

# Energy Efficiency Monitoring for Ukraine and Rankings of Energy Efficiency of Heating Sector

**Borys Dodonov**

New Social & Economic Policy

October 13, 2015

# Motivation of indicators development

*There can be economy only where there is efficiency*

Benjamin Disraeli

*The fifth fuel, as energy efficiency is sometimes called, is the cheapest of all*

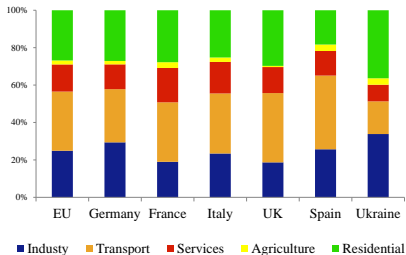
*The Economist*, "Invisible Fuel", 17th Jan 2015

## Energy Efficiency Monitoring for Ukraine (EEMU)

- Initiated by the UNDP in Ukraine and NewSEP
- Instrument for an effective energy policy
  - ① Estimate the potential energy saving after energy efficiency increase
  - ② Set short and long-run energy efficiency targets
  - ③ Use for monitoring the progress towards determined targets
  - ④ Publication of the results should increase the responsibility and efforts of public authorities

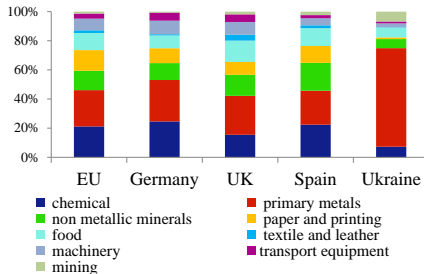
# Structure of the Economy affects the final energy intensity

Figure 1: STRUCTURE OF ENERGY CONSUMPTION IN UKRAINE AND THE EU IN 2013



Source: ODYSSEE and Derzhstat

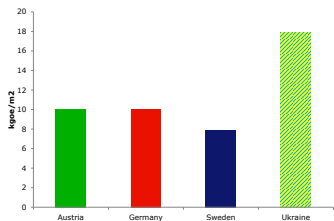
Figure 2: STRUCTURE OF MANUFACTURING ENERGY CONSUMPTION IN UKRAINE AND THE EU IN 2013



Source: ODYSSEE and Derzhstat

# Rankings of Energy Efficiency in the Heating Sector (REEHS)

**Figure 3:** Inefficiency of heating and hot water supply\*



Source: ODYSSEE, Derzhstat and NewSEP estimates

\*Consumption in the EU was corrected by the structure of the residential stock in Ukraine.

## Energy efficiency of residential heating

- Energy consumption per m<sup>2</sup> is twofold higher in Ukraine than in the EU
- Energy efficiency increase up to the EU level would allow to drastically decrease natural gas import, increase households' welfare and improve environment
- Effectiveness of state programs would considerable increase after incorporation into them the quantitative energy consumption targets

# Use in the EU

## The EU Directive on Energy Efficiency (2012/27/EU)

- Submission of country's annual reports on the progress achieved towards national energy efficiency targets (Article 24)
- Starting 2014 and 3 years thereafter, Member States should submit NEEAP containing achieved and expected energy efficiency saving
- The targets should be quantitative and expressed in primary and final energy consumption

## Energiewende in Germany

Germany adopted additional monitoring process at national level. The implementation of policy measures and targets will be examined at regular intervals

## Pan-European project on energy efficiency indicators ODYSSEE

- 28 EU countries and Norway
- Monitor and compare energy efficiency progress by sector
- Evaluate the energy efficiency policy measures in national programs

# Methodology

- Methodology is based on IEA's method of energy consumption decomposition
- Accounts for changing the structure of the economy and business activity over time
- What would energy consumption in Ukraine would be if economy performed at the EU intensities?
- The data availability from SSSU constrained us to calculation of indicators for the following sectors:
  - agriculture
  - mining and 9 manufacturing industries
  - services
  - construction
  - residential sector
  - energy transformation at fossil–fuel power plants (FFPP)



# Energy efficiency index

- The benchmark of the efficiency energy consumption is the correspondent energy intensity in the EU
- Hypothetically efficient consumption - intensity in each sector drops to the EU level
- Hypothetical energy saving  $i$  ( $HES_i$ ) – difference between current ( $E_i$ ) and hypothetically efficient consumption
- Energy efficiency indicator  $i$  ( $I_i$ ) – percent of an effective energy use
$$I_i = \left(1 - \frac{HES_i}{E_i}\right) * 100\%$$
- The energy efficiency benchmark in heating sector varies by region due to the different structure of heating supply

## Major factors affecting energy consumption

- Business activity ( $A$ )– VA in the economy, tonnes of steel in steel industry, population in residential sector.
- Intensity ( $I$ ) – energy use per unit of output
- Structure ( $S$ )– different activity by sub–sector

## Decomposition of energy consumption over time

$\Delta E = E_{2013} - E_{2012} = \Delta A + \Delta S + \Delta I + \varepsilon$ , where

$\varepsilon$  residual term, the magnitude of which depends on decomposition method

Method of decomposition in EFMU 2015 – Log Mean Divisia I (recommended by IEA)

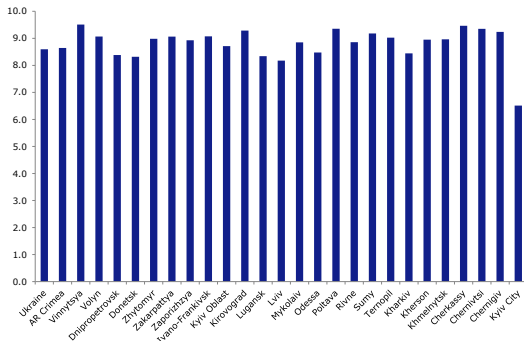
- Strong theoretical soundness
- Only LMDI allows to simultaneously get:
  - 1 ideal decomposition ( $\varepsilon = 0$ )
  - 2 time reversibility
  - 3 additivity by sub–sector





# REEHS: Hypothetical energy efficient consumption for heating and hot water supply by region

**Figure 4:** Hypothetical energy efficient consumption of heating and hot water supply per m<sup>2</sup> of floor area by region, kilograms of oil equivalent (kgoe)



Source: ODYSSEE, Derzhstat and own estimates



**NewSEP**  
New social & economic policy



Table 1: ENERGY EFFICIENCY INDICATORS FOR UKRAINE IN 2013

	TFC and energy transformation at FFPP, ktoe	Energy intensity	Energy efficiency indicator, % of the EU
<b>Ukraine</b>	<b>76,599</b>		<b>59.7</b>
<b>Agriculture</b>	<b>2,242</b>	<b>0.26</b>	<b>43.0</b>
<b>Industry</b>	<b>24,870</b>		<b>63.0</b>
Mining	1,663	0.112	65.7
Manufacturing	23,307		62.8
Food&Tobacco	1,658	0.250	44.0
Textile&Leather	62	0.091	68.4
Wood	194	0.440	40.5
Paper&Printing	280	0.254	129.9
Chemical	1,788	0.915	30.6
Non-metallic minerals	1,534	0.842	52.6
Steel industry*	16,701	0.510	70.3
Machinery	665	0.149	17.9
Transport equipment	454	0.089	40.1
<b>Construction</b>	<b>411</b>	<b>0.042</b>	<b>22.5</b>
<b>Services</b>	<b>5,745</b>	<b>0.051</b>	<b>33.0</b>
<b>Residential</b>	<b>23,495</b>	<b>0.022</b>	<b>53.1</b>
<b>Fossil Fuel Power Plants*</b>	<b>19,871</b>	<b>0.312</b>	<b>66.3</b>

Source: EEMU 2015

Note: \*Intensity in steel industry is measured as energy/tonne of steel and intensity at FFPP is estimated according to Taylor et al. (2008)



**NewSEP**  
New social & economic policy



Table 2: POTENTIAL ENERGY SAVING BY SECTOR IN 2013

Sector	Potential energy saving, mtoe	Share in total saving, %
Residential	11.0	34
Industry	10.0	28
FFPP	6.8	21
Services	3.8	12
Agriculture	1.3	4
Construction	0.4	1
<b>Total</b>	<b>32.3</b>	<b>100%</b>

Source: EEMU 2015

32.3 Mtoe  $\Rightarrow$  39.7 bcm of natural gas<sup>1</sup>  $\Rightarrow$  is close to total natural gas consumption and two times higher than total gas import in 2014



**NewSEP**  
New social & economic policy

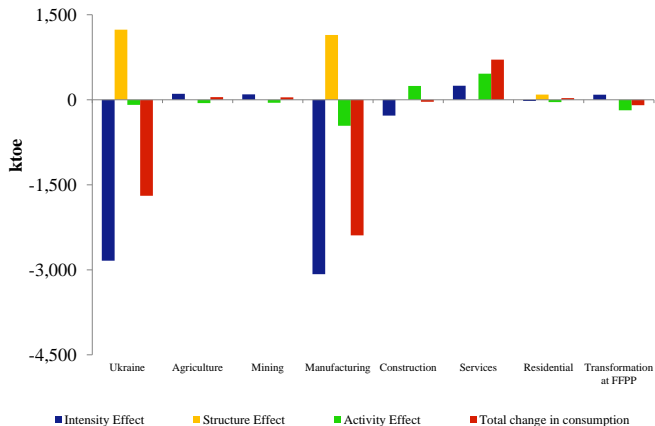
at net calorific value (NCV)



**gef**



Figure 5: DECOMPOSITION OF ENERGY CONSUMPTION CHANGE BY SECTOR IN 2012-2013



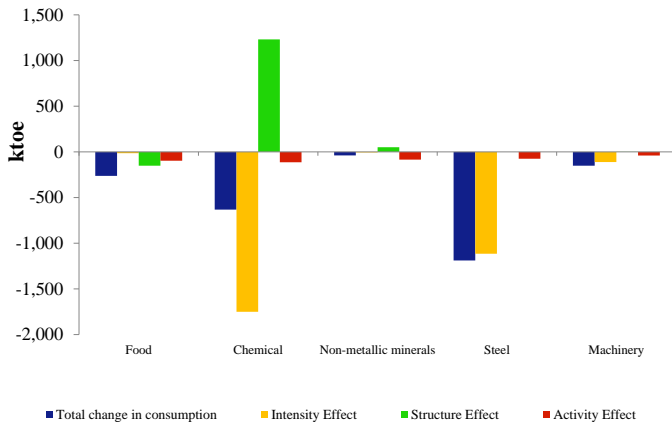
Source: EEMU 2015



**NewSEP**  
New social & economic policy



Figure 6: DECOMPOSITION OF ENERGY CONSUMPTION CHANGE IN INDUSTRY IN 2012-2013



Source: EEMU 2015

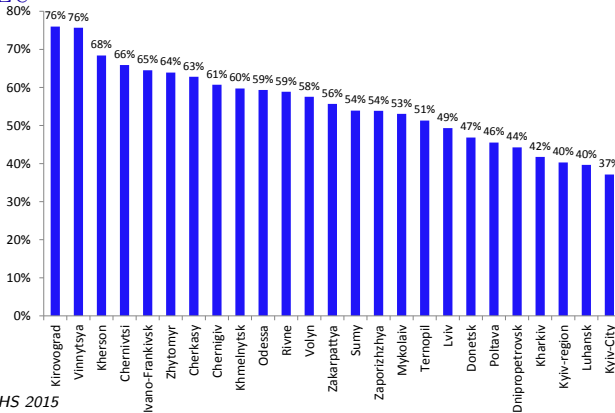


**NewSEP**  
New social & economic policy



# Energy efficiency of residential heating

Figure 7: ENERGY EFFICIENCY OF HEATING AND HOT WATER SUPPLY, % OF THE EU



Source: REEHS 2015

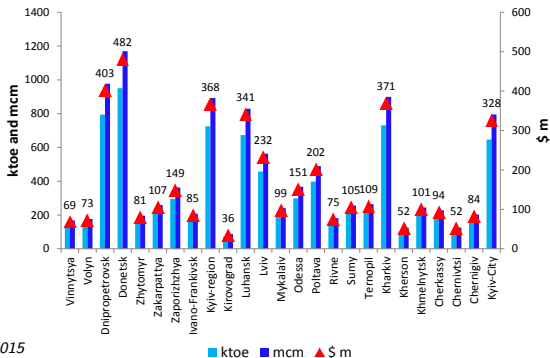


**NewSEP**  
New social & economic policy



# Potential Energy Saving

Figure 8: POTENTIAL ENERGY SAVING AFTER ENERGY EFFICIENCY INCREASE OF HEATING AND HOT WATER SUPPLY UP TO THE EU LEVEL



Source: REEHS 2015

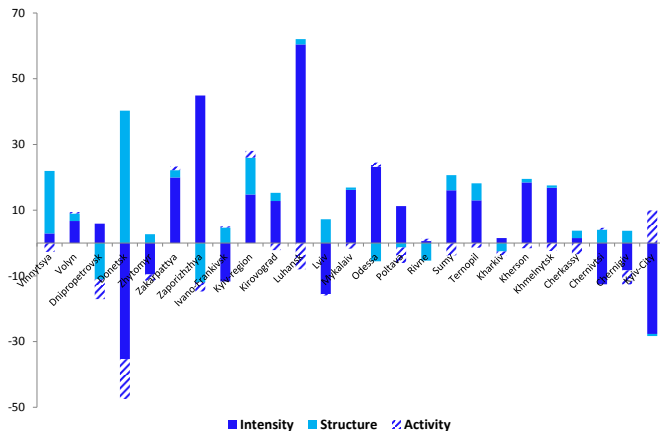
**Potential energy saving – 8.4 mtoe or 10.3 bcm (more than half of import) ⇒ corresponds to \$4.3 bn in 2013 prices**



**NewSEP**  
New social & economic policy



Figure 9: DECOMPOSITION OF ENERGY CONSUMPTION CHANGE IN HEATING SECTOR IN 2012-2013



Source: REEHS 2015



# Conclusion (EEMU)

- In 2013 structure adjusted energy efficiency estimate of Ukrainian economy increased by 1.5% to 57.8% from the EU level
- In 2013 energy efficiency increased in manufacturing and construction while in agriculture, mining and services was documented its decline
- The drivers of energy efficiency improvement were steel and chemical industry
- Potential energy saving – 32.3 mtoe (39 bcm) almost two times higher than natural gas import
- Plans for 2016 – under the support of UNDP in Ukraine continue working on improvement of methodology, collection of new disaggregated energy statistics in transport and residential sector



## Conclusion (REEHS)

- Developed in line with IEA method energy efficiency indicators is a necessary instrument for an increase of the effectiveness of state policy in heating sector
- Average efficiency of heating and hot water supply is 50.7% of the EU level
- Potential energy saving – 8.4 mtoe (equivalent to 10.3 bcm (more than half of total gas import) or \$4.3 bn
- The most efficient regions – Kirovograd, Vinnitsya and Kherson (68–76% of the EU level). The least efficient – Kyiv City, Luhansk and Kyiv Oblast (37–40% of the EU level)
- The least efficient regions have comparatively higher share of district heating ⇒ consumers do not have the opportunity to regulate energy consumption and low level of installed meters (36%) enables district heating suppliers to overstate the amount of energy supplied



## Thank you for attention!

---

---

**Borys Dodonov**

New Social and Economic Policy

Email: [bdodonov@gmail.com](mailto:bdodonov@gmail.com)

Phone: +380 99 501 83 20

---

---



**NewSEP**  
New social & economic policy

