

# SCENARIOS ON THE IMPACT OF THE ENERGY SECTOR IN THE GLOBAL ECONOMY

RADU Dragoș Mircea<sup>1</sup>

“Lucian Blaga” University of Sibiu, Romania

---

## **Abstract**

*Forecasting scenarios are powerful tools used by companies, institutions, and governments in order to coordinate development strategies in the short, medium and long-term. These development scenarios are not only any linear expansion analyzes of the possibilities of evolution, but their complexity can anticipate future developments in different situations of currently existing plans. Because of the many variables that underlie these scenarios, there are always two or more scenarios, sometimes totally different one from another, so that the companies, institutions and governments to consider them in light of subsequent developments and based on them, to create their own flexible strategies of impact. Developing scenarios upon the possible evolution of phenomena or given situation requires explicit assumption evolving conditions and external inputs assumed. This approach can become a very effective tool, addressing the strategies that companies, institutions and governments will develop to face adversity and to take advantage of new opportunities that arise.*

## **Keywords:**

## **JEL classification:**

---

## **1. Introduction**

Companies specialized in providing and processing information try to find the most suitable models of developing different fields of human activity . Elsevier B.V. Thomson Scientific Inc., IHS Inc. or John Wiley & Sons Inc. are just a few of the giants in the field.

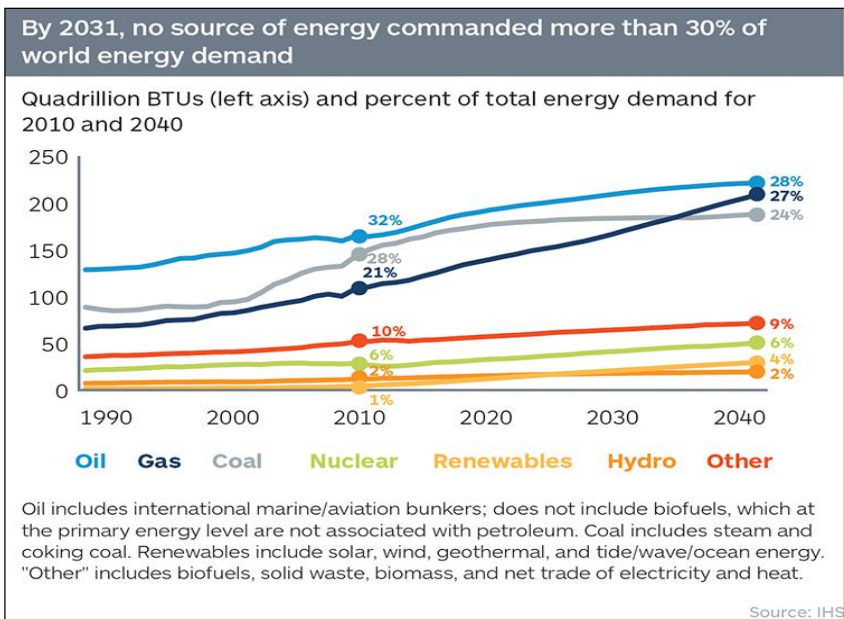
---

<sup>1</sup> Ph.D. Student, Faculty of Economic Sciences, “Lucian Blaga” University of Sibiu  
email: dragosmradu@yahoo.co.uk

One of the most relevant companies in the information and processing as forecasted scenarios namely IHS Inc. launched in September 2014 a comprehensive study on energy resources. The study provides three major variants of energy resource development scenario: rivalry, autonomy and instability (the vortex).

## 2. Rivalry of energetic sources

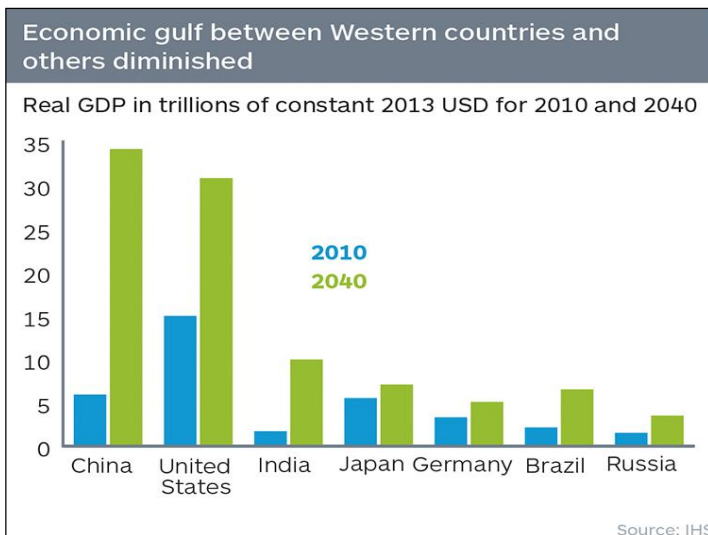
Rivalry in the context promoted by IHS study implies the existence of global competition between energy resources. This competition does not refer only to oil resources, but to all types of resources such as gas, coal, electricity, nuclear energy, unconventional or renewable energy. The rivalry is quantified to express itself in specific ways, depending on the degree of implementation of scientific and technological discoveries arisen in the industry. In this study it is expected that by 2031 no type of energy resource to have a share of more than 30% of global energy consumption.



Oil and coal demand over the past four years was diminished by the high price of these resources, which led towards a continuous diversification of the

alternative energy resources, as gas, electricity and renewable energy. This was not so much because of the oil depletion awareness but of the possibility of making investments in order to develop alternative and renewable resources and government policies of the industrialized countries in order to reduce the energy dependence. The increase of natural gas consumption by using it as fuel in the transport industry will reduce oil consumption. Rivalry among energy resources is not given only by competition between the energy generated by the oil and electricity, but a competition between energy and other energy resources related to the fossil fuel generated by the alternative sources. According to the forecast issued by IHS scenario, the energy generated by the energy sources based on fossil fuels will fall below 25% of global primary energy by the year 2040. Thus, consumers will have the possibility to choose the type of energy by optimizing costs energy.

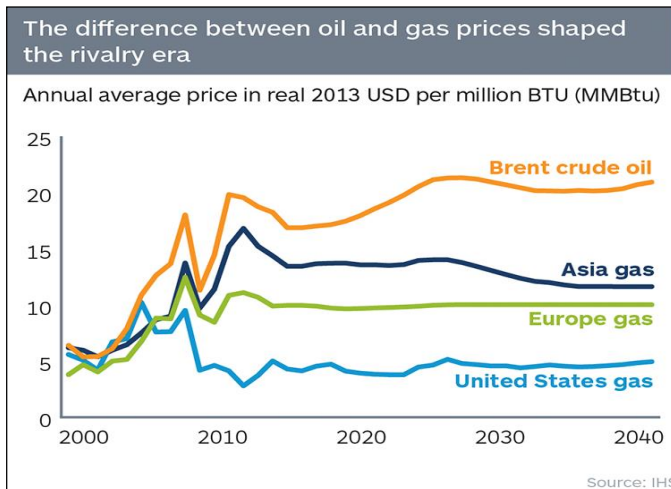
Rivalry among energy resources according to the same scenario could escalate the geopolitical and economic rivalry. The economic gap between developed countries, including those belonging to so - called BRICS group and the rest of the other countries will probably deepen up, reaching alarming levels. The economies of China, US and India will be in the top of economic growth, according to the same source, IHS scenario.



In this era of rivalries, the world might come very close to an irrevocable global disorder. In the opinion of the IHS, this period will be characterized by exacerbating differences, fuelled by national pride, prestige and historical grievances. The world economy will become more decentralized while trade imbalances, both military and political will power rivalry. During this period, the world economy will manage to grow up to an average annual rate of just over 3%, but the economic crisis will finally overcome the period.

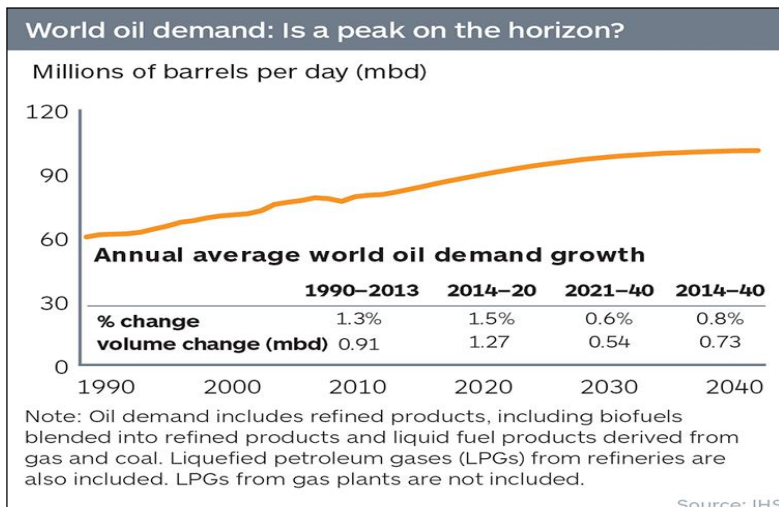
According to an identical scenario, as a force of change, the competition will be the one that will generate new economic relationships or they will enhance the existing ones. Gas supply agreement between Russia and China signed in 2014 and also the penetration of Saudi Arabia on the solar market are some indications of the subject. The encouragement of governmental policy of some European countries carried out to promote the production of unconventional oil and gas, due to the lack of competitiveness among national economies in relation with the US economy of energy costs, and also, due to the fact that energy resources possession enhances security.

If we consider the same scenario, the natural gas price will justify the transition of the transport market towards this type of fuel and the price will actually become another force of change. The natural gas prices forecast is shown in the chart below:



Researchers and economic analysts, both those of IHS and of an independent economic environment, forecast 2018 as the year when the natural

gas will reach a dominant position in road transport of goods. As a prerequisite of this is the increasingly lower demand of the diesel as a source of fuel for heavy road goods transport in United States and China, the price of gas becoming the most relevant factor in this case. Also, in miniature car transport, electricity will be the one to dethrone the oil hegemony. These hypothetical realities, scientific and technical new-arisen solutions will lead to a reduction in oil demand, in conformity to the study. As it could be seen in the chart below, the average growth in oil demand will considerably scale down in the next third and fourth decades of the century.



Technological and scientific progress permitted that the renewable energy sources to become part of the equation of rivalries among the energy sources. Energy production that is based on the wind and solar energy, according to the same "outline of the plot", states that they remain the two big winners. Thus, in 2014 renewable energy production accounted for 15 % of total world energy production, compared to 6 % in 2010.

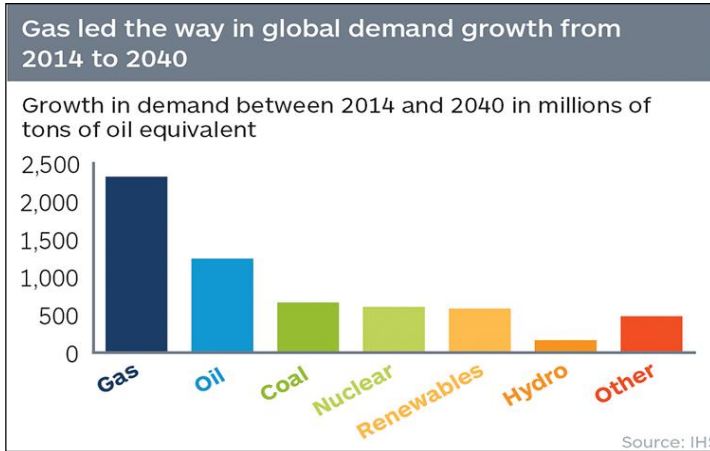
According to Physics World, a prestigious scientific journal, the most important scientific achievement in 2014 was conducted in February, when scientists from the National Ignition Facility (NIF) in California, USA, made a revolutionary discovery in self-sustaining fusion . They managed to get more energy from fusion reactions than all the energy stored in the fuel and used by

the strong laser operated by NIF. There were used 192 laser beam rays in order to heat and compress a tablet of hydrogen, up to the point where nuclear fusion reactions takes place. For half a century, researchers have attempted to obtain a controlled fusion process, without succeeding it. It is expected that the NIF experiment, considered as the most significant one in the last decades to provide the new global energy perspective.

Nuclear fusion will become the energy challenge of the future. Nuclear fusion is the phenomenon through which two light nuclei (of low atomic number elements) are reacting, leading to the formation of a heavier nucleus, releasing energy. Naturally, this process takes place inside the stars, this being the reason for which they radiate energy at all times. The idea of using this reaction to produce the energy for consumption lasts already for half a century, but the difficulties to achieve a controlled fusion process have so far prevented the emergence of civil energy applications.

"The US defense group, Lockheed Martin, says that they are capable of producing reactors based on nuclear fusion, while one of the prototypes will be available in five years, marking a revolutionary technological advance." According to the same source, Lockheed Martin, it is said that a prototype of this reactor is to be available within five years. It is small and could easily be placed on a truck, or within ten years, on an operational reactor. Thanks to its small size, this reactor can be designed, manufactured and tested in less than a year." Tests have shown that the design of a 100 MW reactor is feasible and is almost 10-fold times smaller than the usual ones. However, "there is still a long way to go before a prototype will be commercially able to produce energy", says Joel Gilmore - an expert in ROAM Consulting.

The scenario proposed by IHS researchers did not considered the possibility that this type of renewable energy to get on the world energy market in too short time, therefore they proposed a diagram of prioritization of energy sources, where the natural gas stands for a privileged position.



Shale gas - which is based on untraditional methods will fuel the increasing energy consumption for the next two decades, and according to IHS specialists' opinion, the way how it will be traded on the market, so it will be governed by new contracting methods.

Despite its defamation of being considered a "dirty fuel", coal will remain into the top three due to its price, as figured out in the above scheme. However, the effects of the pollution and gas consumption growth will result in a loss of the market share among the other types of the energy sources.

Considering the same scenario, the global energy mix diversity will know an unprecedentedly development until 2040. Oil, gas and coal will remain the most important sources of energy for the present, but they will not remain the only ones. The world is becoming more and more prosperous through spreading of energy supply and growth distribution infrastructure in Asia and Africa.

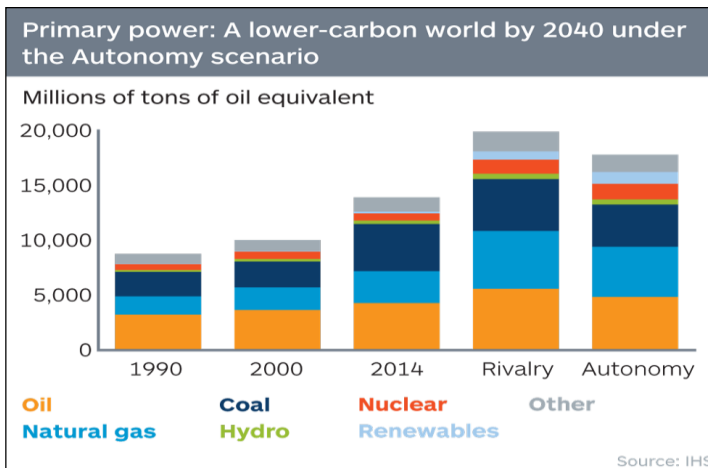
Rivalry of the energy sources related to the economical rivalry, as in the opinion of the IHS specialists, will not make the world become safer or more dangerous but it will be a real challenge to keep up the balance, without the existence of a hegemonic power.

### 3. Energy Resources Autonomy

Autonomy - as in the context of IHS study - involves securing energy supplies by using mostly local resources, placing a great emphasis on the energy independence. This will generate a greater degree of economic security. If such a strategy is applied, every nation will try to exploit energy resources as

efficiently as available. In this context it will be put a focus on the renewable energy sources. Thus, the wind and solar power will bring a significant contribution to the energy balance, while a great attention will be also given to the exploitation of unconventional oil and gas by fracturing shale.

In such a scenario, with reference about types of energy sources that will be operated mainly in the next 25 years, IHS study proposes a suggestive graphic outlining the use of renewable alternative energy sources at the expense of those of alternatives. The presentation is done in a parallel manner, remaining though inside the brackets of the rivalry of both energy sources scenario and autonomy of energy resources scenario.

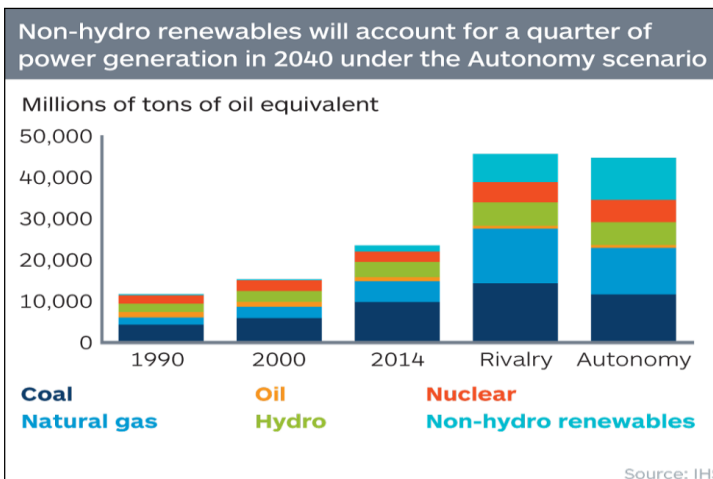


In this respect, a good example is the exploitation of the United States, where oil production has increased by 73.57 % in the last seven years, from an average of 4,999 barrels per day to 8,677 barrels per day, with the assumption that in 2015 will exceed 9,300 barrels per day and in 2016, with 9,500 barrels per day. In the United States, the export of the raw oil is allowed under very restricted conditions set by the Department of Commerce or only in the case of very severe exceptions. Although this is referred to a controversial law, actually this contributes to the raising of the US energy autonomy. Law ban on sales of US crude has as its starting point the oil crisis, triggered in October 1973 by the Arab States of the OPEC decision to impose an oil embargo on sales to the US,



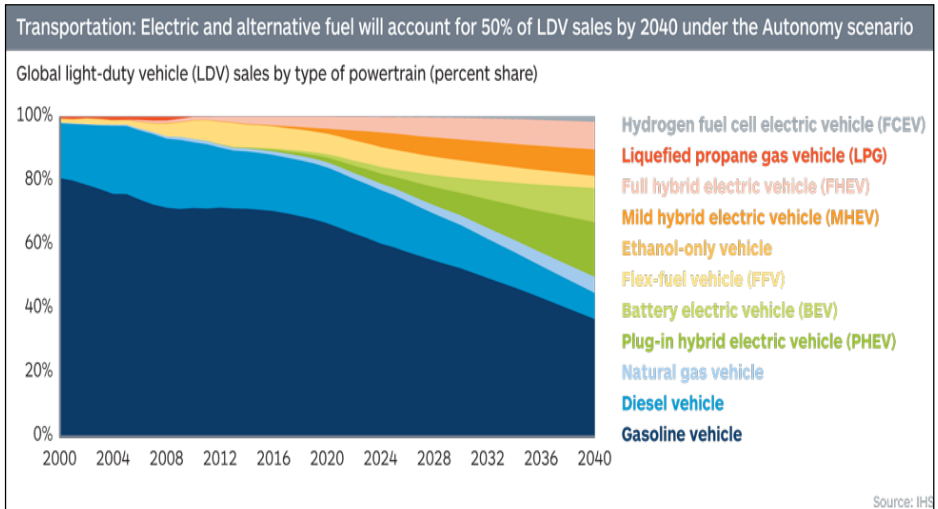
UK, Canada, Japan and the Netherlands - in response to the action of the US to support Israel in the war of Yom Kippur Arab-Israeli . The embargo, maintained active until March 1974, placed the US economy in particular and the global economy in general (considering that this was already unbalanced because of the effects of breaking the Breton Woods Agreement) in front of an unexpected increase price oil for 3 to \$ 12 per barrel. This resulted in a recessionary and inflationary period that lasted until the early 80s' and was accompanied by a steep rise in oil prices, a trend that has spread until 1986. The response of the US was subsequently institutionalized in the "Energy Policy and Conservation Act" - the law that banned oil exports, and stated a range of other measures (such as to establish the consumption standards for cars and trucks) in order to keep inside the country as much of domestic oil as possible, acting as an instrument to limit America's dependence upon imports, and to overcome the period of major volatility of oil market.

From this point of view, an interesting appreciation is that of the IHS specialists, regarding the evolution of the anhydrous renewable energy sources. In their opinion, these sources will ensure the context for a broad promoting of energy independence for a quarter of global energy demand, calculated according to the shown schedule, alongside with the rivalry scenario of energy resources.



In both types of transport of heavy and easy duty, substantial changes will take place. The probability that the oil to be replaced by natural gas (biogas or

gas produced from coal gasification) for the heavy transport and by electricity for the easy transport, will also lead to the local energy resources utilization.



In other words, renewable energy sources will become more profitable. Storing electricity will meet a radical change. The current inconvenience regarding the impossibility of storing energy in sufficient quantities in order to ensure the autonomy for auto vehicles will disappear. The emergence and widespread deployment of unconventional oil and gas production by fracturing and synthesis will lead to local resources in areas where today energy resources are not exploited.

Thus, the energy supply will be easier to maintain and it will remain locally available, resulting in a higher degree of energy autonomy of the regions. Through the concept of autonomy, the energy sources will broaden their availability in the context of revolutionary science and technology development, while the landscape of energy resources will be defined by a sustained local demand for energy in a much higher local energy supply.

### **3.1. Romania in The Context Of Energy Resources Autonomy**

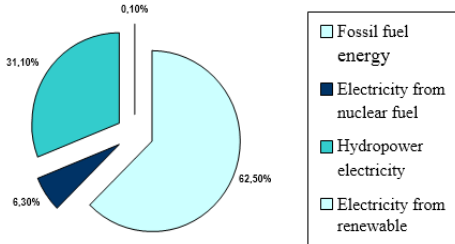
In Romania, in regard with the local resources usage, important steps have been also made. Romania has the advantage of holding important deposits of natural gas, oil, and coal. However, this is not enough; the political will

involvement is strongly required for the energy resources to be secured. The ANRE decision to approve the cut-off of the natural gas imports, starting with April 2015, will turn April 2015 into the first time for the last decades, when Romania's population will have to consume only from the domestic production, while gas industry imports will be extremely low and completed only through direct negotiations between the companies consuming and external suppliers.

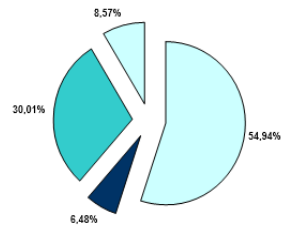
Coal is another fuel that Romania owns: pit coal reserves of approx. 755 million tons and lignite - about 1490 million tons, while the annual output is about 3 million tons of pit coal and 30 million tons of lignite. Using the coal in order to obtain synthetic gasoline and diesel by liquefaction is an old process, known since the inter-war period. However, after the Second World War, synthetic fuel production ceased because of cheaper oil imports from the Middle East. In the context of increasing energy security and the emergence of economic opportunities, Oltenia Energy Complex announced that by mid - 2015, Motru municipality will operate a station coal gasification and liquefaction, able to consume approx. 2 million tons of lignite annually, the equivalent of one-third of the amount consumed by the power plants in Craiova. The project is implemented in partnership with two other companies from Germany and UK, who operated a similar facility in Brasov. Besides the so-called "synthetic oil" factory, a smaller one is to be built also in Motru, a smaller pellets plant, obtained from coal, with a consumption capacity of approx. 50 tons per day.

Comparing the origin electricity from Romania in 2011 and 2012, we can see a significant change by substantially increasing electricity from renewable and alternative sources on one hand and a significant reduction of electricity deriving from fossil fuels, on the other. The sharp development of the wind and photovoltaic energy parks produced a radical change of approach on the possibility of further development of electricity production.

ORIGIN OF ELECTRICITY USED IN ROMANIA Year 2011



Year 2012

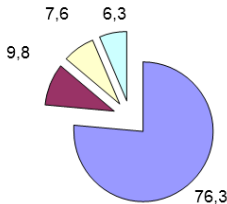


Source: Central Intelligence Agency  
Library Publication: The World Factbook

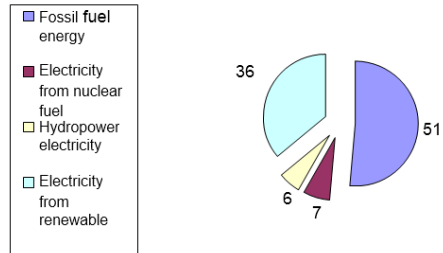
<https://www.cia.gov/library/publications/the-world-factbook/geos/ro.html>

We can compare this evolution with the existent situation in the United States and with the one recorded in Germany.

ORIGIN OF ELECTRICITY USED IN USA 2011



ORIGIN OF ELECTRICITY USED IN GERMANY 2012



It can be seen that the dynamic growth of electricity production using renewable energy development follows the European path, where the emphasis is increasingly higher put on renewable resources.

Although Romania preoccupations on a strategy for securing energy resources is more of conjecture, the evolution is governed mainly by economic reasons, oriented especially to the European model. Thus, at the Conference 'The Future of Energy. Energy Scenarios - Energy Strategy 2050 vision - NDP 2020' held at the Romanian Academy, on February 28, 2013, some priorities were outlined for the energy sector in Romania:

- the need to find smart solutions for energy security;

- the need to prepare users for changing their energy behaviour in order to increase rational and efficient use of energy (1% increase in energy efficiency by 3%, corresponding to a reduction of polluting emissions);

- dissociation of the political agenda (short term) from the energy agenda (medium and long - term) for achieving a long-term energy strategy;

- the need to develop an institute of strategic energy source planning;

- extraction of unconventional gas represents a possible source of energy in Europe and in Romania; the Romanian operators experience in exploration and exploitation of the natural gas can be considered as an asset, in dealing with unconventional gas extraction, even if there is a dose of skepticism in regard with seismic and environmental side effects;

- the dynamic changing on the global market of the natural gas through the possible entry of the US among exporters, the discovery of other new reserves of conventional gas and the efforts made in the unconventional gas exploitation will lead to important changes in the energetic flows.

- taking advantage of the geographical position of Romania, being at the crossroads of the major energy corridors, and develop the energy services sector, becoming a pole of the energy;

- a more efficient approach of European funds, in order to secure the investment needed to develop the energy sector in Romania;

- a particular attention paid to the air pollution problems, that will become a core element in assessing the sustainability of a country's industry;

- elaboration of a master plan, as a first step in a professional manner in the issues of reducing greenhouse gas emissions.

#### **4. Energy Resources Instability (The Vortex)**

A third scenario, expected by IHS implies an instability of energy resources. This instability, also named vortex, refers to a world of important technological changes. As a matter of fact, these changes could be so important, that the governments and society will have to hardly strive to keep up with the assurance of energy sources. In this respect, such inconsistencies could occur between demand and supply with energy, that could bring a major turbulence between energy price and the supplying way from multiple sources with uncorrelated prices. It is possible that an overheating fascination of new technologies to cause an increase of instability and create an unpredictable future about energy sources that could be exploited. Long-term investments in this area will find themselves in difficulty and the general trend of the energy

market will be hard to be described in such a turbulent context. A key feature of this scenario is defined by unsustainable growth in emerging economies. This situation could generate an additional request of energy resource and therefore rising energy costs.

If among the competitors that use different types of energy, the unconventional gas was the big winner and it was considered as the main energy source, in this third scenario, the emergence of new energy alternatives such as nuclear fusion or zero point energy, could easily disrupt the energy market, with uncertain investments in favour of traditional energy sources, investments that usually cannot be paid off in a short time. If ten years ago a major project was evaluated between 3-5 billion dollars, sometimes even about of 10 billion, today we can refer to major projects of over 50 billion dollars in many cases. These kind of projects usually generate a complex set of problems, situated beyond of their costs and schedule in regard with the labour force implied, the situation when a failure occurred could have critical implications. Therefore, these scenarios must be seriously taken into consideration in order to be able to adapt them to the new major market trends, including scenarios characterized by prices instability or important prices fluctuations of different energy sources.

This scenario foreshadows a global economy being in search of new states of equilibrium, able to support both investment and production but also to be able to reset the consumers' expectations.

Challenges should not be neglected or minimized. Instead, they should be seen through the eyes of the most important leaders in industry, the ones that prepare the global planning for the future and production strategies. If business economic conditions continue to persist in the scene of global economy, the most probable consequence is the emergence of a whole generation of consumers, buying trends of products with low and very low prices and the generalization of a business climate, with important tendencies of volatility. This could add more pressure on both the investment and the production of goods, and the advice for those unprepared managers for such situations, is to seriously take into consideration the adage "He, who is able to survive" (best adapted to market requirements).

Vortex is the world where technological changes are accelerated much faster than those that occurred in the past decade, fostering volatility to economic growth, while the companies struggle to adapt to so-called "creative destruction".

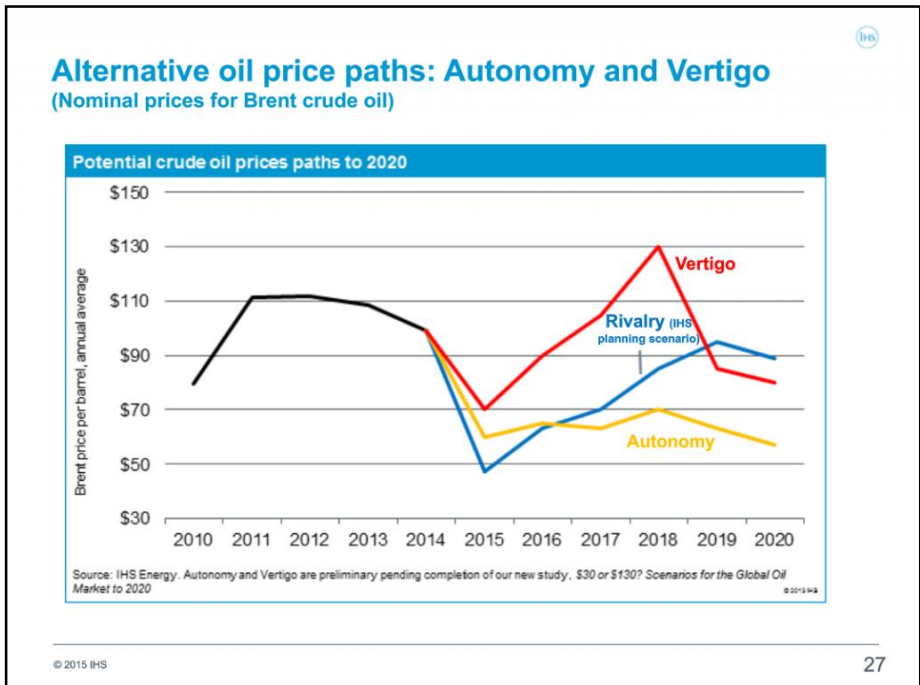
## 5. Dynamics of Brent Crude Oil Expected in Light of the Three Scenarios

What is noticeable in the three scenarios proposed by IHS is the fluctuant price of a barrel of Brent crude oil during of 2015 - 2020:

- "Rivalry" Scenario starts from less than \$ 50 / barrel of oil in 2015 and increases to almost 90 USD / barrel in 2020 ;

- "Autonomy" Scenario estimates a mostly constant price, of around \$ 60 per barrel of oil;

- "Vortex" Scenario suggests an evolution of W type price, of around \$ 70 in 2014 and 2015, with an increasing of up to \$ 130 in 2018 and then a comeback in 2019 and 2020, of around \$ 80/barrel of oil Brent.



## 6. Conclusions

Yet, even if we do not take into account such analyzes, the dynamic of price could be approximated just through these predictable parameters that such

study is able to define and parameterize. Unknown variables that could occur after any of these determinations, might significantly change any conclusion get based on these scenarios.

The role of such scenarios is not to simply determine the oil price development or any other energy resources, but to pinpoint the trends so that the investors to be able to analyze and make strategic decisions, taking into account an accepted margin of risk upon investments they want to develop in the energy sector. Creating multiple scenarios assumes different interpretations or approaches about the information that someone performing these scenarios can get, so that the recipients to be able to give a proper interpretation of these scenarios, depending on the evolution of economical, political, and social reality, trends and directions towards which the economic sector emerges, so being able to anticipate any possible developments.

## **7. References**

Central Intelligence Agency The World Factbook  
<https://www.cia.gov/library/publications/the-world-factbook/geos/ro.html>

IHS CERA – Fueling the Future with Natural Gas: Bringing It Home  
january 2014, <https://www.fuelingthefuture.org/assets/content/AGF-Fueling-the-Future-Study.pdf>

Investment in exploration-production and refining in 2012 IFP Énergies nouvelles - October 2012 - G. Hureau, S. Serbutoviez, C. Silva, G. Maisonnier  
Economics and Information Watch and Management Division

Ludwig von Bertalanffy „General Theory of Systems. Application to Psychology” în volumul „The Social Science: Problems and Orientations”, Paris, UNESCO, 1968

Lotka, A.J., 1922. Contribution to the energetics of evolution. Natural selection as a physical principle. In: Proceedings of the National Academy of Sciences of the United States of America, vol. 8. 1922, p. 147-155

Nobuo Tanaka, IEA ‘Oil in the global energy mix: climate policies can drive an early peak in oil demand’, 13 April 2011, [http://www.iea.org/index\\_info.asp?id=1928](http://www.iea.org/index_info.asp?id=1928)

Robelius Fredrik 2007. Giant Oil Fields -The Highway to Oil. Giant Oil Fields and their Importance for Future Oil Production. Acta Universitatis Upsaliensis. Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Science and Technology. 168 pp. Uppsala. ISBN 978-91-554-6823-1



Statistical Review of World Energy, Workbook (xlsx), London, 2014  
<http://www.bp.com/statisticalreview>  
Study about global energy resources - Information Handling Services Inc.;  
U.S. Energy Information Administration (EIA), <http://www.eia.gov>;  
U.S. Energy Information Administration – Independent Statistics &  
Analysis                      Petroleum                      Supply                      Monthly,  
<http://www.eia.gov/petroleum/supply/monthly>  
West Texas Research Group, LLC, <http://www.wtrg.com>  
Yergin Daniel, Premiul – about Oil, money and power, Vol. I, II, Adevărul  
Holding, București, 2007;