CONTEMPORARY ENERGY WAR – NEW COORDINATES

MARIAN RIZEA*

Abstract: The beginning of the third millennium started with the pessimistic note of the Report IIASA/WEC prepared by Global Energy Perspectives, WEC, London in 1998 year which stated officially that the time of depletion of known fossil energy sources, taking into account the intake from that year, was: oil – 45 years, natural gas – 65 years, coal – 257 years.

As a result, the responsible states from the entire planet have been forced to revise energy security strategies on medium and long term and the most industrialized ones have proposed, based on new technologic-scientific and technical discoveries, to reshape this component of state security. Thus, the U.S.A. which has the upper hand in the exploitation of shale gas relies on this new energy resource, is engaging in its backwater Western European countries, Germany is planning to quit nuclear energy in the first decades of this century by opting for green nonpolluting energy, China is revising its research engines to replace uranium with thorium (less radioactive and there are no risks of a nuclear explosion), Russia still relies on the huge fossil fuel reserves in Siberia, OPEC member states are trying to maintain the balance between production and export of hydrocarbon fluids. Romania, with a complex energetic mix (hydro, nuclear, fossil, wind and more recently, photovoltaic) and as a holder of an outstanding inventions (Karpen battery), has scaled its energy strategy, trying to keep up with modern states.

Keywords: energy, energy war, shale gas, hydraulic fracturing, wind energy, photovoltaic energy, thorium, biofuels, hemp, Karpen Batery, artificial fuel.

1. GEOENERGY CONTEMPORARY COORDINATES

The energy crisis of the early ’70s, also known oil crisis led all states, more or less industrialized, to rethink their national energy strategies in the medium and long term to gain access to resources, both on peaceful way, encouraging research in recognized fields (fossil, hydro and nuclear fuels), and and by developing new, clean, renewable technologies (wind power, photovoltaic), army (Falkland Islands conflict in the 80s, anti-terrorism preventive wars to eliminate alleged chemical arsenals of the ’90s and restart in 2003), but also through diplomatic force (see for Romanian oil case, 2004) and more recently based on trade and economic contracts or partnerships (in countries from Asia, Africa, South America and eastern Europe, including the Romanian continental shelf). Holders of energy resources used in full this versatile weapon, while others tried to illegally benefiting from transit pipelines content.

* Prof. Dr. Eng., Ecological University of Bucharest, Faculty of Engineering and Environmental Management, associate professor at the “Oil & Gas” Ploiești and West University; Member of the Division of History of Science of CRIFST, Romanian Academy (e-mail: r_17m@yahoo.com).

Nominalization of the players involved and the evolution of each suggested case is less important than the "*lessons-effects*" for the world [1].

In 1998, *Global energy perspective*, WEC, London published the IIASA / WEC report, which officially stated that the time of depletion of known fossil energy sources, taking into account the intake from that year, was: oil – 45 years, natural gas – 65 years, coal – 257 years.

When best estimates and studies of prestigious governmental and international institutions showed that end of the era of fossil fuels (coal, oil and gas) is near, with a time horizon of 2–3 decades, determining the responsible states from the entire world to review and accelerate their energy security strategies, a new discovery, the extraction of shale gas through hydraulic fracturing technology, substantially alters the energy balance of the contemporary world.

In early 2000, the United States had to implement the provision of energy security strategy for the import and storage of over 100 billion cubic meters of liquefied natural gas (LNG) from imports (Russia and Qatar) and building specific infrastructure. This meant bringing imported gas with tankers (specially equipped boats), downloading (decanting) in specially equipped for regasification terminals (conversion of natural gas in liquefied gas) transport and use. Since 2005, the U.S. developes the technology for shale gases exploitation by hydraulic fracturing method (fractionation) and extracts in a massive manner, so that in 2011 imports decreased from 100 to 20 billion cubic meters. Experts estimate that, based on geological data obtained, the reserves discovered could meet U.S.A. needs for more than a century!

As a result, nowadays there are efforts to transform these terminals in liquefaction facilities to send for export large quantities of gas.

If natural gas from gas-bearing clays will catch speed on global level, gas could reach a share of 25% in primary energy consumption by 2035, compared to 21% as it is now. But if the general public will oppose and hampers the development of this resource so share would remain at 22% [2].

2. ESTIMATION OF SHALE GAS RESERVES IN THE E.U.

According to a report in the April 5, 2011 of the *Energy Information Administration* (EIA), Romania, Hungary and Bulgaria have together recoverable shale gas reserves of 19 trillion cubic meters, while Poland has 187 trillion cubic meters.

The countries that have the largest natural gas reserves in the world are, in order, Russia with 25.02% of total proved natural gas reserves in the world, Iran (15.57%) and Qatar (13.39%). China and Australia also have significant reserves of shale gas.

American estimates show that Eastern Europe has reserves of 7100 billion cubic meter shale gas. Natural gas thus obtained could cover demand in Europe for almost 80 years, according to the EIA.

Poland, for example, would have 5200 billion cubic meters, enough to ensure domestic intake for 300 years.

According to the latest data of the *Energy Strategy of Romania for the period 2011–2035*, oil and conventional gas reserves are enough for about 15 more years, taking into account the proved reserves and annual production rate of hydrocarbons. Romania imports about 20–25% of its gas consumption and the rest is produced in almost equal amounts by Romgaz and Petrom [3].

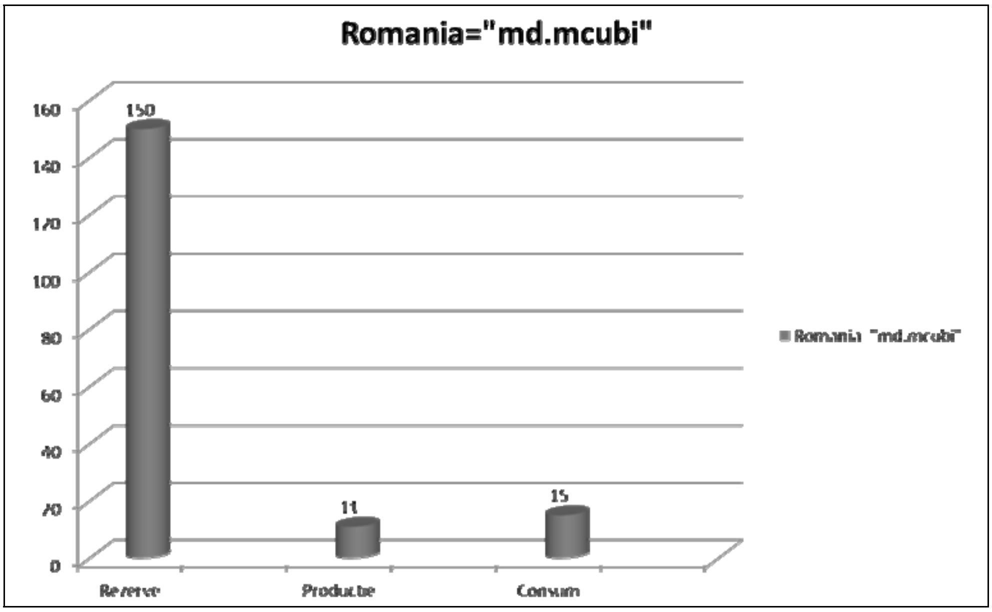

Fig. 1. *Schematic presentation of production, demand and gas reserves of Romania (2012).*

Specialists estimate that Romania has shale gas reserves of over 150 billion cubic meters, which would provide easy consumption of 15 billion cubic meters per year for 10 years.

Obviously, the temptation to extract and use these resources in this globalized energy hunger is difficult to control, being balanced only by reason that negative effects can cause irreparable damage. Therefore, the government's decision to allow the next five years only research and exploration works for in-depth knowledge of the geology of shale layers to be exploited is welcome and wise. In addition, the drilling and seismic research activities on and offshore will be constantly supervised by Romanian specialists.

Even if the former and famous research institutes in oil and gas from Câmpina, Ploieşti and Mediaş were destroyed, and of the 25 drilling scaffolding of the former oil minister not even one belongs to the state, there are still many trade specialists in private entities that may be useful to the Romanian state. There is also the possibility that students practice from engineering faculties (drilling-extraction, environment), geology and gas transport (public or private) to incur even in locations assigned to foreign companies.

A pragmatic approach of the opportunities offered by shale gas discovery in Romania would bring an energetic comfort and long-term ecological safety, in addition to jobs, training and specialization of youngsters.

Although the story of shale gas exploitation worldwide is barely beginning, already started showing effects: for or against actions become increasingly nuanced and giant GAZPROM lost at the end of January 2013 world leadership in gas exports. The fight will certainly be lengthy and bluntly; it will be a continuation of the battle for oil that has lately occurred in more than 100 years till now.

3. FUTURE – NEW SOURCES OF CLEAN ENERGY

Clearly, Fukushima episode meant for developed countries much more than September 11, 2011 for the U.S.A. and its allies. Although distinct areas, both events led to strong changes in national security strategies of most states. In the energy field, the fastest and decisive decision took Germany who set precise objectives of gradually abandon of the energy based on fossil fuels (coal, oil and gas) and on nuclear energy and passed to the development of renewable energy, clean energies such as wind and photovoltaic, green energy category.

3.1. *Wind energy*

Wind energy is based on the use of wind force and transform it into mechanical energy and then electricity.

Modern wind turbines are re-conceptualized versions of the old Persian windmills, medieval European or the ones from American and Australian farms.

Modern wind turbines convert wind energy into electricity producing 50–60 kW (propeller diameters from 1 m), 2–3 MW (60–100 m diameter), most of them generating from 500–1500 KW. At the end of 2010, worldwide capacity of wind generators was 194,400 MW. All around the globe turbines can generate 430 terawatt Time/the equivalent of 2.5% of world energy consumption.

States largest producer of wind energy are: China (44 733 MW), United States (40 180 MW), Germany (27.215MW), Spain (20,776 MW), India (13,065 MW), Italy (5,797 MW), France (5,560 MW), United Kingdom (5203 MW), Canada (4,008 MW), Denmark (3,734 MW).

In early 2011, the share of wind energy in total domestic consumption was 24% in Denmark, 14% in Spain and Portugal, approx. 10% in Ireland and Germany, 5.3% in the EU. In late 2012 Romania had 1,200 wind turbines (over half of them being in Dobrogea) with an installed capacity of about 950 MW (representing 3% of national production), more than one reactor of the nuclear power plant in Cernavodă.

In 2010, in Texas, The Roscoe Wind Complex, with a capacity of 781 MW, is able to provide electricity for 230,000 households, being the largest wind farm in the world. It has cost 1 billion dollars, its construction began in 2007, has 627 turbines and covers cca. 100.000 acres of land. By contrast, a coal thermal power plant is generating medium 550 MW.

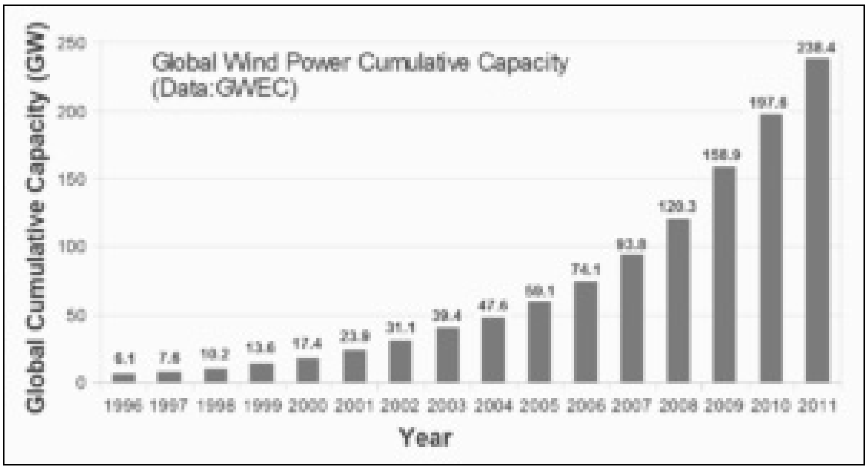

Fig. 2. *Global Wind Pover Cumulative Capacity.*

A particular case of wind turbines is the Maglev turbine. Maglev wind turbines use a technology invented by the scientist Nicholas Tesla and perfected by American researchers, assuming the use of permanent magnet to rotate the windmill pallets. The principle of operation is similar to the famous Maglev trains operating on magnetic cushion. Experts say that this is a unique technology in the world that has many advantages and almost no disadvantages. The efficiency is 95%, wind turbines being capable of producing from a wind speed of 1.5 m/s to very high speeds of 40 m/s.

A MW of installed turbines Maglev costs about the same as a MW of a classic windmill: approx. 1.7 million €. The guiding principle that the central is ruling, is magnetic levitation that makes the pallets of wind generator float in the air, without bearings. Turbines operate due to permanent magnetic flux. These permanent magnets are composed of a rare metal called Neodymium which does not lose energy through friction, being used by NASA in certain spaceflight for it's magnetic resonance. Researchers from Germany, China and Russia are in a fierce race against time for the use of Maglev technology in the automotive industry.

3.2. *Photovoltaic energy*

Photovoltaic solar energy is produced by solar photovoltaic cells, which convert sunlight directly into electricity. They are made of semiconducting materials similar to those used in the electronic on chips in the structure of semiconductor [4].

Solar cells use layers of semiconductor materials only a few micrometers thick. The leap of technology made it possible for them to be seamlessly integrated into building facades, roofs, etc. The first photovoltaic cells were 4% efficiency and have been produced in 1950. Today, the third generation of photovoltaic panels contain cells with an efficiency of 20% and it seems that in a few years it will grow.

The largest photovoltaic park in Europe will be built at Arad.

An investment of 100 million euros in a photovoltaic park is near completion at Sebiş (Arad), where on 200 hectares of land are installed 317,000 panels with a total power of 65 MW. The panels would cover the needs for 100,000 people.

Photovoltaic parks have been built in Buziaş-Timiş and Vrancea, but they have modest power.

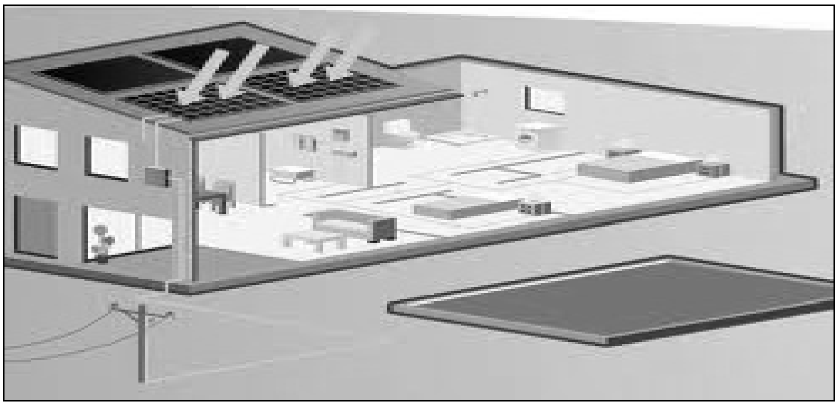

Fig. 3. *Networked facilities* [5].

4. CHALLENGES OF THE MOMENT IN THE ENERGY WAR

4.1. *Thorium*

While global energy giants fight over shale gas reserves and conquering the markets, Russia is desperately trying to maintain its leadership in the field of fossil hydrocarbons, Germany announces firstly renouncing to nuclear energy and then to the one based on oil and gas, and China stuns the world with a shocking statement: investing hundreds of millions of dollars into a project that can revolutionize life on Earth. Jiang Mianheng, son of former Chinese leader Jiang Zemin, coordinates an important project with a budget of 350 million dollars for the Chinese Academy of Sciences. Jiang Mianheng already recruited 140 graduate students to devote themselves to thorium based energy project taking place at the Shanghai Institute of Applied Physics. The number of researchers involved in this project will increase to 750 by 2015.

Thorium would have the advantage that it can be used widely, cheaply and without carbon dioxide emissions.

Recently, Norway has launched a test that will cover four years, during which they test whether the conventional Halden reactor can operate with thorium.

Also, research institutes in Japan study the alternative options that can save the nuclear industry and regain public trust. Chinese authorities intend to win this race of thorium.

Underlying technology on the basis of molten salt reactor is not new. In the ’60s, researchers at *The Oak Ridge National Laboratory* in Tennessee have built such a reactor, but their success was subsequently abandoned by U.S. President Nixon. Pentagon needed plutonium waste, obtained using uranium to build nuclear bombs. Thus, the priorities of the Cold War “buried” this technology [6].

So fight for energy supremacy continues.

4.2. *Artificial fuels*

At global level goes a strong struggle to find substitutes for diesel and gasoline engines. Bio diesel and gasoline have become a reality.

Researchers in several countries are concerned with the patenting of technologies for the production of synthetic gasoline. The problem is not new, it was resolved in part by German savants which managed to produce gasoline for the Nazi war machine from coal. Now is being experiencing obtaining gasoline from natural gas (shale gas eventually), including in Romania, and British researchers have produced gas from the air.

British innovation is that they managed to combine several technologies. “We took carbon dioxide from the air and hydrogen from water and turned these elements into gasoline”, said Peter Harrison, CEO of the company, which revealed the success of in a conference hosted by the *Institution of Mechanical Engineers.*

British researchers want to produce on a large scale this new range of gasoline by the end of 2014 and over the next 15 years to reach a production level similar to today’s refineries.

4.3. *Karpen Pile*

“Dimitrie Leonida” National Technical Museum of Bucharest there is an electrical pile built by Vasile Carpăn, <u>who works continuously for about 70 years</u>. The patrimony object is kept in an armored metal safe. It’s about “Thermoelectric pile with uniform temperature” known as “Karpen pile”, built in 1950. The pile is actually a perpetuum mobile, i.e. <u>a device that generates energy endlessly</u>. Scientists can not yet explain how is that possible.

About Carpăn’s invention knew only a small number of specialized people. In Paris, Bucharest and Bologna took place some scientific communications where the invention was presented in detail. In the past decades, the great mechanism was a real research object of the University of Brașov and Polytechnica Bucharest.

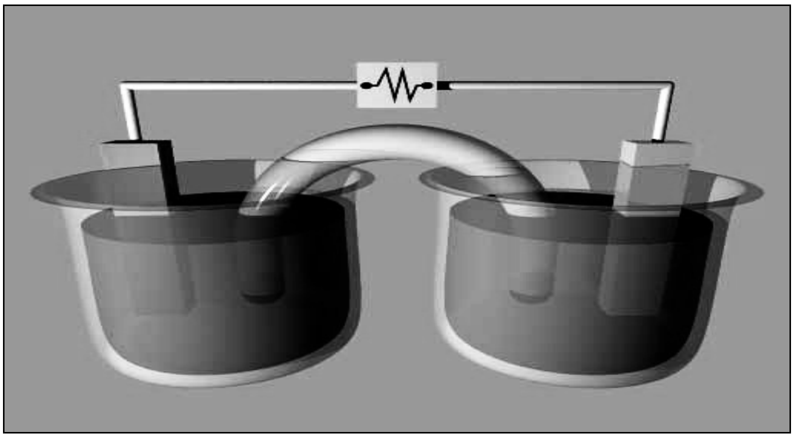

Fig. 4. *Karpen Pile* [7].

4.4. ***The hemp***

Ancient and ordinary plant called hemp used by generation on all continents of the world was one of the raw materials with tens of thousands of uses, which contributed to the perpetuation and development of mankind. Hemp or “cannabis sativa” in its multiple species was found useful in the manufacture of clothing, food, medicine, construction, arts (paintings of great artists like Rembrandt, van Gogh and Gainsborough were made on hemp canvas, using watercolors extracted also from the same hemp) and missed, for very little, the final entry in the automotive industry. In the early ’30s, Henry Ford produced a car that was composed 70% of plastic made from hemp. The first diesel engine was designed to use vegetable oils, including hemp oil. But, at the same time, the future of this millenary plant (organic and biodegradable) was torpedoed by DuPont invention which began producing on a large scale plastics from oil and coal. Plastics are nonbiodegradable and contributes fully to pollution of the planet.

Some companies are focusing their research activities on potentiation of hemp qualities and ecological properties and its reintroduction widely in food industry, textile industry, pharmaceutical industry, or to obtain auto hemp oils and biofuels, etc.

5. CONCLUSIONS

– Contemporary and future modern world can not exist without energy.

– States which have energy strategies based on energy mixes (complementary sources) are less vulnerable to future challenges.

– An independent state in terms of energy is a powerful state in all aspects.

– Discovery research into new less polluting energy sources are as important as all other core areas that provide state, zonal and global stability.

– Regardless of declarative attitude, grate powers will continue the energy war to access and ownership of resources and energy reserves using the entire arsenal: diplomatic, informational, economic-financial and, last but not least, the military force.

REFERENCES

1. Rizea M.; Rizea E. *Oil, Development and (In)security*, Second edition, 2008, published by "Oil and Gas Engineers Society" Association in Romania.
2. Energy Information Administration, The report named *Golden rules for a golden future of natural gas,* May 2012.
3. Rizea M. "Hydraulic fracturing – saviour or destructive technology", International Conference UEB-2013 – *The ecology of XXI century – challenges and perspectives*, Ecological University of Bucharest, 4–5 of April 2013.
4. Panduru, V.; Catană, I.; Bigan C. "Solar cells conversion optimisation by sun position tracking, in *Ecologica Universitaria*, IV year, n° 18, 2012–2013, Ecological University Press Publishing House, Bucharest.
5. http://www.georbigo.es/energia-solar-fotovoltaica/.
6. http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/9784044/China-blazes-trail-for-clean-nuclear-power-from-thorium.html.
7. http://www.energobiologie.ro/index.php/Energii/O-sursa-inepuizabila-de-energie-pila-Karpen.html.