

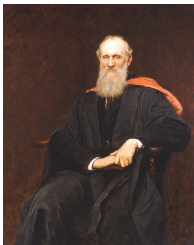
Energy Efficiency Indicators for Ukraine

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Motivation for indicators development



"If you cannot measure it, you cannot improve it."
Lord Kelvin

System Capital Management initiated and financed the project **Ukrainian Energy Index** in 2011-2013. It aimed at developing robust and meaningful energy efficiency indicators for Ukraine at regional level.

Instrument for effective energy policy

- Estimate the potential energy saving after energy efficiency increase
- Set short and long-run energy efficiency targets
- Use for monitoring the progress towards determined targets
- Publication of the results should increase the responsibility and efforts of regional authorities

Government program monitoring

- Report on achievements in National Plan of Actions in 2013
 - Forming the energy efficient behavior of population
 - Improvement in regulation of buildings' energy efficiency
- Update the Energy Strategy till Ukraine till 2030 – refuse from Soviet-style supply-side planning approach
 - Setting short, medium and long-run energy efficiency targets and implementing the monitoring to assess the progress towards them
 - Estimate the effective demand on energy resources by sector and design the effective supply to meet this demand

Methodology of Ukrainian Energy Index

- Methodology is based on IEA's method of energy consumption decomposition
- Accounts for changing the structure of the economy and business activity over time
- The data availability from SSSU constrained us to calculation of indicators for the following sectors and subsectors:
 - agriculture
 - mining and 10 manufacturing industries
 - services
 - construction
 - freight and passenger railway transportation
 - residential sector

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

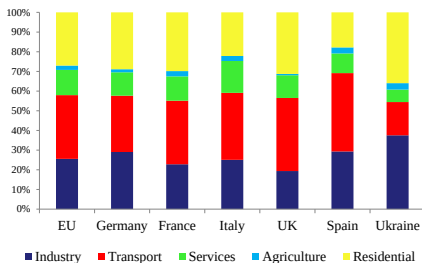
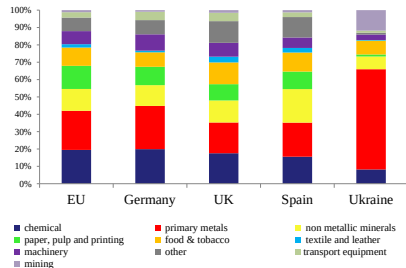


Figure 2: STRUCTURE OF MANUFACTURING ENERGY CONSUMPTION IN UKRAINE AND THE EU



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

$$I_i = \left(1 - \frac{HES_i}{E_i}\right) * 100\%$$

Major factors affecting energy consumption

- Business activity – VA in the economy, population in residential sector, passenger and tonne-kilometers in transportation. VA in steel and cement industries weighted to crude steel and cement production
- Intensity – energy use per unit of output
- Structure – different activity by sub-sector

Decomposition of energy consumption over time

$$\Delta E = E_{2011} - E_{2010} = \Delta A + \Delta S + \Delta I + \varepsilon, \text{ where}$$

ε residual term, the magnitude of which depends on decomposition method

- Method of decomposition in UEI 2013 – 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

Data

- Data on Ukraine – State Statistical Service of Ukraine
- Data on the EU – ODYSSEE data base (28 EU countries + Norway)
- Data for PPP calculation – The World Bank, OECD and ECB

Energy efficiency and real sector growth

- Econometric method – difference-in-difference estimator
- Specification – Rajan and Zingales (*AER* 1998)

$$\begin{aligned}
 growth_{ij} = & constant + \beta_{1...k} * Region\ Dummies + \beta_{k+1...m} * Industry\ Dummies \\
 & + \beta_{m+1} * (Industry's\ j's\ share\ of\ manufacturing\ in\ region\ i\ in\ 2007) \\
 & + \beta_{m+2} * (Efficiency\ of\ industry\ j\ in\ region\ i) \\
 & * (Intensity\ of\ industry\ j\ in\ the\ EU) + u_{ij}, \quad (1)
 \end{aligned}$$

where $growth_{ij}$ – real VA and capital expenditures growth and
 $(Efficiency\ of\ industry\ j\ in\ region\ i) * (Intensity\ of\ industry\ j\ in\ the\ EU)$ – interaction of manufacturing industries i in region j and their intensity in the EU

Table 1: ENERGY EFFICIENCY INDICATORS FOR UKRAINE IN 2011

Sector	Energy intensity in Ukraine	Energy intensity in the EU	Energy efficiency indicator
Ukraine			54%
Agriculture	0.37	0.14	37%
Industry			51%
Mining	0.22	0.10	42.8%
Manufacturing			52.2%
Food&Tobacco	0.38	0.15	39.8%
Textile&Leather	0.17	0.10	57.2%
Wood	0.64	0.18	38.9%
Paper&Printing	0.64	0.18	38.9%
Chemical	1.60	0.29	18.2%
Non-metallic minerals	1.35	0.56	41.2%
Primary metals	1.84	1.16	62.8%
Machinery	0.18	0.03	18.7%
Transport equipment	0.10	0.04	42.5%
Other Industries	0.20	0.17	83.8%
Construction	0.10	0.01	11.3%
Services	0.05	0.02	46.1%
Railways			
Passenger	3.2	8.0	250.0%
Freight	2.13	11.00	515.5%
Residential	0.022	0.014	62%

Table 2: POTENTIAL ENERGY SAVING BY SECTOR IN 2011

Sector	Potential energy saving, mtoe	Share in total saving, %
Industry	12.7	48%
Residential	9,2	35%
Services	2.4	9%
Agriculture	1.5	6%
Construction	0.5	2%
Total	26.5	100%

26.5 mtoe $\Rightarrow$ 29.3 bcm of natural gas (GCV) $\Rightarrow$ is higher than gas import from Russia

Figure 3: DECOMPOSITION OF ENERGY CONSUMPTION CHANGE BY SECTOR

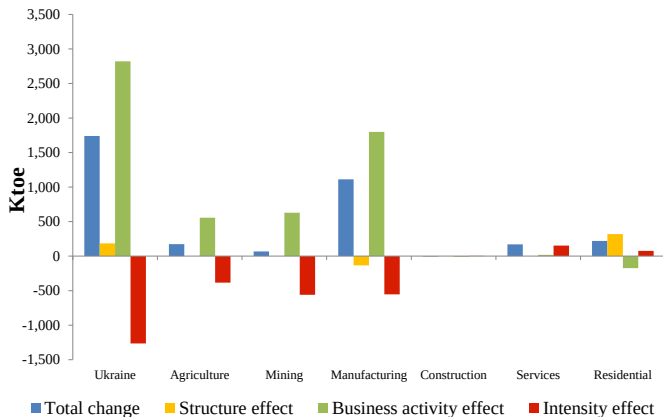


Figure 4: DECOMPOSITION OF ENERGY CONSUMPTION CHANGE IN INDUSTRY

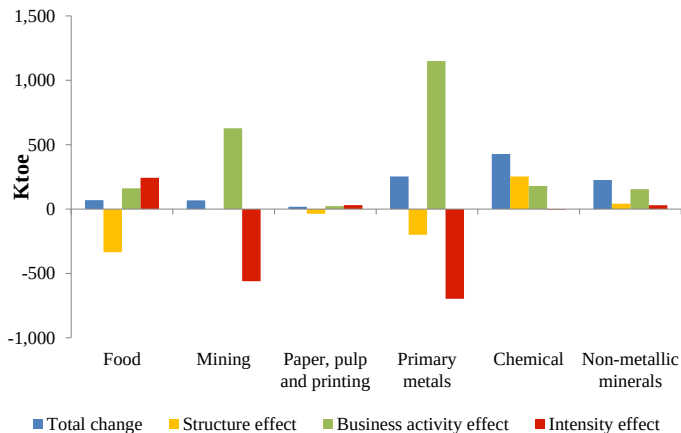


Figure 5: DECOMPOSITION OF ENERGY CONSUMPTION CHANGE IN RAILWAY TRANSPORTATION

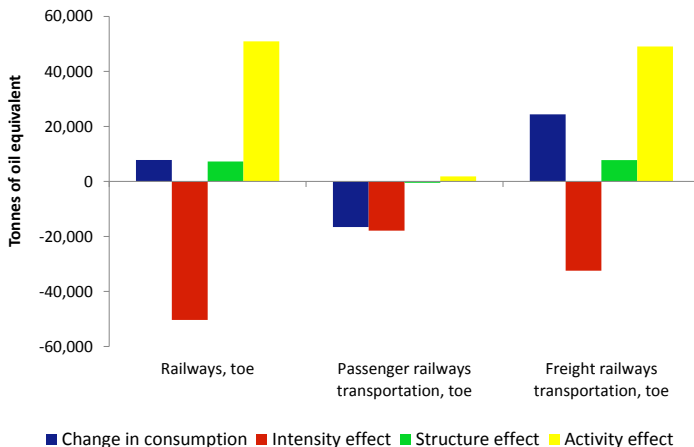


Table 3: ENERGY EFFICIENCY AND GROWTH OF THE REAL SECTOR, AVERAGE GROWTH RATES

Dependent variables – average growth rates of VA and capital expenditures in columns 1 & 2 respectively (logarithmic change) in 2007-2010

	(1)	(2)
Industry j's share of manufacturing in region k in 2007	0.1799 (0.137)	0.5681 (0.364)
Efficiency*Intensity	0.4594** (0.227)	1.6503** (0.705)
Regional effects	YES	YES
Industry effects	YES	YES
R2 Adj	0.212	0.129
# obs	219	170

** denote significance at 5% level of statistical significance

s.e. corrected for heteroscedasticity are presented in parenthesis

Table 4: DIFFERENCE IN ENERGY EFFICIENCY IN DONETSK AND DNEPROPERTOVSK REGIONS AND ENERGY INTENSITY IN THE EU

	Steel	Food
Difference in efficiency	11%	13%
Intensity in the EU	1	0.13

⇒ Steel industry in Donetsk region will grow 5.2% faster than in Dnipropetrovsk region but food industry will grow only 0.8% faster despite bigger difference in energy efficiency

⇒ Differences in capital expenditures growth in steel and food industries due to differences in energy efficiency are 18.6% and 2.8% respectively.

- In 2011 energy efficiency indicator for Ukraine increased by 0.6% compared to 2010 and reached 54.2% from the EU level
- Energy efficiency increased in agriculture, mining and manufacturing while in services and residential sector was reported its decline
- Potential energy saving – 26.5 mtoe (28.3 bcm exceeds the import from Russia)
- Energy efficiency positively affects real sector growth and the effect increases with energy intensity of the industry
- Plans for 2014 – 2015 - improvement of methodology, collection of new disaggregated energy statistics and estimation second level indicators for residential sectors

Contacts

Thank you for attention!

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