

## **ENERGY INTENSITY - A KEY INDICATOR FOR THE ECONOMIC DEVELOPMENT**

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**ABSTRACT:** *Energy intensity represents one of the main indicators for economic development and is expressed as the ratio between the gross inland consumption of energy and gross domestic product (GDP). The least energy-intensive economies in the EU are Denmark, Ireland and the UK. Among the most energy-intensive economies are Bulgaria, Romania, Estonia, the Czech Republic and Slovakia. In socialist times, eastern European Member States had economies with high shares of energy-intensive industries as well as an energy-inefficient infrastructure serving these industries. In this paper we will perform an analyze at Romanian level by comparing the obtained results with the one's at Europe 27 level and we will determine the decouple degree between energy consumption and economic growth.*

**KEY WORDS:** *economic development; GDP; gross inland energy consumption; energy intensity.*

**JEL CLASSIFICATION:** *O10, O13.*

### **1. INTRODUCTION - MAIN TRENDS FOR THE ECONOMIC DEVELOPMENT INDICATORS**

In order to establish the key role that energy intensity has among the others economic development indicators, we will briefly present below their evolution at EU 27 level.

Most of the long-term trends in the socioeconomic development are have been influenced, either positively or negatively, by the recent global economic and financial crisis (Rodrik, 2009). In this respect trends have deteriorated on a short term perspective in investment, employment and unemployment, as well as in real GDP per

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capita and labor productivity. On the other hand, improvements can be noticed in R&D expenditure and energy intensity, and briefly in household saving.

Between 2000 and 2011, real GDP per capita for the EU as a whole grew on average by 0.9 % per year, but wide variations in the growth rate across the EU can be observed. During the good economic period from 2003 to 2007, growth rates rose to 2.7 %, although several eastern European countries grew much faster. However, as a reaction to the economic crisis, GDP per capita stalled in 2008 and fell sharply by -4.6 % in 2009.

Hardest hit by the crisis were the fastest-growing eastern European Member States, including Romania. Slow growth was experienced in the EU as a whole and in most Member States during 2010, although Ireland, Greece, Spain and Romania experienced negative growth.

Between 2000 and 2009, the share of investment in GDP followed the economic cycle, mostly because of business investment. After reaching an extraordinary peak of 21.7 % in 2007, it fell over 2008 and 2009 to a level of 19.4 % mainly due to big reduction in business investment, as a response to the economic crisis.

Regional disparities in GDP in the EU fell from 35.5 % to 32.7 % during the period 2000 to 2007. Together with the reduction of regional disparities in employment it suggests a growing convergence of EU regions. Within-country dispersion of regional GDP remained high, in particular in eastern European Member States, where the rapid transition into market economies has led to an increasingly uneven distribution of wealth.

For most of the period 2000 to 2010, household saving as a share of disposable income in the EU fell steadily; however, it rose slightly in 2008 and considerably in 2009 as a response to the financial crisis. In 2010 the level of household savings fell again, almost to 2004 levels. Differences across Member States still remain significant.

Labor productivity in the EU rose on average by 1.1 % per year between 2000 and 2010. Although it grew by up to 1.7 % or 1.8 % per year in several years, mostly due to eastern European Member States catching up, it started to fall in 2008 and in 2009 dropped by 1.2 %. In 2010 it grew by 1.6 %.

For most of the period between 2000 and 2009, the share of R&D expenditure in GDP remained fairly stable for the EU as a whole at between 1.8 and 1.9 %. In 2008 and 2009 R&D expenditure improved slightly. Romania is still performing bad on this indicator, and measures need to be taken in order to reach a sustained economic development. Between 2000 and 2009 the energy intensity of the EU decreased steadily, in some years by as much as 2.5 %, resulting in an absolute decoupling of gross inland energy consumption from GDP growth. Employment in the EU rose from 66.6 % in 2000 to 70.4 % in 2008, but had fallen back to 68.6 % by 2010. Men, young people and persons with lower education were particularly affected.

## **2. GDP EVOLUTION**

Our first step on the analysis is to present the GDP evolution at Romanian and EU 27 level, and the most appropriate approach is to use the real GDP per capita indicator.

This indicator is a measure of economic activity, namely the value of an economy's total output of goods and services, less intermediate consumption, plus net taxes on products and imports, in a specified period. GDP can be split by output, expenditure or income components. (O'Sullivan & Sheffrin, 2003)

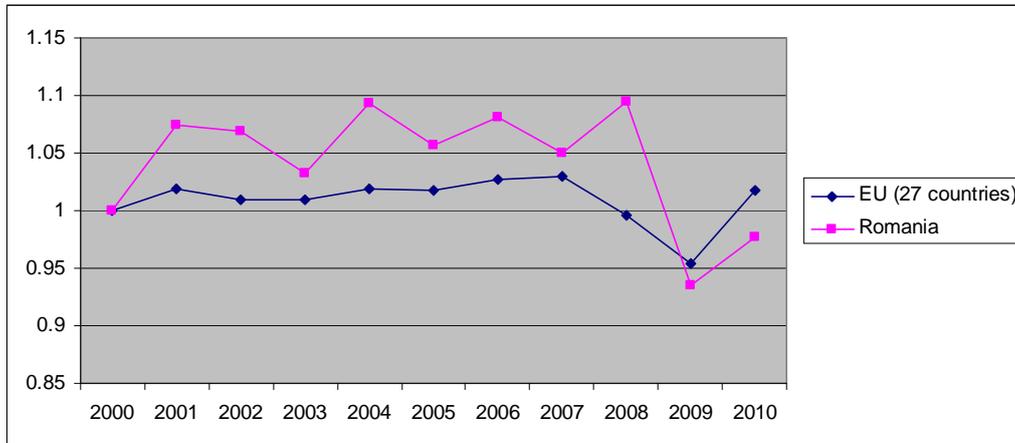
The main expenditure aggregates that make up GDP are household final consumption, government final consumption, gross fixed capital formation, changes in inventories, and net exports, i.e. the difference between imports and exports of goods and services (including intra-EU trade).

Real GDP per capita reflects the amount of goods and services produced by an economy. It is often a proxy for economic prosperity, which is needed to enlarge people's freedoms and provide them with resources to lead satisfying lives. Despite the recent economic crisis, we can say that Europe is living in an age of unprecedented economic prosperity and material affluence. (Castro, 2005). Real gross domestic product (GDP) per capita grew in every year from 2000 to 2007 until the impact of the global economic and financial crisis began to be felt in 2008.

The growth of GDP per capita is a measure of the dynamism of an economy and its capacity to create new jobs. It reflects the phases of the economic cycle. After the economic peak of 2000, GDP per capita grew rather slowly during the economic downturn between 2000 and 2003.

This was followed by a period of higher growth rates until 2007. However, with the onset of the crisis, GDP per capita grew by only 0.1 % in 2008 and fell by -4.6 % in 2009 down to a level similar to that of 2005. GDP per capita grew by 1.6 % in 2010.

Some countries were hit harder by the economic crisis than others. A large slump in per capita GDP occurred especially in high-growth countries dependent on exports (mostly eastern European Member States whose economic output is expected to 'catch up' with that of the more developed Member States). GDP contraction in most western European Member States extended over four or five quarters before growth resumed. The picture has been more varied in eastern European Member States. Particularly affected by the crisis in terms of GDP per capita were Latvia (with the previous GDP per capita growth rate between 2000 and 2007 being 9.4 % on average), Estonia (8.8 %), Ireland (4.1 %), Lithuania (8.1 %) and Finland (3.2 %). However, some eastern European countries (in particular Poland, Bulgaria, Slovakia and Romania) were hit less severely, due in part to lower current account deficits and external debts at the start of the crisis, stricter banking policies, lower dependence on stock exchange performance and exports, more stable domestic demand and modest exchange rate depreciation (in Member States outside the Euro area). A moderate recovery began in 2010 for most EU countries, with the exception of Greece, Ireland, Latvia, Romania and Spain.



Source: Eurostat- Statistic database available at [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database)

**Figure 1. Real GDP per Capita Growth rate in EU 27 and Romania (2000 = 1)**

The figure is more than suggestive, we can see that starting with 2000 until 2008 Romania had a faster growth rate than EU 27, but because of the unsustainable growth and bad policies, Romania was affected more than the EU 27 by the economic crisis.

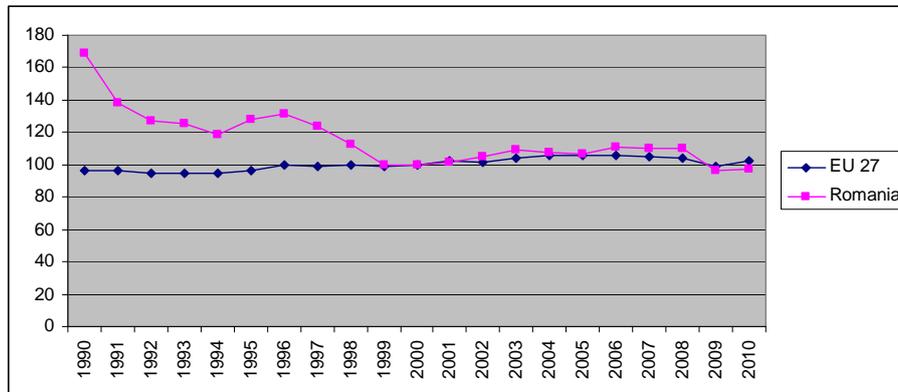
### 3. GROSS INLAND ENERGY CONSUMPTION

Gross Inland energy consumption is the second economic development indicator that needs to be taken into consideration in order to determine the energy intensity.

In this chapter we will perform an analysis at Romanian and EU 27 level, with the main scope to highlight the main trends of this development indicator and to see where our country is situated comparing with the European average. We will analyse for this indicator the period 1990-2010 in order to see how the transition period affected Romania and to highlight the recent trends, including the effect that the growth period and the economic crisis had on the gross inland energy consumption.

As you will notice in the bellow figure (reference year is 2000), Romania had a very intensive energy consumption, and in the first transition year, 1990, the gross inland energy consumption was almost 80% higher comparing with EU 27. In the period 1990-2000, we can obviously notice a decreasing trend for Romania, mainly influenced by the disparition of some industrial activities that consumed lots of resources, but also influenced by the new technologies implemented in order to reduce the energy consumption.

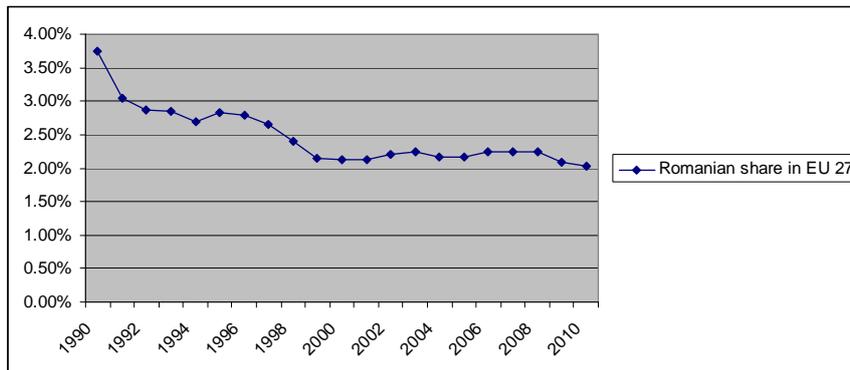
Already, in the period 1999-2000, we can start to see similar trends for both Romania and EU 27 countries.



Source: Eurostat - Statistic database available at [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database)

**Figure 2. Gross inland energy consumption evolution in EU 27 and Romania (2000 = 1)**

The good results that Romania is experiencing on the gross inland energy consumption indicator can be also highlighted by presenting the share of Romanian consumption in the EU 27 total consumption.



Source: Eurostat- Statistic database available at [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database)

**Figure 3. Share of Romanian consumption in the EU 27 total consumption**

#### 4. ENERGY INTENSITY

After presenting in the previous 2 chapters the GDP and the Gross inland energy consumption, it is appropriate to cover the energy intensity topic, that is very close related with the above mentioned indicators.

Total energy intensity is the ratio between the gross inland consumption of energy and the gross domestic product (GDP). Energy consumption comprises the consumption of solid fuels, liquid fuels, gas, nuclear energy, renewable energies, and other fuels.

By measuring how much energy is used to produce one unit of economic output, energy intensity addresses one aspect of eco-efficiency (Abdelgalil & Cohen, 2007). The indicator helps identify whether there is a decoupling between energy consumption and economic growth. Relative decoupling occurs when energy consumption grows at a slower pace than economic growth. Absolute decoupling occurs when energy consumption falls despite economic growth.

The energy intensity of the EU fell significantly between 2000 and 2010. Due to overall GDP growth and a drop in energy consumption over the same period an absolute decoupling has been achieved.

Absolute decoupling of energy consumption from economic growth has been achieved between 2000 and 2010.

Energy intensity is strongly linked to the economic cycle. Thus energy intensity decreased from 1996 to 2000, remained almost constant from 2000 to 2003 and fell again from 2003 to 2010. This is a result of GDP growth slowing faster than gross inland energy consumption during economic downturns.

The overall decline in energy intensity by almost 12 % has been enough to meet the 1 % average yearly reduction target despite only minor improvement during the downturns.

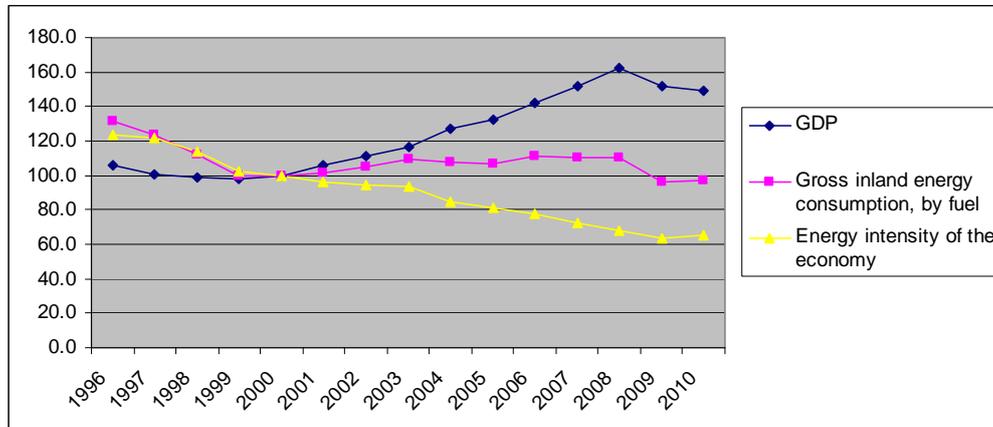
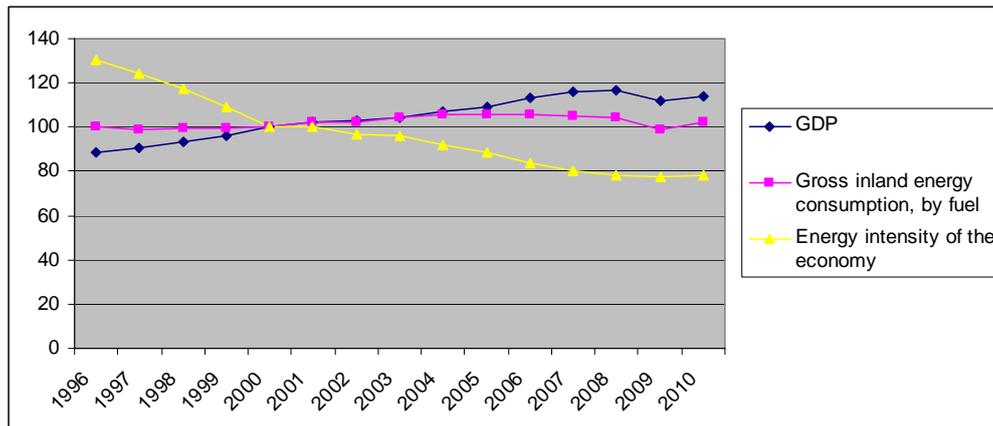
Viewed in more detail, between 1995 and 2000 energy intensity fell by 2.1 % per year on average (GDP grew by 2.9 % per year while gross inland energy consumption increased by 0.7 % per year on average).

Between 2000 and 2010 energy intensity continued to fall, by 1.4 % per year on average (GDP rose by 1.3 % per year and gross inland energy consumption decreased by 0.1 % per year on average).

The least energy-intensive economies in the EU are Denmark, Ireland and the UK. Among the most energy-intensive economies are Bulgaria, Romania, Estonia, the Czech Republic and Slovakia.

In socialist times, eastern European Member States had economies with high shares of energy-intensive industries as well as an energy-inefficient infrastructure serving these industries. They have been undergoing the transition to economies based more on services or higher value-added production as well as the process of industrial modernization.

Bellow we can find 2 figures that are illustrating the evolution of economic intensity and his 2 drivers. From an EU 27 perspective, we can notice good results, and, as stated also above, the level of decouple between the energy intensity evolution and the economic growth is very high, mostly due to idustry modernization and policies applied at european level.

**Romania****EU 27**

Source: Eurostat- Statistic database available at [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database)

**Figure 4. Energy Intensity- Romania and EU 27 (1996-2010)**

In the Romanian case, we can notice also an absolute decouple starting with year 2000, and also we need to highlight the very good achievement of this indicator in the transition period.

## 5. CONCLUSION

As presented in the precedent chapters, one of the best improvements that Romania had considering the main indicators of economic development was in the area of Energy intensity.

To summarize our findings, we can stated that:

- in 1990, the first transition year, the gross inland energy consumption was 80% higher comparing with year base 2000, and the Romanian share in total Europe 27 consumption was almost 4%.

- Between 1990-2000, because of the negative economic growth periods and the diminuation of industry role, we can notice a sharp decrease on inland energy consumption and consequently a decrease considering energy intensity indicator. Comparing with EU 27, we can see a catch-up process and in year 2000 the Romanian share in total Europe 27 consumption was about 2.15%, 1.6% better comparing with year 1990.
- Starting with 2000 until the end of the analyzed period, an absolute decouple is being noticed and the Romanian share in total Europe 27 consumption was constantly staying at a level of around 2-2.2%.

To obtain the desired performances and to accelerate the catch-up process, among this indicator, we need to improve also the other main indicators that are detemining the degree of economic development.

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