the table below.

Table 3: Data on the state of (centralized) heat generation capacities

Heat Generation Capacities		
Total capacity of the boilers at the end of the year	137,000	GW
Number of installed boilers at the end of the year	80,100	Number of units
Length of heat and steam pipelines at the end of the year, two-pipe	32,400	km
Generated thermal energy	435	PJ
External thermal energy supply	38.5	PJ
Thermal energy consumed for own needs of the boilers	14.65	PJ
Supplied thermal energy	402	PJ
including:		
To population	230,3	PJ
To public utilities	91,7	PJ
Thermal energy losses	58,0	PJ

Source: Ukrstat 1, 2012

The original source of the above table does not provide sufficient data to trace back the composition of the total generated/supplied thermal energy values in detail. A crosscheck with e.g. the country energy flow chart or the average losses in heat supply networks however proved the plausibility of the values.

The share of district heating amounts to 90-95% in cities (population > 0.3 Million people), and to 40-50% in towns (except towns with an individual heating system). About 16,000 boilers (20%) are outdated and have been in operation for over 20 years. The majority of heat supply systems are in poor condition, over 28% of all heat supply systems have been in operation over 25 years, 43% over 10 years and only around 29% of the heat supply systems have been operating less than 10 years. Heat losses in the heat supply networks are between 5% and 32%. However, according to the Statistics Authority this indicator is on average 14.3% for Ukraine.

Nowadays, the electricity generation in Ukraine is in very bad condition. This became apparent by the recent accident in March 2013 at the Uglegorsk TPP, where a fire destroyed 3,600 MW of generating capacities due to very old power units assets and poor maintenance. According to the Ministry's of Energy and Coal Industry estimates, the entire electricity industry needs 50 to 60 billion EUR investments until 2030. Also, at present, the total equivalent EUR value of the energy saving market in the utilities sector is estimated at approximately 6.1 billion EUR by Ukraine's State Agency for Investment and Management of National Projects and mainly refers to replacing boilers and pipelines (RBC 2013).

4.2 Energy demand

The following figures show the energy demand per sector. A large share of the total consumption (34%) is attributable to the residential sector (source: State Statistic Service of Ukraine). However, this is not due to a high usage of electric appliances in the residential sector, but rather to the low efficiency of energy consumption, mostly used for district heating. As shown in the table, the industry also uses other energy sources besides thermal and electrical energy from external, regional supply. Natural gas and coal (coke) are mainly used for heating, petroleum products for transportation (in different sectors) and biofuels (wood, wood chips) for heating in households.

Table 4: Structure of energy consumption by industrial sectors, PJ

(2011) PJ	Coal and peat	Petroleum products	Natural gas	Biofuels and wastes	Electricity	Thermal energy	Total
Ferrous metallurgy	271	9	174	-	87	51	592
Chemical and Petrochemical	3	7	19	0	21	62	113
Non-ferrous metallurgy	1	0	9	-	6	12	28
Non-metallic mineral products	34	3	31	1	11	4	84
Machinery	0	3	13	0	21	12	49
Ore mining	1	13	16	-	37	4	71
Food and tobacco	2	7	11	0	16	46	83
Transportation	1	352	139	-	36	-	528
Households	30	4	591	39	139	189	991
Trading and services	7	7	18	2	76	94	203
Agriculture	1	58	7	1	13	14	94
Others	18	19	4	1	41	14	97
Total	369	482	1,031	44	505	502	2,933

Source: Energy balance of Ukraine 2011

The energy demand in different sectors is mainly covered from fossil fuels. Natural gas is used for boilers and other heating applications. Diesel is a major petroleum product and is consumed in construction. Second largest consumer of petroleum products is the food and tobacco industry. The largest consumers of natural gas are chemical and petrochemical, non-metallic minerals and again food and tobacco. As

some EE measures can optimize the fuel consumption (e.g. adjusting combustion efficiency) the fuel demand can also point at energy intensive industries.

An extract from the expected energy balance for the pessimistic¹ scenario of the Energy Strategy of Ukraine until 2030 is given below, which expects increased resources, domestic production and ongoing dominance of fossil fuels.

Table 5: Energy supply and demand according to the energy strategy until 2030

Forecast (PJ)	2010	2015	2020	2025	2030
Resources, total	6,797	6,715	7,386	7,767	8,488
Production of energy, total, incl.:	3,869	4,212	4,939	5,572	6,917
Production of fossil fuels	2,110	2,274	2,559	3,057	4,051
Coal	1,260	1,445	1,653	1,893	2,166
Oil	149	117	100	138	299
Natural gas	698	709	806	1,025	1,588
Generation of electricity not from fossil fuels, including:	367	403	503	554	633
NPPs	320	345	417	454	507
HPPs and storage PP	47	54	72	75	75
WPPs, SPPs, and small HPPs	0	4	14	25	50

Source: Energy Strategy for Ukraine

4.3 Greenhouse gas emissions

The largest contributor of CO₂ emissions is the energy sector - because of the wide use of coal for electricity generation - and the use of motor fuels in the transport sector. Within the energy sector, transport is responsible for 13.76% of all emissions, manufacturing industry for 20.29% and the energy industries for 35.29%. Within the industrial processes sector the largest contribution falls on the iron and steel industry (60.88%) and the chemical industry (17.62%). In 2011, total GHG emissions amounted to 401 million tCO₂-equivalent (without LULUCF) and total CO₂ emissions to 306 million tCO₂ (without LULUCF) (UNFCCC). The following chart shows the overall emissions by sector.

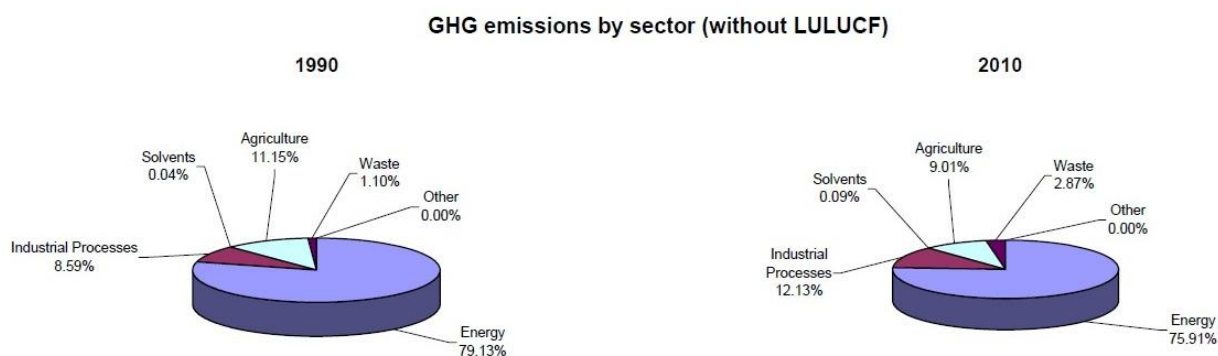


Figure 2: CO₂ emissions per sector

Source: UNFCCC

4.4 Energy efficiency overview

Analyzing the energy flow diagram of Ukraine (see Figure 1) the importance of the industrial sector and electricity and heat generation sector in terms of energy saving potentials gets obvious. The residential sector also offers considerable energy efficiency potential, which is however limited due to lacking funds and economic attractiveness following highly subsidized gas prices for households.

¹ The pessimistic scenario was chosen as Ukraine had 0.1% GDP increase last year. For this year the forecast is 1%. So both scenarios (optimistic and realistic) are likely to be unreachable.

4.5 Energy efficiency in the industrial sector

Following the “Energy Efficiency of the Regions of Ukraine” (2012) study the following summary can be derived.

Table 6: Summary energy status and potential in the industry

Industrial Sector	Consumption 2010 (PJ)	Share/Industry	Remark on Potential	Energy Saving Potential
Primary	594.5	56%	technology change (abandon open hearth technology)	
Food	83.7	8%	partly very low efficiency level compared to EU	
Mining	138.2	13%	changes so far due to external factors (price shocks)	
Chemical	83.7	8%	potential in renovation, upgrading, CHP plants	
Non-metallic minerals	75.4	7%	technology change (e.g. dry cement production)	
Others (incl. paper/machinery)	79.5	8%		
Sum industry	1,055	100%		765.93 PJ/72.6 %

Source: Summarized based on BEST, 2012

The Study does not provide details on energy saving potentials per subsector, only an overall estimation for the whole country.

According to the Energy Efficiency Program for Industry of Ukraine until 2017 the energy efficiency potential of the most important industry subsectors is evaluated as follows:

Table 7: EE potential in industry subsectors

Sector	EE Potential, %	EE Potential, PJ
Construction and construction materials	approx 50% ²	20,5
Iron&Steel	35%	232
Light industry and woodworks	18-23%	-
Machinery	25-30%	12-15
Chemical and petrochemical	approx 70%	79,1

Source: Industry.kmu.gov

The **primary metal sub-sector** is the biggest energy consumer in the industrial sector and accounts for more than half of the country's energy needs in the industrial sector. Changes have been mainly due to external factors, such as reduced demand, which lead to worse plant load factors. Considerable potential for the increase of energy efficiency is seen in technology changes. The inefficient open-hearth method of steelmaking is still widely used in Ukraine and could be replaced by the pulverized coal injection process. However, lack of the required amount of ferrous metal scrap and the large capital investments are seen as obstacles to this process.

Despite considerable differences among the regions and improvements in the last years, the energy efficiency status of the **food industry** in some parts of the country is very low in comparison to EU levels (e.g. 12% in the Ternopil Oblast, but 78 % in the Autonomous Republic of Crimea).

On average, the energy efficiency of the **chemical industry** is five times lower than the EU average. Biggest consumers are 6 fertilizer manufacturers, which show large regional differences in energy intensity, but even the most efficient one is more than twice as bad as the EU average. Highest potentials are

² http://archive.nbu.gov.ua/portal/natural/PZE/2010_23/04ua_Symborskiy.pdf

expected in the renovation and upgrading in the ammonia production as well as in the installation of CHP plants.

Recent increases of the energy efficiency in the **mining sector** have been mainly due to external supply shocks to the steel industry, such as the increase in the coking coal price in 2010, which led to a better utilization factor due to increased demand. Moreover, upgrades of production facilities took place after privatization or concession agreement on some plants.

The energy efficiency of the production of **non-metallic mineral** products varies considerably among the regions. Differences between 70% of EU average (Kharkiv region) and 8% (Khmelnitsky region) can be explained by the type of production (more efficient dry processes or wet processes in the cement production) but also be due to out-sourcing some production steps. Further implementation of the dry process is limited by a currently low demand.

According to local experts, the focus of realistic energy saving measures is put on the following areas:

The most attractive economic sectors in terms of energy saving are the **iron and steel industry** (as the largest consumer among all industrial sectors and as the sector with the high percentage of fixed asset depreciation). This sector is characterized rather **by large companies** than by SMEs. The main focus of investment in this sector could be compressor replacement, improvement of oxygen production and automation of manufacturing processes.

The continuous growth of energy tariffs for the population increases the attractiveness of heat supply utilities for households as a client for energy saving measures (products).

Based on **technologies nature, short payback period, market scale and replication potential** the following EE technologies are the most interesting to be financed in Ukraine:

- Replacement of outdated **boilers** with the new ones equipped with heat recovery systems and designed for changed loads;
- Installation of state-of-the-art automated **burners**;
- Installation of systems for **recovery of flue gas** energy from technological processes;
- Installation of **waste heat recovery units** in ventilation and air conditioning systems;
Use of **electricity for heating with accumulation of thermal energy** during time of night minimum load on energy system (thus reducing the expenditures for power plant in-house needs) (opinion of local expert)
- Replacement of **outdated compressors** with new ones that fit to changed loads;
- Replacement of **worn pumps** with new ones preferentially with VSD motors;
- Installation of **condensate collection** and return systems.

4.6 Energy efficiency in SMEs

In Ukraine, **small enterprises** are defined as companies that have an annual average staff number of maximum 50 people and the annual gross income from sales of products (works, services) does not exceed the amount equivalent to 6.3 million EURO.

Medium enterprises have an annual average staff number from 51 to 249 people and the annual gross income from sales of products (works, services) is more than 6.3 million EURO and less than 9 million EURO.

The following table provides a more detailed look on the role of the SMEs sector in Ukraine.

Table 8: Small and medium enterprises in Ukraine

Countries	Number of SME's (ths)	Number SMEs per 10 ths. citizens	Employed with SMEs (million people)	Share of SMEs in the total number of employed (%)	Share of SMEs in GDP (%)
EU	15,770	450	68.0	72	63-67
USA	19,300	742	70.2	54	50-52
Japan	6,440	496	39.5	78	52-55
Russia	875	57	7.5	15	9-10
Ukraine	152	41-81	1.1	5	10-11

Source: Jivkurilka, 2013

The following table shows in which sectors SMEs are active and the share of small, medium and large enterprises in the respective sector:

Table 9: SME shares in sectors of the economy

	Small, %	Medium, %	Large, %
Agriculture	91,7	8,0	0,3
Industry	86,8	10,9	2,3
Construction	95,7	4,0	0,3
Commerce	95,1	4,5	0,4
Hotels, restaurants	95,4	4,5	0,1
Transportation	92,4	6,8	0,8
Financial	93,9	5,6	0,5
Real estate	96,5	3,4	0,1
Education	95,8	4,2	0,0
Health care	94,0	5,8	0,2
Public utilities, culture, sport	93,2	6,6	0,2

Source: Statistic survey of Ukraine, 2011

There is neither specific data on SMEs energy-saving potential nor on their energy consumption. However, proceeding from the GDP share generated by SMEs (approx. 10%) and energy efficiency potential of Ukraine in general (approx. 47.6% (UEI-2012)), own expert estimations deduct that some 5% of the total national potential or **97 PJ** are attributable to SMEs. Currently, most EE potential concerning SMEs is seen to be in the industry sector in the heat generation and consumption systems. Due to limited financial resources which do not allow major renovation of equipment SMEs very often use obsolete and second-hand equipment, including homemade equipment. Local experts also claim that governmental support is rather available for big companies than for small ones. E.g. VAT returning is possible for large enterprises only (with large lawyer departments). The situation for SMEs worsens due to high interests on loans in Ukraine (20-25%), which is another obstacle for modernization and energy efficiency improvement in productions.

4.7 Energy efficiency in the residential sector

The residential sector - including about 19.3 million apartments – shows a current final energy consumption of about **1,000 PJ**, which is about the same amount as the overall industrial consumption, including primary energy conversion. The electricity consumption of households amounts to **132 PJ** (UNdata). Thus the major share of energy consumption is attributable to heating purposes. The **total energy saving potentials** within the residential sector are quantified with about 380 PJ or **37.9%** of the current consumption. It is important to note that available studies (such BEST 2012) did not consider the reduced number of household appliances as well as the different quality of hot water supply and heating services compared to the EU level. Moreover, the average size of apartments in Ukraine is smaller than in the EU, which leads to different results even if the same appliances were used.

Older documents, such as the State Program on Energy Saving 2010-2014 (published in 2009) identified the following measures/areas of estimated energy saving potentials (Ministry of Housing and Communal Services 2009):

- 30% of heat in buildings;
- 22% of natural gas in boiler rooms;
- 25% of heat in heat supply system;
- 30% of water in water supply systems;
- 25% of electricity in sewage systems.

Main barriers for more efficient use of energy are the still pending reforms in the field of utility services, highly subsidized (and thus very low) gas prices for the population and lack of heat meters in about 2/3 of the houses.

As of January 1st, 2013 (Ukrstat 2) the urban population in Ukraine made up 31,378.6 thous. (68.9%), while 14,174.4 thous. people (31.1%) lived in rural areas. Natural gas is the main source of heat, both in urban and rural areas. In the eastern regions of Ukraine (Luhansk, Donetsk region), coal is often used as the source of thermal energy. This is due to the coal mining profile of the regions and governmental subsidies reducing coal prices.

Since 1994 Ukraine has been reforming the regulations in the construction industry to improve energy efficiency in buildings. In 1994-1996, new legislation was adopted which requires a higher level of heat insulation for new and public buildings (Nbu.gov).

According to the National Institute for Strategic Studies for the President of Ukraine, about 47% of the housing stock exceeded their designed lifetime (Niss.gov 1). The cost for the renovation of the housing stock of Ukraine is estimated at 40 billion EURO by the Ministry of Regional Development, Building and Housing. According to the estimates of the Research Institute of Building Structures, the EE potential is 60% (Nbu.gov 2). The trend to insulate the building envelope both in private houses and apartment blocks has increased recently although this measure has a long payback period. Insulation of walls and roofs, replacing old windows with energy efficient ones, replacing old heating boilers and radiators with new ones can considerably improve the energy efficiency situation and comfort, but faces major obstacles. On the one hand there is limited household budget and hardly any affordable loans available for the residential sector. On the other hand, investing in such measures is not attractive from economic perspective due to subsidized gas prices for the residential sector.

Concerning electricity consumption in Ukraine, typically used electrical appliances are the following (number of appliances per household provided in brackets):

- TV-set (1,1)
- refrigerator (1,09)
- washing machine (0,85)
- vacuum cleaner (0,75)
- iron (0,99)
- computer (0,25)
- microwave oven (0,33)
- air conditioner (0,06).

It is assumed that the overall electricity consumption in Ukraine will further increase due to a larger number of electric appliances in the future such as TV-sets, computers and air conditioners as also indicated in the energy efficiency analysis of the regions (BEST 2012).

Despite the fact that modern energy efficient state-of-the-art household appliances are available in the country, there is a lack of transparent labeling. Currently there are no laboratories that may identify energy efficiency of household appliances. There is no authority responsible for inspection of marking validity,

and no penalty for false marking has been adopted. Therefore, currently conscious consumers mostly rely on brands from EU, USA, and labeling such as the EU Energy Label and Energy Star.

The highest **energy saving potential** relating to the residential sector is expected in the field of heat generation and distribution. Modernization of boiler houses with installation of energy efficient boilers, renovation of heat supply networks and installation of individual automated heat supply stations is relatively easy to implement and provides low payback periods. Insulating of buildings and structures is a more cost-intensive measure with longer payback periods.

4.8 Energy efficiency in the agricultural sector

Worldwide, Ukraine ranks in the TOP10 in exporting sunflower oil, wheat and barley (National Institute for Strategic Studies). The agriculture and processing sector accounts for 4-5% (Energy Balance 2011) in the energy balance of Ukraine. But despite the relatively small share, this sector is very energy intensive, because product processing involves warming and cooling processes.

The energy consumption in the agricultural sector amounted to **96.3 PJ**, which is comparable to some industrial subsectors. Despite the fact that energy consumption per hectare is almost comparable to the EU average the energy efficiency in agriculture (output compared to energy input) is **three times** lower than the EU average. However, the value added in the EU is much higher due to the higher yield and productivity in the agricultural sector. Thus, energy efficiency gains could be achieved via investing in more productive agricultural technologies.

One of the main problems of the agricultural sector is old and outdated equipment – 70-90% of the machinery exceeded its designed lifetime and over 40% of the tractors are over 15 years old (source: National Institute for Strategic Studies). Processing enterprises are far ahead of other industrial enterprises in energy saving aspects. This is due to the fact that most enterprises are associated to large agricultural holdings having own financial resources and they need to ensure product quality and certification. The majority of the small enterprises, however, do not focus enough on saving energy, because they lack necessary funds.

Energy saving in the agriculture is primarily based on replacement of outdated agricultural machinery with modern multifunctional machines. The replacement entails a significant drop in fuel consumption and improves control over its use. The energy efficiency potential of the agricultural sector is approx. 60% or 56,8 PJ (UEI-2012).

5 Framework for Energy Efficiency

This section of the report analyzes the framework conditions for carrying out energy efficiency. The main questions to be asked are:

- Is energy efficiency, its actors, targets or specific measures mandated or supported in any legal or policy related document?
- Are the technical capacities in place in Ukraine in order to realistically realize specific measures?
- Does it make sense in economic terms to invest in energy efficiency in the country?

5.1 Legal and policy framework

As shown in the **Energy Strategy until 2030** focus is still on growing energy consumption, on the development of fossil fuels and nuclear energy generation. Despite the declared target of energy efficiency improvement by 40%, the document lacks mechanisms to finance energy saving and incentives to promote launch of energy efficient technologies. All funding mechanisms are aimed at increasing generation. Currently, National Agency on Energy Efficiency and Energy Saving (SAEE) focuses on the possibility to

increase the share of renewable generation in the Energy Strategy of Ukraine. Such a position leads to debates between experts groups and takes away attention from energy efficiency issues.

The state policy is focused on support to large primary resource-based business, and continued subsidizing of the tariffs for households, no drastic changes are likely in the next 3-4 years.

In 2011, Ukraine joined the **Energy Treaty** and according to its requirements the development of the National Energy Efficiency Action Plan has started. The draft Plan was developed by March 2012, however, it has not been approved due to bureaucracy of various Ministries yet. In summer 2013, National Renewable Energy Action Plan should be developed but most probably the approval will be similarly delayed.

According to the legal frame existing in Ukraine a law provides the framework regulation, the details are addressed in sub-legislative acts (such as a Resolution of the Cabinet of Ministers, an Order of the Ministry etc). The main principles of the energy saving state policy are regulated by the **Law of Ukraine "On Energy Saving"** No.74/94-VR dated 1 July 1994. In order to support energy saving in Ukraine, the Cabinet of Ministers approved the **State Target Economic Program of Energy Efficiency and Development of Energy Generation from Renewable Sources** for 2010-2015.

The document defines objectives and activities to be implemented in order to achieve the objectives, which are:

- To reduce the GDP energy intensity by 20% as compared to 2008;
- To optimize the structure of the country's energy balance, where the share of energy from renewable sources and alternative fuels will be minimum 10% in 2015;
- To ensure a 25% reduction in consumption of imported natural gas.

The estimated funding of the program consists of EUR 32.3 billion of which only EUR 0.72 billion derive from state budget and EUR 1.4 billion are provided by local government budgets. These shares indicate that the state does not intend to introduce significant support to finance energy saving. Also each oblast has to develop and approve its own regional energy saving program. Nowadays, all oblasts have finished this work, but lack of financial resources in regional budgets is a barrier for their implementation.

Moreover, the following regulatory acts should also be mentioned:

The Law of Ukraine "**On Alternative Fuels**" No.1391-XIV dated 14 January 2000 establishing the main principles of the state policy in alternative fuels sphere, giving definitions of various types of fuels and stating the need to introduce preferences for manufacturers. However, the support mechanisms are absent so far.

The Law of Ukraine "**On Electricity Industry**" No.575/97-VR dated 16 October 1997 establishes the main principles of "green tariff" applications within the territory of Ukraine and the factors to calculate the green tariff.

The Law of Ukraine "**On Heat Supply**" No.2633-IV dated 02 June 2005 establishes the main principles of heat supply market operation and the system of tariff regulation. The law is quite general and defines the right to keep tariffs unmodified for three years for heat supply enterprises, which have introduced energy saving measures.

The Law of Ukraine "**On Combined Generation of Heat and Electricity (Cogeneration) and Use of Waste Energy Potential**" No.2509-IV dated 05 April 2005 establishes the cogenerator's mandatory right to access the electricity networks and the energy market's obligation to buy the entire amount of generated electricity.

The Resolution of the Cabinet of Ministers of Ukraine No.444 dated 14 May 2008 "**Issues Relating to Importation of Energy Saving Materials, Equipment and Components to the Customs Territory of Ukraine**" provides a reduction in the import duty and VAT for the goods above, if such goods are not manufactured in the territory of Ukraine. However, in order to be eligible for this mechanism, an enterprise must get a lot of supporting documents. The procedure requires that the preference for each individual enterprise is approved at the meeting of the Cabinet of Ministers of Ukraine, making these scheme a subject to corruption.

5.2 Technical framework

Almost all existing energy saving technologies are represented in Ukraine. However, not all of them are used. The following systems are rather rare:

- Cogeneration (trigeneration) at enterprises;
- Use of recovery systems for flue gas heat of technological processes;
- Use of soft heat insulation in heating furnaces;
- Biogas production;
- Use of solar water heaters in households and at enterprises;
- Use of heat pumps.

These technologies currently have low market penetration mainly because of lack of finance and relatively long payback periods.

The following technologies are manufactured in Ukraine:

- Waste wood-fuelled/straw boilers;
- Energy efficient boilers;
- Pellet, briquette making units;
- Flue gas heat recovery systems;
- Metering and automation systems;
- Variable-frequency drives;
- Pre-insulated pipes;
- Automated heat supply substations.

These technologies have good market positioning and there are many manufactures on the market. Details are provided in a separate report.

Many private energy saving service providers operate in Ukraine. These companies position themselves as manufacturers (importers, installers) of energy saving equipment. Representative offices of the following energy efficient equipment and material manufacturers are present on the market:

- Boilers: Viessmann, Buderus, Atlas Copco Ukraine, Ferroli S.p.A.
- Pumps: Grundfoss, Wilo.
- Insulation: Rockwool, Knauf insulation, Saint Gobain.
- Automation: Herz Armaturen, Samsung, Mitsubishi electric.
- Compressors: Cooper Turbocompressor, Kaeser Kompressoren,
- CHPs: York, Zeppelin (Caterpillar), Jenbacher GE, Deutz AG.

5.3 Economic framework

The following table provides an overview of the current Ukrainian energy prices for households and industry.

Table 10: Energy prices comparison

	Industry, EUR/kWh		Households, EUR/kWh	
	Gas	Electricity	Gas	Electricity
Ukraine	0.04088	0.113	0.0063	0.026
EU (average)	0.04000	0.118	0.0720	0.197

Sources: National Electricity Regulatory Commission Ukraine, Eurostat

From the figures above it can be concluded that the energy prices for households are extremely low compared to the EU average. Such state approach makes energy saving projects highly unattractive for this sector in economic terms. Despite this fact, the population pays more and more attention to energy conservation due to relatively low income. Energy saving lamps, regardless of their comparatively high price, have almost replaced incandescent lamps. House owners also perform insulation of buildings (e.g. exter-

nal walls of the flats in blocks of flats) and multifuel boilers (solid fuel/natural gas), but also electric boilers are becoming popular.

The Ukrainian industry like its utilities demonstrates low energy efficiency penetration. This situation is attributable to unfavorable circumstances and “blind” management with short terms thinking at the majority of the enterprises. In times when enterprises had the opportunities to attract cheap loans to make investments in energy saving (before the end of 2008) the prices of energy sources were low and the enterprises owners were not interested in investing. A few enterprises modernized their production facilities rather due to depreciation of and failures in operation of their equipment than to energy saving needs.

Upon the crisis in 2008, loan interest rates have increased hampering long-term investments. However, enterprises are extremely interested in energy saving projects with short payback periods of up to three years.

The efficient energy use problems are inherent to the entire consumption chain starting with generation and ending up with final users. So, the market potential of energy saving in the industry is very high and it continues growing due to equipment depreciation.

Several years ago Ukraine introduced the green tariff system for electricity from renewable sources. It will be in place until 2030. In 2014, 2019 and 2024 the tariff should be reduced by 10%, 20% and 30% respectively. Currently, Ukrainian’s green tariff is the highest in Europe (NERC).

Payment of gas and electricity consumption in the industrial sector is based on actually metered amounts. The same counts for households’ gas and electricity consumption. In the field of hot water and centrally delivered heat both metering, but also still fixed prices per m² are common. Before considering energy efficiency measures in the heating sector it is necessary to implement metering systems.

The following static payback periods can be expected when investing in specific energy efficiency measures in Ukraine.

Table 11: EE measures and average payback periods

Measure	Investments, EUR	Energy saving EUR/year	Payback, years
Replacement of outdated boilers with the new ones equipped with heat recovery systems and designed for changed loads	50.000-1.000.000	17.000-250.000	3.0-4.0
Installation of state-of-the-art automated burners;	20.000-80.000	20.000-55.000	1.0-1.5
Installation of systems for recovery of flue gas energy from technological processes	30.000-1.000.000	30.000-650.000	1.0-1.5
Installation of a waste heat recovery unit in ventilation and air conditioning systems	500-10.000	500-6.500	1.0-1.5
Use of electricity for heating with accumulation of thermal energy during time of night minimum load on energy system (thus reducing the expenditures for power plant in-house needs) (opinion of local expert)	5.000-500.000	2500-150.000	2.0-3.0
Replacement of outdated compressors with new ones that fit to changed loads	50.000-1.000.000	20.000-350.000	2.5-3.5
Replacement of worn out pumps with new ones preferentially with VSD motors	5.000-500.000	2.000-150.000	2.5-3.5
Installation of condensate collection and return systems	10.000-1.000.000	5.000-350.000	2.0-3.0

Source: Local expert (experience from energy audits conducted in the last 10 years)

5.4 Awareness and information level

The general public awareness on the energy efficiency topics is reported to be high. There are many different events in Ukraine like conferences, roundtables, TV campaigns (sponsored by IFI's) etc. as well as specialized magazines "Energozberezhennya", "Energozberezhennya, Energetica, Energoaudit", "Esta" etc. Manufacturers also highlight consumers' attention on energy efficiency parameters of their equipment.

6 Conclusions

Based on pertinent studies and local experts' experience, there is large untapped potential for energy efficiency measures in Ukraine.

The **local energy demand** of Ukraine is expected to rise in the upcoming years and requires considerable investments in both new and upgraded supply and distribution facilities. Energy efficiency is not only influenced by dedicated energy saving measures, but also by the general economic situation and external supply/demand developments, which are reflected in the production volume (while assuming partly fixed energy input requirements).

Energy tariffs (especially gas) for the residential sector are currently highly subsidized and, thus, very low, which makes investments in energy efficiency unattractive from an economic point of view. Higher tariffs for industry lead to more attractive potentials in the industrial sector.

Energy efficiency opportunities can be identified in the upgrade of energy supply and distribution facilities, but also in the industrial, agricultural and residential sector. The overall saving potential compared to today's level in the industry amounts to more than 70%, which can be realized via changes in production technology (e.g. in the primary energy field or in the cement production), but also through the exchange of outdated equipment, boilers (including biomass boilers) and through the use of waste heat potentials. Especially in times of privatization or concession agreements, important changes can be realized. Due to findings from the past it is considered important that anticipated measures have to be accompanied by market studies and following marketing activities in order not to lose efficiency gains via low utilization rates of plants. For the industrial sector especially those measures are of specific interest, which exhibit short payback rates.

Another target group for EE is the household sector, where considerable efficiency gains in the range of about 30% of the current consumption are expected to be achieved. However, current low gas prices and lack of meters especially for centrally delivered heat pose an important obstacle to the economic viability of investments in this sector despite generally increasing information level and awareness among the population. Energy efficiency measures in the short term will rather be focused on using more efficient electric appliances than on larger investments in the heating sector. Also the agricultural sector provides opportunities for important energy saving potentials via the replacement of outdated machinery and equipment, but also via the general change of production technologies.

7 Relevant Institutions

The following table provides an overview of institutions relevant for EE in Ukraine, including numerous private enterprises that are currently active in the country.

The Ministry of Energy and Coal Industry is responsible for oil, gas, coal mining and trading and power generation.

The following governmental structures are in charge of regulation in energy saving in Ukraine:

- State Agency on Energy Efficiency and Energy Saving (SAEE);
- National Energy Regulatory Commission (NERC);
- National Utilities Regulatory Commission (NKP).

Each of them has its own service network.

SAEE (www.sae.gov.ua) has acknowledged 125 companies as energy auditors so far, however, only a few companies are really actively working in this area.

Currently, with the support of USAID, there is ongoing work for establishing ESCO companies. However, the lack of legislative framework hampers this process (the term “energy service company” is absent, there is no regulation covering performance contracting (EPC)).

On the positive side, Ukraine has acceded the International Performance Measurement and Verification Protocol (IPMVP®). Since Energy Performance Contract does not work in Ukraine, the existing ESCOs (UkrESCO, Rivne ESCO) operate under the supplier’s credit scheme.

Among IFIs, IFC, GEF, UNDP, UNIDO, GIZ, GGF, EBRD, USAID, EC, NEFCO are active in the market and are implementing their energy efficiency projects in Ukraine.

8 Literature

BEST, 2012, System Capital Management, *Energy Efficiency Ranking of the Regions of Ukraine*, www.energy-index.com.ua

Bprice.ua, http://bprice.ua/news/construction_news/6566

Cabinet of Ministers, 2010, *State Target Economic Program of Energy Efficiency and Development of Energy Generation from Renewable Sources for 2010-2015*, <http://zakon2.rada.gov.ua/laws/show/243-2010-%D0%BF/paran14#n13>

EUROSTAT, <http://epp.eurostat.ec.europa.eu>

GEF/UNIDO, 2013, *Improving energy efficiency and promoting renewable energy in the agro-food and other small and medium enterprises (SMEs) in Ukraine*, www.reee.org.ua

Industry.kmu.gov,
<http://industry.kmu.gov.ua/document/70528/%D0%9C%D1%96%D0%BD%D0%9F%D1%80%D0%95%D0%BD%D0%97%D0%B1.doc>

Jivkurilka, <http://jivkurilka.com/about1.html>, last access: 01.10.2013

L. Sakhnevych, Ph. D., 1996, *Building Energy Efficient agro-industrial production on the principles of strategic allocation management tools*, www.economy.nayka.com.ua/?op=1&z=1996

Lawrence Livermore Laboratories, 2011, C. A. Smith, R. D. Belles, A. J. Simon, *2007 Estimated International Energy Flows*, <https://e-reports-ext.llnl.gov/pdf/473335.pdf>

Ministry of Housing and Communal Services Ukraine, 2009, *Sectoral program efficiency and energy saving in the residential sector for 2010 - 2014*, <http://document.ua/galuzeva-programa-energoefektivnosti-ta-energozberezhennja-u-nor17772.html>

National Institute for Strategic Studies, *"Tools to stimulate the development of the agroindustrial complex of the East". Policy briefing*, www.niss.gov.ua/articles/1175/

Nbuv.gov 1, http://archive.nbuv.gov.ua/portal/natural/Rezh/2008_9/Farenyuk.pdf

Nbuv.gov 2, http://archive.nbuv.gov.ua/portal/natural/knizh/2011_3/9.pdf

NERC, National Electricity Regulatory Commission Ukraine, www.nerc.gov.ua

Niss.gov, www.niss.gov.ua/articles/1237/

RBC, 2013, Ukrainian News Agency, www.rbc.ua/rus/newsline/show/obshchiy-obem-rynka-energoberezheniya-v-kommunalnom-sektore-28022012164900

State Committee of Statistics of Ukraine, <http://zakon2.rada.gov.ua/laws/show/z1279-05>

State Services of Ukraine, *Energy Balance of Ukraine 2011*, www.ukrstat.gov.ua

Ukrainian Parliament, *Law of Ukraine "On Energy Saving" No.74/94-VR dated 1 July 1994*, www.rada.gov.ua

Ukrstat 1, www.ukrstat.gov.ua/operativ/operativ2012/pr/etgv/etgv_u/ok_tm_11u.html

Ukrstat 2, www.ukrstat.gov.ua/operativ/operativ2013/ds/kn/kn_u/kn0113_u.html

UNdata, United Nations Statistics Division, <http://data.un.org>

UNFCCC, 2011, *Summary of Greenhouse Gas Emission Ukraine 2011*,
http://unfccc.int/files/ghg_emissions_data/application/pdf/ukr_ghg_profile.pdf

USAID, *Municipal Heating Reform in Ukraine*, www.mhrp.org.ua/index.php?lang=english



Oesterreichische Entwicklungsbank AG

1011 Vienna, Austria
Strauchgasse 3
Tel. +43 1 533 12 00-0
Fax +43 1 533 12 00-5262
office@oe-eb.at
www.oe-eb.at

