

# ANALYSIS ON WORLD ENERGY RESERVES AND BIOMASS FUEL SOLUTION

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**ABSTRACT** - This paper presents some aspects regarding the potential of biomass for producing alternative fuels in the context of a rising energy demand. Fossil fuels account for 77% of the increase in world primary energy demand in 2007-2030, with oil demand rising from 85 mb/d in 2008 to 88 mb/d in 2015 & 105 mb/d in 2030. Currently the world's fuel and chemical production is based on petroleum crude oil. As the oil barrel price raises, the production of alternative fuels and the exploitation of the biomass reserves are viable.

## INTRODUCTION

Throughout the history the mankind needed energy to survive and evolve. In the beginning, biomass (firewood) was the primary and only source of energy providing the basic needs such as heat for cooking and warming and light. From the late XIX<sup>th</sup> century, once with the industrial revolution, new sources of energy were found and the world energy consumption started to grow drastically. Today the main energy resources can be divided in two main categories: nonrenewable and renewable. The nonrenewable resources are any type or resources that cannot grow, generate, or be produced at a rate that can sustain the exploitation rate. This type of resources is represented by fossil fuels (oil, natural gas and coal) and nuclear energy. A renewable resource can be any resource that can grow, generate or be produced faster than its rate of exploitation. The renewable resources are represented by wind and hydro power, geothermal but also by Sun. Also biomass is considered a renewable resource if is harvested in a sustainable manner.

Today almost half of the energy consumption is sustained by oil and, together with the rest of the non renewable resources, it covers almost all the world consumption. It is well known that the fossil resources are a finite and pollutant source of energy. To stop the global warming effect and to provide continuity after the fossil fuels depletion it is important to discover and exploit new alternative resources in a sustainable manner. In this sense, it is important to have a good estimate of the world energy production in conjunction with demand and available stocks. Also it is important to take into account the amount of energy produced by alternative resources.

## WORLDWIDE ENERGY PRODUCTION AND DEPLETION

Until 2008, after several years of rapid growing, due to the global recession the oil prices began to fall. Soon, the prices for natural gas followed. For the first time, since the Second World War, the whole countries economies began to contract, this leading to lower mondial

energy consumption. After the recession period we are dealing now with a recovery period which is also reflected in a stabilization of the supply and prices of energy. Figure 1 depicts the variation of oil barrel price from 1970 until now.

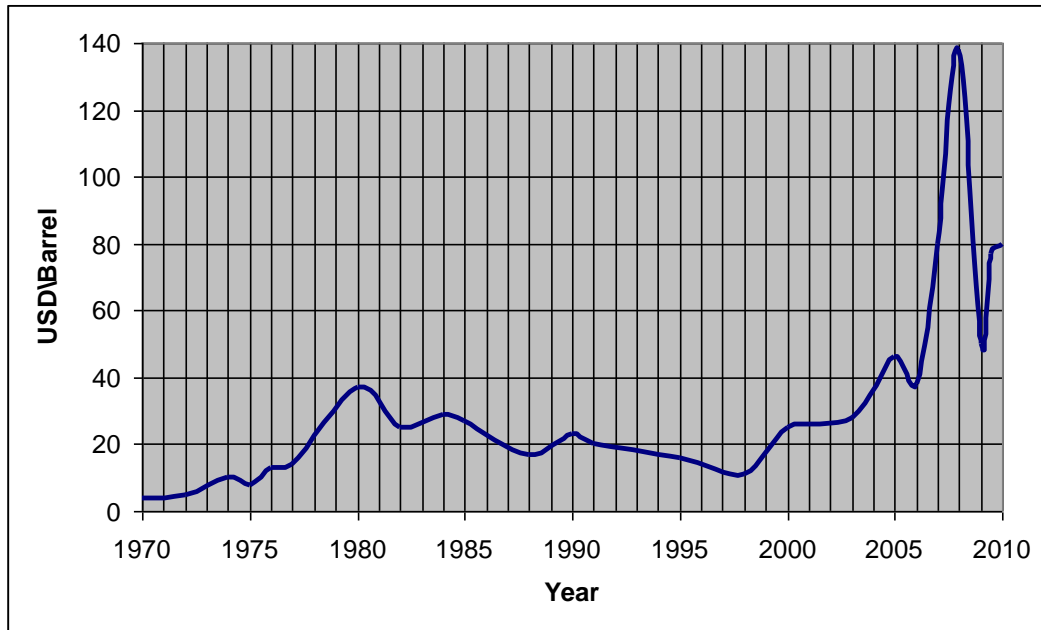


Figure 1 Oil barrel price.

The worldwide energy supply is ensured by five main sources. These are oil, natural gas, coal, nuclear and hydroenergy. According to BP Statistical Review of World Energy 2010, from a total energy content of 11102,7 MTOE, about 87,8% is represented by fossil fuels (oil, natural gas and coal) and from this, one third is represented by oil. As it can be seen from figure 2, in the last 5 years the oil consumption stabilized at about 3900 MT but with natural gas and coal consumption growing rapidly. The only so called “green” energy, represented by hydropower grew almost 25% in the last 10 years, reaching 740 MTOE in 2009.

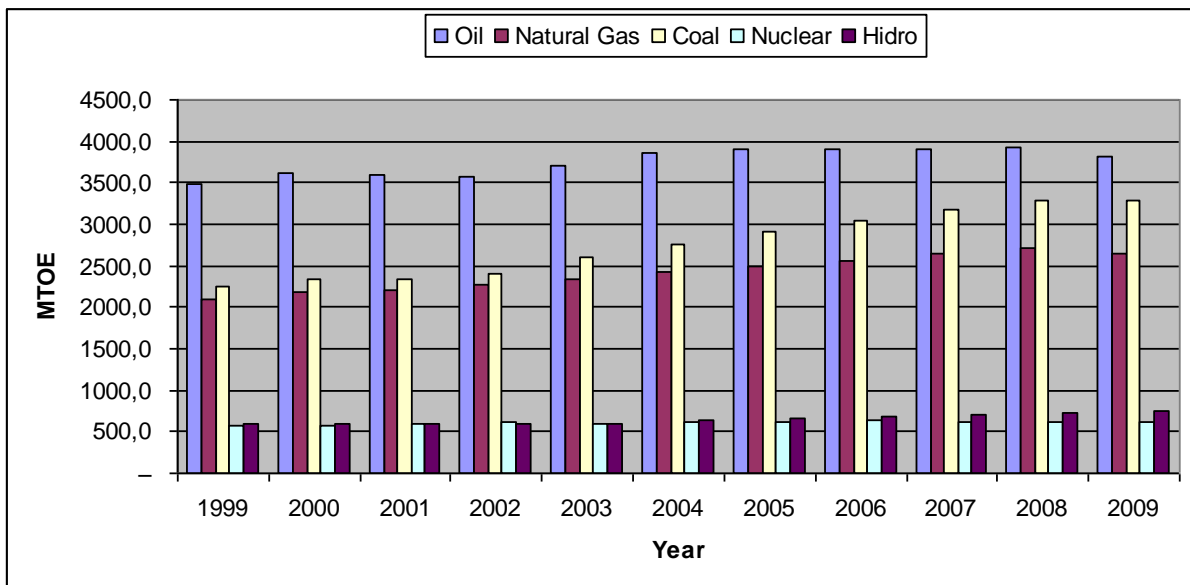


Figure 2 Yearly consumption of the main energy sources.

There is a concern regarding the energy production and consumption rates regarding not only about the air pollution but also about the depletion times. It is known that the fossil and also nuclear fuels are finite. During the years, several models, some pessimistic others optimistic were made taking account the proved reserves and yearly consumption. The fact is that the variables such as the world recession and the rate of finding new deposits cannot be predicted with high accuracy.

In number 6/2004, National Geographic published a study regarding the depletion time of oil reserves for the major oil exporters. The chart adapted from National Geographic is showing that by the middle of year 2057 all oil reserves will be depleted. The study is made at a depletion rate of 23300 Million Barrels per year.

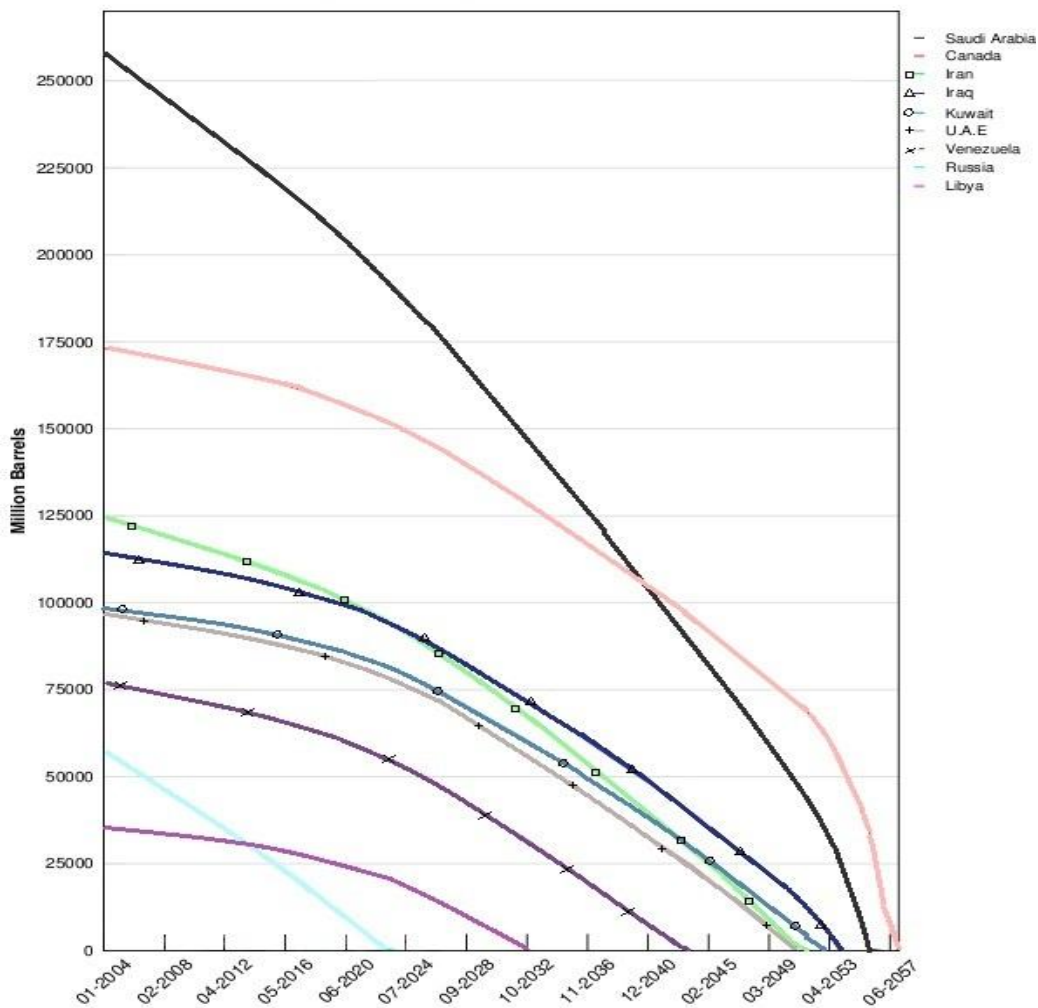


Figure 3 Estimated oil depletion time.

A more recent study, released by BP, stated that, at the 2009 extraction rate, the remaining oil reserves will completely end by year 2056, remaining natural gas reserves will end by 2073 and coal in 2129.

## ALTERNATIVE ENERGY SOLUTION

Using renewable energy instead of fossil fuels can create certain advantages such as:

- reduction in emission of greenhouse gases and other pollutants;
- improving the security of supply by boosting diversification of energy production;
- creation of new jobs and businesses.

For stopping the global warming phenomenon and lowering the dependency of fossil fuels, EU adopted in April 2009 the Renewable Energy Directive 2009/28/EC that sets mandatory national targets consistent with a 20% share of energy from renewable sources and a 10% share of energy from renewable sources in transport by 2020. It also requires for each Member State to provide an action plan, following a common template, for implementing the renewable resources. In 2009 it was released the State of Renewable Energies in Europe by EurObserver that shows significant grows in 2008 compared with 2007 in the output of all alternative energy sectors across Europe. The report takes account of energies in the sector of Wind power, photovoltaic, solar thermal, small hydropower, geothermal energy, ground source heat pumps, biogas, biofuels, urban waste, solid biomass, solar thermal electricity and ocean energy.

Table 1 EU alternative energy production.

<b>Energy Type</b>	<b>2007</b>	<b>2008</b>	<b>Unit</b>
<b>Wind Power</b>	56681	65247	MW
<b>Photovoltaic</b>	1833	4747	MWc
<b>Solar thermal</b>	2093	3172	MWth
<b>Biogas</b>	7.22	7.54	MTOE
<b>Biofuels</b>	7.96	10.47	MTOE
<b>Urban Waste</b>	6.61	6.8	MTOE
<b>Biomass</b>	67.18	70.29	MTOE

In 2008, the total share of alternative energy in the EU gross consumption was 8.2% with Romania having a 13.5% of use of alternative energy. The share of alternative energy use for EU member states is planned to be 20% by 2020. This number is achievable due to the fact that that there is still progress to be made in this domain.

### BIOMASS

Biomass is represented by the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fractions of industrial and municipal waste. Examples of biomass are given by trees, agricultural crops, algae, agricultural and forest residues, manure, sewage sludge, industrial organic byproducts and municipal solid waste. As an energy source, biomass has the following advantages:

- it can be converted into a wide variety of products (gaseous, liquid and solid, for use in spark and compression ignition engines as well as power plants);
- biomass is available in a range of forms all over the world including Europe and Romania;
- it does not contribute to the CO<sub>2</sub> emissions;
- technologies for exploiting its potential are available and improving rapidly.

As seen in table 1, the biomass sector in EU countries is the main alternative energy producer. In 2008 there was a 4.6% grow of energy production from biomass. The main users of

biomass are represented by the Northern Europe and Baltic countries, and Romania is the 9<sup>th</sup> EU country producer of biomass energy. Although Romania produced in 2008 a considerable amount of energy from biomass, 3.75 MTOE the country's potential is huge. The biomass energetic potential is evaluated at about 7.5 MTOE/year; this could substitute about 75% of Romania's oil consumption.

The biomass categories used for energy conversion can be divided into:

- wood: 1175 kTOE;
- wood waste products: 487 kTOE;
- agricultural waste products: 4799 kTOE;
- biodegradable biomass waste: 588 kTOE;
- urban human waste: 545 kTOE.

If the biomass resources are fully harvested, several pathways for the generated energy can be taken using today's technologies and intelligent investments. Some of the available directions are:

- substitution of heavy oils with wood briquettes in industrial applications (eg. Burners, boilers, steam generators);
- production of heat and electricity in Combined Heat and Power Plants (CHP), in areas of small towns or villages;
- production of methane or synthetic fuels in conversion facilities, fuels that could substitute fossil fuels.

## CONCLUSIONS

Due to the decreasing of the worldwide hydrocarbon reserves the shares of alternative energy sources in global energy consumption are growing with each year.

Already the existing alternative energy power plants are proving the feasibility of the technologies employed but for further expansion regional supports it is needed. For EU Member Countries, directives such as 2003/30/EC and 2009/28/EC are supporting the use of alternative energy by setting targets from the total energy consumption. The target set for 2020 is 20% of alternative energy use.

By using and increasing the share of alternative energy, the depletion rate of fossil fuels can be diminished thus, in the gained time, the existent technologies can be optimized, and new solution can be found, the final aim being the independency of fossil fuels.

Romania's biomass potential is huge, together with the development of other alternative energy sources, all the country's energy needs could be assured.

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