# Analysis of Hungarian Energy Sector with Trend Calculation

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## Abstract

*During this decade we have to face some problems such as climatic changes, world financial crisis, new trends in energy sectors. Renewable energy sources can mean one of the solutions to recent financial and economic crisis. It is generally supposed that the green energy can contribute to the recovery of any economy. If we do not invest into renewable energy sources now, we will have to face serious problems in the future.*

*This paper is divided into four sections which are following ones:*

- *Challenges in the new millennium.*
- *Trend calculation in Hungary to analyze the growth of electricity consumption in the long run.*
- *Analysis of economic energy intensification and energy dependency in the EU-27 and in Hungary.*
- *Potential solutions to the problems mentioned above.*

**Keywords:** energy dependency, trend, renewable energy sources, green energy, sustainable economic growth

**JEL Classification:** Q4

## 1. Introduction

This paper is about the Hungarian energy sector, such as energy dependency, inadequate energy efficiency and the review of Hungarian electricity consumption. Why is the participation of renewable energy sources so low in Hungary? Which are the necessary measures?

## 2. Challenges in the new Millennium

*R.E. Smalley* – Nobel laureate – in the essay titled „The terawatt challenge”, published in December 2004, named the most critical problems the world have to confront, as we go through this century. The problem of energy has always been preeminent. When we have a look at the prioritized list of the top 10 problems, we can realize that energy seems to be the key to solve the remaining problems – ranging from water to population:

1. Energy
2. Water
3. Food
4. Environment
5. Poverty
6. Terrorism and war
7. Diseases

8. Education
9. Democracy
10. Population [5]

At the same time, the fact is also admitted in business circles that recent problems of the world is not allowed only from economics view examine. According to the "Global risks 2008" – published by World Economic Forum in 2008 – the most important risks of the world economy are the following ones:

1. Economics (6 risks)
    a. Rising and volatile prices globally create significant shortage of poor consumers (those people whose consumption basket contains more than 50% food)
    b. Oil or gas prices rise steeply due to major supply disruption (decreased global supply -by 10%- for several months)
    c. An abrupt, major fall in the value of the US$ with impacts throughout the financial system
    d. Domestic social/political issues combined to reduce Chinese growth to 6% or lower (sustained slower growth)
    e. Declining fiscal positions force multiple governments of wealthy countries to raise taxes, leading to economic stagnation
    f. House and other asset prices collapse in the US, UK, and Europe significantly reducing consumer spending and creating a recession
2. Geopolitics (12 risks)
3. Environment (7 risks)
4. Society (4 risks)
5. Technology (2 risks) [6]

It is interesting to observe that only 6 risks out of the 31 are economic ones, the others are in connection with environment and geopolitics. *Robert Socolow* és *Stephen Pacala (Socolow, 2004)* – professors in Princeton, USA – offer 15 solution facilities to the governments of the world which are separately and jointly suitable to reach global goals. According to Worldwatch Institute the main question is what combination of strategies can result in the lowest costs, and at the same time can have healthy, safe and durable effects.

## 3. Trend calculation of electricity consumption in Hungary in the long run

Not only the world, but Hungary has to face some challenges as well. Either of them is the downturn caused by world financial crisis, the other one is that we have to cope with our energy dependency. To solve the problems, first of all, we have to recognize the essence and the origin of the problems. I advisedly carried out the following examinations.

Firstly, I clarified the meaning of the word of trend, how I can use it to forecast the electricity consumption. After that I chose the 1973-2007 period. I prepared the linear and exponential trend line with the $\Sigma t=0$; $t=1,2,..,n$ methods. At the end I made the method of least squares to select the best.

Henceforth I review the parameters of the trend. "The basic underlying movement over an extended period of time is called the secular trend. Over long periods of time, there are usually changes in economic and sociological factors that bring about changing values in time series. Increases in population cause some time series to have long-term growth. A long-term increase in productivity in agriculture has caused the number of people employed in agriculture to have a long-term decline. A newly introduced product may experience a long-term pattern of early rapid growth, then stability, and finally decline.

If a time series exhibits a pattern of long-term change, judgment usually requires this secular trend to be incorporated in a forecast. Many forecasts are based primarily on trend; if a time series shows seasonal variation, a combination of trend and seasonal factors may lead to a very useful forecast.” [1]

**1. Table: The trend analysis to 1973-2007**

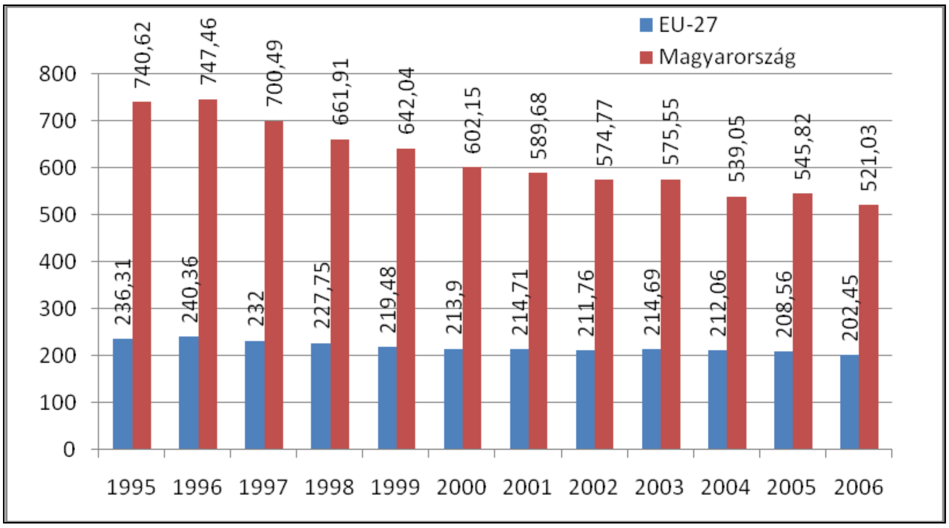
| Time of analysis: 1973-2007 | Time of analysis: 1973-2007 |
|---|---|
| Name of method: Linear trend line analysis | Name of method: Exponential trend line analysis |
| y=Hungarian gross electricity consumption (Gwh)<br>Σt=0 method<br>Σy=1.166.540<br>Σty=3.011.404<br>$\Sigma t^2$=13.090<br>n=35<br>Σt=0 | y=Hungarian gross electricity consumption (Gwh)<br>Σt=0 method<br>Σlgy=158,0855<br>Σtlgy=42,62653<br>$\Sigma t^2$=13.090<br>n=35<br>Σt=0 |
| $\Sigma y=b_0*n+b_1*\Sigma t$<br>$\Sigma ty= b_0*\Sigma t+ b_1*\Sigma t^2$<br>1.166.540= $b_0$*35<br>22.552.517= $b_1$*13.090<br>$b_0$=33.329,71<br>$b_1$=230,05 | $\Sigma lgy=b_0*n+b_1*\Sigma t$<br>$\Sigma tlgy= b_0*\Sigma t+ b_1*\Sigma t^2$<br>158,0855= $b_0$*35<br>42,62653= $b_1$*13.090<br>$b_0$=4,5167<br>$b_1$=0,00326<br>$a=10^{4,5167}$=32.862,45<br>$b=10^{0,00326}$=1,00753 |
| $\hat{y}_t=b_0+b_1*t$<br>$\hat{y}$=33.329,71+230,05*t | $\hat{y}=a*b^t$<br>$\hat{y}=32.862,45*1,00753^t$ |
| According to the linear trend line the Hungarian gross electricity consumption increased by 230,05 Gwh average, every year in the period of 1973-2007 and in the examined term the gross electricity consumption is 33.329,71 Gwh. | According to the exponential trend line the Hungarian gross electricity consumption increased by 1,00753 Gwh average, every year in the period of 1973-2007. |
| Using the method of least squares:<br>$\Sigma(y-\hat{y})^2$=262.911.047,5 | Using the method of least squares:<br>$\Sigma(y-\hat{y})^2$=305.892.468,3 |
| Explanation:<br>y= Hungarian gross electricity consumption (Gwh)<br>t: time<br>$b_0$: value of standard line in the time of t=0<br>$b_1$: the annual absolute growth rate, it can sign rise or drop in the examined period | Explanation:<br>y= Hungarian gross electricity consumption (Gwh)<br>t: time<br>$b_0$: value of standard line in the time of t=0. If Σt=0, and there is no t=0 date, in that case $b_0$ parameter is the geometric average of the period items.<br>$b_1$: the annual relative growth rate |

*Source: Data of Hungarian Power Companies Ltd., own construction 2009.*

According to the linear trend line the gross electricity consumption (Gwh) in Hungary increased by 230,05 Gwh on average every year in the examined period (1973-2007) and in the examined period the consumption was 33.329,71 Gwh on average every year. According to the exponential trend line the Hungarian gross electricity consumption (Gwh) 0,753 is the fitted annual growth.

## 4. Analysis of economic energy intensification and energy dependency in the EU-27 and in Hungary

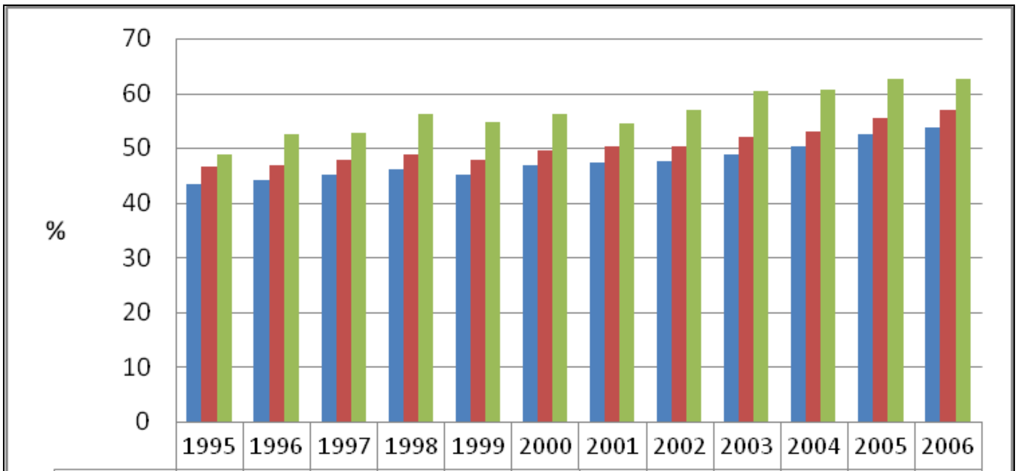
Then I compared the average energy intensification of the EU-27 to Hungary's. It shows how much domestic energy consumption is compared with the Hungarian GDP which says how much energy is needed to generate 1000-Euro GDP. Although, the situation is constantly changing for better, the Hungarian energy claim is still much higher than in the EU on average.




**1. Figure: Gross inland consumption of energy divided by GDP (kilogram of oil equivalent per 1000 Euro) 1995-2006**

*Source: Eurostat, own construction 2009.*

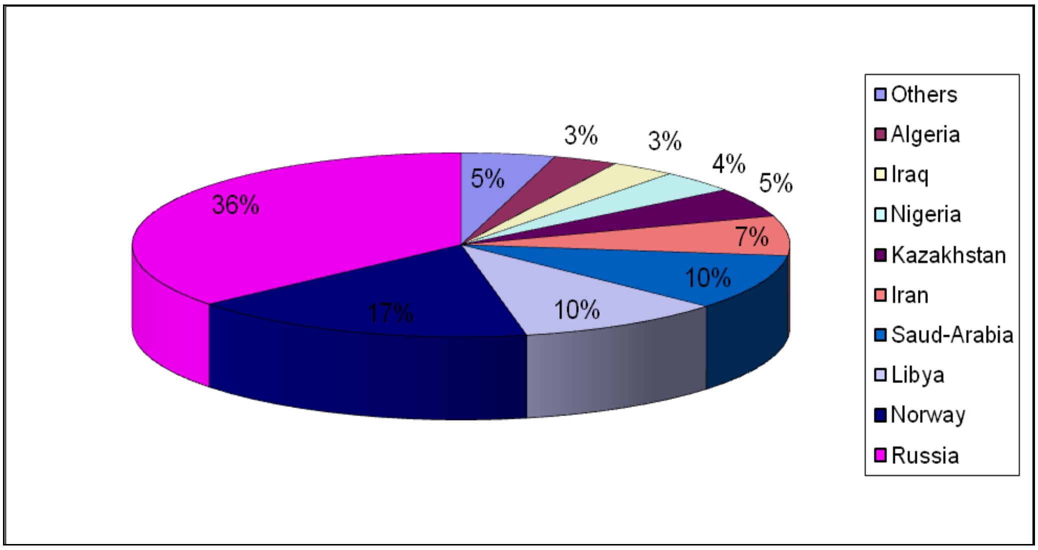
After the previous analysis, I have concluded to an efficiency factor which shows the increase of GDP and electricity consumption which shows the results of GDP's and electricity consumption's rise. It means that 1 percent GDP-growth results in 1/0,75=1,33 percent plus electricity consumption (between 1973 and 2007 the electricity consumption increased by 0,75 percent per year in Hungary). According to the data provided by Hungarian Power Companies Ltd. in the EU-27, this flexible factor is about 0,5-0,6. It means that the Hungarian energy efficiency is less than 50% of the EU-average. It is a very critical situation because Hungarian energy import is rather one-sided.



| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EU-27 | 43,5 | 44,1 | 45 | 46,1 | 45,2 | 46,8 | 47,4 | 47,6 | 48,9 | 50,3 | 52,6 | 53,8 |
| Eu-15 | 46,7 | 46,8 | 47,8 | 48,9 | 47,8 | 49,6 | 50,3 | 50,4 | 51,9 | 53,1 | 55,5 | 56,9 |
| Hungary | 48,9 | 52,6 | 52,8 | 56,1 | 54,7 | 56,1 | 54,5 | 57 | 60,4 | 60,6 | 62,6 | 62,5 |

**2. Figure: Energy dependency of the EU 1995-2006 (%)**
*Source: Eurostat, own construction 2009.*

Hungary's energy dependency rate exceeds the average 8,7 percentage point in the EU, and what is more, the diversification of energy import structure is practically 0. Hungary has to import 99,5 percent of petroleum, and 100 percent of natural gas from Russia. It increases the defencelessness of the energy sector and economy in Hungary, because Ukraine – as transit country – is unreliable.




**3. Figure: The oil import of EU-27 by countries in 2006**
*Source: Eurostat – Eurostat Yearbook 2008, own construction 2009.*

The situation in the EU is much better regarding its energy import diversification than in Hungary. Examining the EU-27, it can be realized that the first partner in the petroleum and natural gas import is Russia, the second is Norway, and only after them the OPEC-members are listed. Not only in Hungary, but in the EU-27 it is a necessary measure to increase energy efficiency and to utilize own resources. Hungary can decrease its dependency if greater part of renewable energy sources is enhanced.

## 5. Potential solutions to the problems mentioned above

The prevalent opinion is that green energy may be the solution to the crisis. Formerly I made the SWOT-analysis on renewable energy sources which clarified that they have more advantages than disadvantages. Their use can decrease energy and import dependency, and may contribute to have positive foreign trade balance and to realize sustainable economic growth. They can generate higher local income, spread of environmental friendly technologies, drop in unemployment. The duration of renewable energy based equipment is longer; and great innovation, research and development characterize this infant industry.

A lot of problems can arise when the proportion of renewable energy sources increases. It is very typical that a lot of studies and strategies on the topic can be reached in Hungary (Renewable Energy Strategy, Energy Efficiency Action Plan, National Sustainable Development Strategy), but phasing is not enough in the decision of special authorities. (A very serious problem that nowadays 8 authorities operate side by side, at the same time there is no common leadership of these authorities)

The Hungarian supports can be reached only in very fragmentary, so – in contrast with the systems in America and Portugal – it is not eligible to efficiently increase the proportion of renewable energy sources. A new supporting system should be established to reach “real green revolution”. To utilize renewable energy sources needs not only money and new equipment but we have to change our attitude to life. Thinking in system and active action should be taken. The lack of them causes Hungary to take the risk of lagging behind other nations in the regional competition.

An outbreak point can be a cluster which would clamp the authorities and companies across the border in the Carpathian Basin. A stable law system and an unambiguous framework should be established. Calculable market terms would be necessary, stability in field of purchasing price (“KÁT”-system), and simplification of the loan system. The allowance process should be shorter and less complicated – for example nowadays more than 20 permissions are necessary for a wind turbine.

In public procurement that producer should be favored who uses green energy in production. Nowadays only the prices are taken into account, but it can happen that in the long run more expensive solution is more economic. In public procurement two rounds would be necessary. Only professional aspects would be adverted in the first round, and occurs the price should be taken into account only in the second round.

Not only biomass, but other renewable energy sources should be utilized in Hungary. There is huge potential in water and geothermal energy. Unfortunately, the utilization of biomass is supposed to be dangerous all over the world. For example, energy grass is said to be aggressive, very heavily controllable so those fields where energy grass is planted, can not be integrated back into traditional utilization. The production of biomass has little energy density so it needs big field and serious logistic performance. It can happen that logistic actions cause irreversible damage so the advantages provided by it can disappear.

According to exporters the elimination of untouched natural fields and put into biomass production cause higher level of carbon-dioxide.

Some renewable energy technologies are criticised for being intermittent or unpredictable, yet the market is growing for many forms of renewable energy. Concerns about climate changes concerns combined with high oil prices, peak oil and increasing government support are driving for the need of increasing renewable energy legislation, incentives and commercialization.

The advantage of renewable energy sources includes their inability to produce carbon-based warming and to emit polluting agents into the atmosphere. The financial cost of their application is not always cheap but if the environmental costs of using fossil fuels are accounted, renewable energy wins hands-down. There is also indirect savings in the health care system, as they have no harmful emission. By using renewable energy sources we can reduce our energy dependency, and they can also contribute to positive foreign trade balance and sustainable development. They can generate local revenues and cut in unemployment rate. These power plants can operate for few decades.

My opinion is that not only money, but a new view/way of thinking is necessary in application of renewable energy sources. Renewable energy can mean a chance not only for Hungary, but for the whole world as well.

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