

## TECHNOLOGY, ECOLOGY – INTERACTION AND CLIMATIC CHANGES

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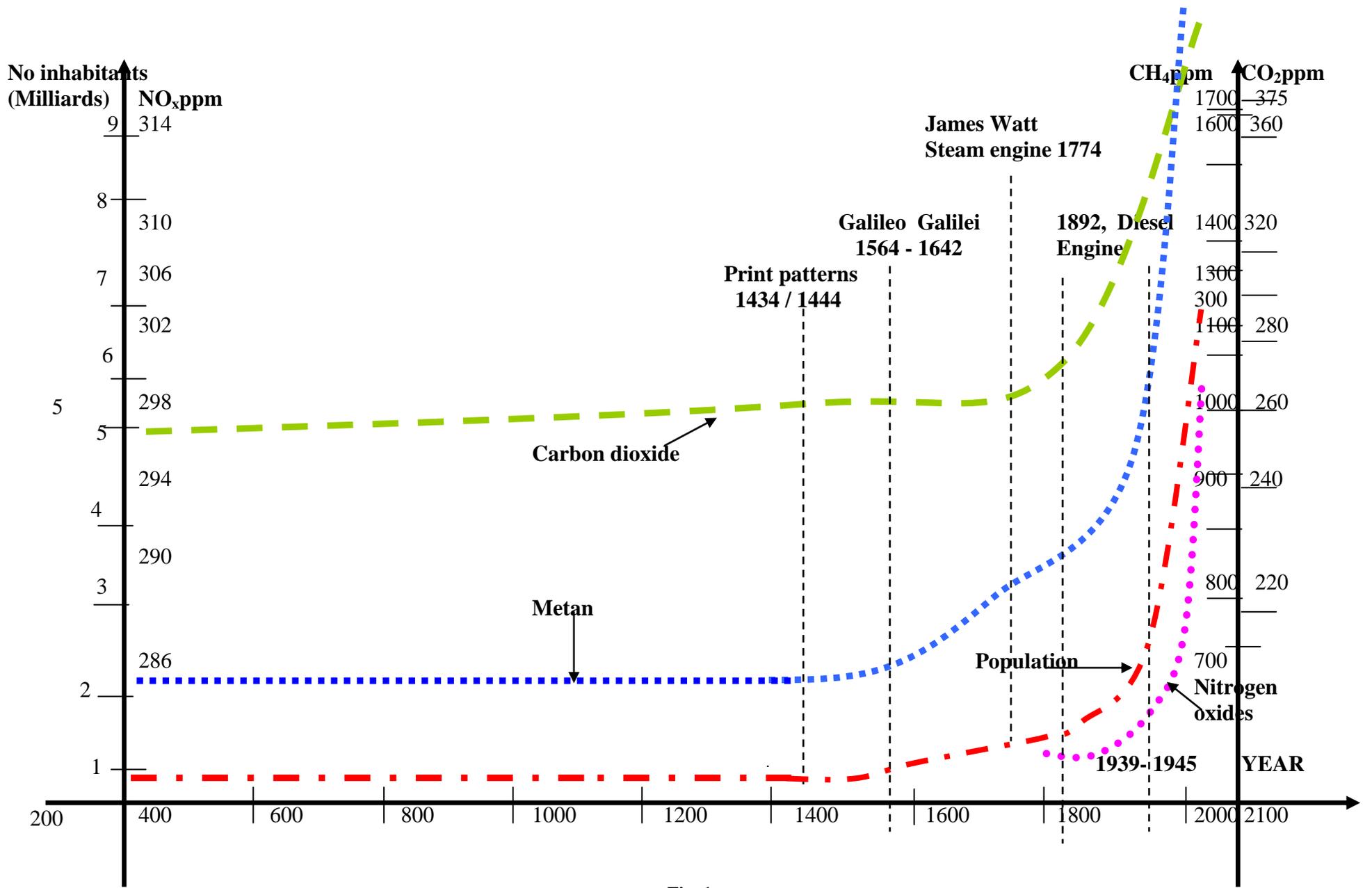
**Abstract.** *The scientific proofs lead to the conclusion that our planet has changed his natural environmental condition due to the results of exploiting the power produced by the combustion of fossil fuels. In this paper, it is mentioned that, in reality, there are different opinions about the main responsibility in the atmosphere warm up (some scientists sustain that industrial development is responsible for the climatic changes, others consider that climatic changes have not been determined significantly by the industrial development. Solar system, stellar formations, sun radiations, cosmic rays have had also a great influence). In the opinion of the author of this paper, the mankind will have a future only if our planet ecosystem will, at least, preserve the existing climate conditions if not improve them. Actually, in our days, the civilization's development implies a continuum deterioration of the ecosystem. Climatic changes have been generated by multiple causes; people can interfere only to reduce the greenhouse effect gas emissions produced by the combustion of fossil fuels. This paper presents, also, the Olduvai theory that starts from the idea that, in our days, there is no a viable substitute for replacing the petroleum-the most important actual source of energy. In the end of paper, the author refers to the main existing technologies that can contribute to the diminutions of the climatic effects of the technology/ecology interaction. Reading again the renowned reports of the Club of Rome, we find that the lack of power resources was the great issue of mankind from 1960<sup>th</sup>-1970<sup>th</sup>. Hydrocarbon ores were assessed and how much time technology can count on them was also evaluated. The last decade of the millennium II showed another reality. The development pace imposed by the „history acceleration” has evolved in the last three decades without taking into consideration the ratio between the extent of the human activity and the natural resources. The global economy annual increase was measured one century ago in billions of dollars. At the very start of millennium III, this increase was measured in trillions of dollars (Brown Lester, 2006).*

**Keywords:** climatic changes, globe climate, technology/ecology interaction&industrial development

A future will exist for the mankind only if our planet ecosystem will at least preserve the existing climate conditions, if not improve them, because nowadays the civilisation development implies a continuum deterioration of the ecosystem. In order to see how the environment conditions have been influenced during the centuries by the „results” of the human civilisation, let's compare the evolution of the world population number and the evolution of CO<sub>2</sub>, CH<sub>4</sub> and NO<sub>x</sub> concentration. The below graph shows also the principal moments that have significantly influenced the industrial development of the humanity (Fig. 1) (Iancu Stefan, 2007). The world population has evolved around an almost constant figure in the first millenniums of the human existence.

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During Christ time, the world population was around 300 million inhabitants. The world population has been estimated to be the same during Moses, Buddha, Confucius, and Mohamed times or during the battle of Hastings (1066). The reason the world population number was kept constant is that the economy of those times was mainly agricultural, the developed handicraft having a reduced economic share. The actual superior „High Tech” did not exist in those times. The number of people to be fed remained constant in an agricultural economy based on muscular power (either human or animal), where the arable area was limited and no modern medicine existed and diseases reduced the average life age. The result was to make a balance between births and deceases that limited the world population number to 300 million inhabitants for few millenniums.

The world population has known also a slight reduction between 1348-1349 caused by the black plague; around 50-60 million people died only in Europe and in England and in France population was reduced by a third. In that period the lands were not worked and this is why the price of agricultural or handicraft products has increased, as well as the work force. In England and France regulation were established to oblige the unemployed people and the people without land to work the land for the salaries that existed before the black plague.

After the black plague crisis passed, around 630-660 years ago, the modern civilisation began to develop due to knowledge spreading that lead to a slight increase in the number of world population. Under the impact of the physical science or of the scientific methods from Galileo Galilei<sup>1</sup> and Johannes Kepler<sup>2</sup> times, the technical knowledge has known a remarkable progress mainly in fields like: textile industry, mining, metallurgy, paper manufacture, ship building (geographical explorations) also.

The creation of telescope, field glass and microscope comes also from this period. One of the most important Renaissance technological achievements was the mobile letters metal print pattern. This technical achievement<sup>3</sup> of Gutenberg<sup>4</sup> has

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<sup>1</sup>Galileo Galilei (1564-1642), Italian physicist and astronomer, has put the basis of cinematic, has made correlations between mathematics and mechanics, and has considered the study as starting point in nature knowledge, becoming one of the founders of techniques based on mechanic science. He discovered the inepthness law, has established the laws of falling and body throwing; pendulum law, isochronism's law of mathematical pendulum oscillations; law of movement composition; he has given a correct definition for speed and acceleration and has emphasized the movement relativity.

<sup>2</sup>Johannes Kepler (1571-1630), German astronomer, considered being the founder of modern astronomy; he discovered the laws of planet movement.

<sup>3</sup>In reality the print pattern machine of Gutenberg has been reinvented. The mobile stamp with mobile metallic letters has been introduced in XI<sup>th</sup> century by Chinese that earlier invented also the real pattern print procedure.

<sup>4</sup>Johan Gutenberg (1400-1468) began his printing activity at Strasbourg (1434 -1444).

contributed to the spreading of technical culture in the condition of XV century upsurge of handicrafts, science and arts. The notions of space and time were studied in that age and examples of other technical achievements of Renaissance were: measure and observing instruments, the clock with arch, calculation ruler; vacuum pumps, lathe for lens smoothening, knitting machine, steam boiler with safety valve, porcelain, copper engraving, and others.

The pace of population increase began to intensify. During the industrial revolution from the last decades of XVIII century and the beginning of XIX century, new production areas and new industrial centres and cities appeared. The creation of spinning machine Jenny (1764), of sputter machine Arkwright (1769), of mechanic weave machine and after the creation and improvement of steam engine<sup>1</sup>, the social labour division has developed. As a consequence of new technology development and also under the impact of new discoveries and inventions (electricity-1794, electromagnetic induction 1831, internal combustion engine<sup>2</sup> etc.) the world population number has increased in the following decades more rapidly reaching around 1.900 year the number of 1,634 milliards inhabitants and in the eve of second world war a number of 2,5 milliards inhabitants (Iancu Stefan, 2007).

Fifty years after the Second World War, the world population number almost doubled and this is why the birth control becomes more and more an issue with a necessary control. One of the explication of the significant increase in the number of world population is the knowledge and medical modern technologies spreading, especially to the third world countries. In the same time with the moving of the military troops during the world wars, technical and economic

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<sup>1</sup> Giovanni Branca has proposed in 1629 the use of steam as turbine mortise agent. In the last years of XVII century, T. Savery (1650-1715) was the first who made a usable steam engine, known in literature as "miner friend". Denis Papin (1647-1714) has invented in 1680 the steam boiler with safety valve and has proved that the water boiling temperature was depending on pressure. Developing Savery engine, Thomas Newcomen (1663-1729) has realized a steam engine that resembled very much is one of our days. James Watt (1736-1819) has improved the steam engine of Newcomen and built in 1769 the first universal steam engine with condenser; he has designed and built between 1776 and 1784 the steam machine with double effect destined to obtain a continuous shaft rotation movement and thus becoming the first steam engine to operate a work machine. In 1789 he invented the speed regulator, a centrifugal device with balls that control the steam engine revolution using a feedback system.

<sup>2</sup> Francoise Issac de Rivaz has invented in 1807 an internal combustion engine that used as power source a mixed of hydrogen and oxygen. (Orselli Jean, 2002). French engineer Beau de Rochas designed the theory of internal combustion engine with piston in 4 times in 1862. German inventor Nikolaus Otto has succeeded together with E. Langen engineer to build in 1876 an internal combustion engine with piston in 4 times, with gaseous fuel, and in 1878 they realized an improved engine with liquid fuel (gasoline). Rudolf Diesel (1858-1913), German inventor that built in 1892 an economic internal combustion engine that worked following Carnot cycle; in 1897 he built a new type of engine with combustion by compression known as diesel engine.

specialists were sent by multinational companies in Africa and Asia and also doctors that implemented in this part of the world the modern medical technology reducing in this way the infantile, maternal and infant-juvenile mortality by 90%. This also led to more rapid increase of the population after the Second World War (Brown R. Lester, 2012).

Today, the world population is around 6,4-6,5 milliards inhabitants from which 2 milliards have no access to electric power and 3,5-4 milliards are living under the minimal poverty threshold. Even if nowadays the increase in population number could stop, it will not be able to assure a decent life for all the world inhabitants, no matter the present high technologies. However, the rapid increase rhythm of the world number of inhabitants raises the following questions: How can we stop it? How can we develop the High Tech such that to ensure a decent life for the world population? How can electric power be produced, without any ecological uncalled for effects?

Our civilisation is not the first one not been able to be supported by the natural environment. In 2005, Jared Diamond remarked „Studying the archaeological sites of past civilisations we find out that also other did not succeeded in keeping pace and adjust it in time” (Diamond Jared, 2005). In 2002, under the leadership of Mathias Wackernagel<sup>1</sup>, a team of scientist from the National Academy of Science from USA has supported the idea that starting with 1980, the humanity requests have overpassed the possibilities offered by our environment and in 1999 this overpass was of more than 20% (Diane Coyle, 2012).

The scientific proves lead to the conclusion that our planet has changed his environmental condition under the influence of the human civilization. To continue to deteriorate the environment using our present technologies is equal to put fire to our own house. Our planet ecosystem will no longer support the evolution of the human civilization. Before making any future scenarios, we have to stay aside and take care of our actual planet health.

The atmosphere was the result of life and its evolution was in closed interdependence with the planet life. When our planet appeared, no oxygen existed in the surrounding environment. Terra atmosphere has mainly nitrogen and carbon dioxide. Life, at least the primitive one, was relatively rapidly created, 500 million years after the globe creation. Almost one-milliard years took afterwards for the photosynthesis process that generated oxygen to appear and 1.5 milliard years for the oxygen to accumulate in the atmosphere. Once the oxygen consumer animals appeared, for a period of one-milliard years a balance was kept between the quantity of oxygen produced by the plants and the one consumed by the animals.

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<sup>1</sup>Mathias Wackernagel – leader of “Global Footprint Network”

The evolution of different gases concentrations ( $\text{CO}_2$ ,  $\text{CH}_4$ ,) in atmosphere can be estimated for the last 150 thousand years by analysing the successive ice layers from Greenland and Arctic. For 110 thousand years,  $\text{CO}_2$  concentration has been about 260-280 ppm in volume or 0,026-0,028 %. In the last 200 years, after the start of modern civilisation period,  $\text{CO}_2$  concentration has increased more and more and today is about 380 ppm (0,038 %) as a result of industrial revolution. In order to study the evolution of  $\text{CO}_2$  concentration curve, measurement have been performed in Hawaii, Alaska, Samoa and South Pole and it was found out that  $\text{CO}_2$  concentration varies annually due to vegetal cycle from the North hemisphere where the greatest share of Terra land exists. The variation depends on the place the measurement was taken. However, no matter the place where measurement was done,  $\text{CO}_2$  concentration is increasing.

Methane, one of the most important gaseous greenhouse products created by the decomposition of the organic material in water, was for 100 thousand years 700 ppm and now is 1700 ppm that means about 2.5 times more than before the industrial revolution. The cause of rapid  $\text{CO}_2$  and  $\text{CH}_4$  concentration increase can be due to the implementation of the technologies that followed the industrial revolution that implied the combustion of fossil fuel and the forest destroying in order to increase the arable areas. Shortly, destroying the balance between the oxygen quantity produced by plants and the one consumed by animals by reducing the production and increasing the consumptions, the combustion of fossil fuels representing an important oxygen consumer as well as the World population number increase, contributed to the increase of Terra balance lack. A logical question is what will happen if no pollution exists and the balance between oxygen produced by plant and oxygen consumed by animals is re-established. Firstly, this is a hypothetic case because there is no exchange technology, economically or technically available not to make use of fossil fuel combustion. Secondly the scientific studies estimate that there is a need of other 200 years to re-establish the natural balance of atmosphere concentration. But this implies that huge actual arable areas would disappear and two thirds of actual world population will not have any food. Other component of atmosphere is  $\text{NO}_x$ , a mix of nitrogen oxides ( $\text{NO}_2$  especially), a colourless and no danger gas, with the exception of its presence in stratosphere where ozone layer is destroyed. These gases were not studied 100 years ago. After 1940-1950, once the improvement of the agricultural technology by intensifying the use of fertilisers, the evolution curve of  $\text{NO}_x$  concentration began to increase, copying the evolution curve of the production and use of artificial agricultural fertilisers.

As a conclusion, the evolution of  $\text{CO}_2$ ,  $\text{CH}_4$  și  $\text{NO}_x$  concentration can be the result of the development of industrial civilisation. There is no thinking now of how to stop it and this is why there are studies on human civilisation influence on Terra

ecosystem. Ecology is defined as the science that studies the interaction between different bodies and their life environment. The agricultural and industrial revolution, the technology evolution has affected the basis of the interaction between man and environment. (Iancu Stefan, 2007) The atmosphere concentration variation, both in north and south hemispheres, has driven a land temperature increase in the last 100 years (since statistics kept) with 0,6<sup>0</sup> C. In the last years, however the pace has been increased. The land average annual temperature variation as compared with the year of 1950 (considered as comparison basis) shows the fact that after 1986; the respective temperature was anomalous warm. Year 1990 was one of the warmest and this was a large subject for the press. Mount Pinatubo (Philippine) volcano eruption has thrown a lot of dust in the atmosphere, contributing to the atmosphere cooling. After 1994, the dust from Mount Pinatubo has been laid down and the atmosphere began to warm up again. The scientist's opinions on the causes that lead to climatic changes are varied: some of them said that people are responsible for the atmosphere warm-up; other said that the atmosphere warm-up has not been caused only by the industrial development.

<b>INDUSTRIAL DEVELOPMENT IS THE RESPONSIBLE FOR THE ATMOSPHERE WARMUP</b>	<b>CLIMATIC CHANGES WERE NOT DETERMINED ONLY BY THE INDUSTRIAL DEVELOPMENT</b>
<ul style="list-style-type: none"> <li>▪ <i>The greenhouse effect, main cause of the global warm-up, studied first time by Joseph Fourier<sup>1</sup> in 1827, means that the gases from atmosphere absorb and issue infrared radiations that warm-up the atmosphere and the land surface</i></li> </ul>	<ul style="list-style-type: none"> <li>▪ There is no direct link between global warm-up and CO<sub>2</sub> emission due to the human activity. Studies show that starting with year 1940 till today CO<sub>2</sub> quantity was continuously increasing; however the global temperature decreased dramatically up to 1975 and afterwards began to rise;</li> </ul>
<ul style="list-style-type: none"> <li>▪ Planetary ocean could absorb and deposit carbon dioxide only if would be pumped to a great depth where is crystallised and deposited. As the water temperature is rising and the icebergs are melting, the planetary ocean is losing its natural capacity to accumulate CO<sub>2</sub> as has been doing for millions of years.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Solar system is today passing by some areas in our galaxy where denser stellar formations exist, <i>meaning a greater average temperature.</i></li> <li>▪ Sami Solanchi<sup>2</sup> study of 2006 supported the idea that: <i>„the increased sun radiations are responsible in a great measure for the global temperature warm-up”;</i></li> </ul>

<sup>1</sup> Fourier Jean-Baptiste Joseph (1768-1830), French mathematician suggested in 1827 that human activities have had an effect on global climate

<sup>2</sup> Solanchi Sami – manager of “Max Planck Institute for Solar System Research”, Göttingen, Germany

<ul style="list-style-type: none"> <li>▪ The major increase in CO<sub>2</sub> emissions has been remarked from the very beginning of the first industrial revolution; also added to this were the natural emissions from volcanoes and oceans.</li> </ul>	<ul style="list-style-type: none"> <li>▪ The planetary ocean has a distinct mass and this is why the temperature changes are felt by the oceanic mass after hundreds of years;</li> </ul>
<ul style="list-style-type: none"> <li>▪ National centre for Atmosphere Research from France has proved that the <i>solar activity variation has a smaller contribution on the climate than the human activity.</i></li> </ul>	<ul style="list-style-type: none"> <li>▪ If global temperature is decreasing, the planetary ocean absorbs CO<sub>2</sub>, while when temperature is increasing the planetary ocean is issuing CO<sub>2</sub>. Consequently, CO<sub>2</sub> atmosphere concentration <i>is an effect and not a cause.</i></li> </ul>
<ul style="list-style-type: none"> <li>▪ Intergovernmental Group of experts in climate evolution (GIEC) presented in Paris in February 2007 a report for the conclusion that the human industrial activity is responsible in a proportion of 95% for the climatic and ecologic disaster. Today's, CO<sub>2</sub> concentration is of 380 ppm, this level being not reached in the last 650 thousand year (for example before 1750 the level was 270 ppm).</li> </ul>	<ul style="list-style-type: none"> <li>▪ In 2007, Antonio Zichichi supported the idea „It is true that since the emergence of the industrial era, the quantity of carbonic anhydrite from atmosphere has increased. <i>But people are responsible for this only 10% because the cosmic rays are the ones that are determining Terra climatic changes in a proportion of 90%. From this reason we should not blame the people.</i></li> </ul>

At that moment it was not established if either the temperature variation was a normal one or was the start of an increased global land warm up determined by the CO<sub>2</sub>, CH<sub>4</sub> and NO<sub>x</sub> concentration. The Intergovernmental Council on Climate Changes (CISC) convoked in 1996 by UNO has reached the conclusion that due to human activities, the global climate has known a global warm-up process. According to CISC forecast, the global average temperature will increase by 2100 depending on the evolution of the atmosphere pollution with 1<sup>0</sup>-3<sup>0</sup> C. In 2007, GIEC<sup>1</sup> has received the Nobel Prize for Peace together with former vice-president of USA Al Gore. On this occasion, Al Gore stated: "We are dealing with an emergency at the planetary level. The climatic crisis is no a political problem but a moral and spiritual challenge for the entire humanity. This is also the greatest opportunity to increase the level of global acknowledgment". Mathematical models of climate evolution give only general indications without allowing for a present specifically trend. The scientists expect the climate to warm-up more at bigger latitudes than to the tropics. Consequently, the level of the sea will increase either due to the fact that the warmer water is dilated or to the fact that the

<sup>1</sup>Intergovernmental Group experts for Evolution of the Climate.

icebergs are melting. The hurricanes can become more frequently and more powerful as a consequence of increasing the water bad air power in the process of warming up. The climate will manifest everywhere through the frequent presence of the extreme phenomena: droughts, floods, heat waves, and hurricanes. International Institute for the Analysis of Applied Systems, through the project „Risk, Shaping and Politics” is exploring the potential implications of some calamity events, generated by the climate changes on society in general and on financing and insurance companies in particular, trying to find out the answer to the question of how to optimise the risk hedging by the public and private sector against extreme climatic phenomena (Kupchan Charles, 2012).

The arctic zone climate evolution is influencing the entire planet. Weather forecast, precipitations, droughts, storms; even harvests can be measured by an unusual and unexploited barometer up to now: Arctic Zone. Iceberg melting, caused by the global warm-up, has affected some animal species like seal, walrus, polar fox, and polar bear because these are building their habitats on glacier cap. The sweat water freed by the huge glacier caps produces major lack of balance in the polar habitats where the ocean water is salty. Thousands of species, the majority of them being unicellular ones, have to suffer because of the water desalination. The mentioned bodies are feeding tens of fish species, at their turn being eaten by sea ichthyophagous birds or by the man. A major risk that could appear as a consequence of glaciers melting is the apparition of very old viruses prisoned for millions of year in the glaciers.

Edward O Wilson, biologist at Harvard, has calculated that the rich biological structure that forms the planetary ecosystem is today significantly reduced. Tropical forests and other natural ecological subsystems are almost totally reduced due to agricultural area or buildings enlarging or to the water pollution. At global level it is considered that biological subsystem exposed to a maximum risk are: lake or spring fresh water, coral reefs, and tropical forests. Three fourths of birds' species are on the wane and almost one fourth from the total of 4600 birds is going to disappear. Due to rapid warm-up, there is a real risk to break the temporal and special relation between the climatic parameters within one or several communities. Climatic changes have already affected the seasonal cycle. According to some relative recent temperature statistical analysis, season length began to rapidly change after 1920. Spring is coming earlier in some cities and later in others; winter also comes or goes earlier or later (Iancu Șt. 3-1999).

What will happen in the future? A present major scientific problem is to establish possible effects that these changes could have on the planetary ecosystems. In a world with high temperature, precipitations will increase however in parts of the globe drought will spread because water surplus will not be uniformly distributed. Some humid regions will become more humid and other more droughty. Also,

some droughty regions will become draughtier. Droughts will no longer let the plants grow; the insects attacks will intensify, the diseases will spread. Due to the fact that the global economy is almost reaching the petroleum apogee<sup>1</sup>, the human civilisation is coming near a deadlock due to the following:

- cutting more and more the forests;
- soil erosion and lawn deterioration;
- decreasing the level of underground water;
- intense reduction of stream and river debits; lake disappearance;
- desert enlarging;
- temperature increase, arctic glaciers are melting, the level of sea and ocean is increasing;
- some plant species and animals are disappearing and natural fish sources are collapsing;
- decline early sign are appearing; world social division is deepening; environment refugee are appearing; terrorism and failed states appearance.

The globe climate constitutes not a linear system and this is why is so difficult to predict what will happen. The same action can cause different reactions. A temperature change can lead to a slow movement of the forests to the warmer zones, as well as a sudden change of ocean currents. But the sure effect cannot be predicted; we cannot predict what can happen if the forests are not having 1000 years to move to the zone indicated by the temperature modifications. Statistics data shows that the climatic changes driven also by the people application of the present technologies have begun to appear and develop more rapidly in the last decade. It is not forecasted if this pace will slow down or, on the contrary will increase. World Business Council for Sustainable Development (WBCSD) was formed after the conference UNO about environment and development-Rio de Janeiro, 1992, at the initiative of Stefan Schmidheiny, a Swiss successful

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<sup>1</sup> From the total number of 23 countries petroleum producers, 15 of them (including USA and Venezuela) petroleum production has reached the maximum level, while the other 8 countries (Saudi Arabia, Russia, Canada, Kazakhstan, Algeria, Angola, China and México) have petroleum production incrementing. Studies are made in order to evaluate if the petroleum production from the 8 mentioned countries would increase enough to cover the production decline of the other 15 countries. If only one country from the 8 will begin to decrease the petroleum production this will mean the start of mondial petroleum production decline.

The prospective on mondial petroleum production is shadowed by the fact that the main petroleum producer consortium has begun to massively invest in their own shares buying. Exxon Mobil has invested around 10 milliards US\$ and Chevron Texaco has invested 2.5 milliards US\$ from their profits in order to take possession of their own shares.

While petroleum resources are fewer and fewer and new resources discoveries is scarcer, the worldwide demand is in continuous expansion, the petroleum consortiums realize that their own resources need to be concentrated in order to keep the price increase.

businessman, concerned by the surrounding environment problems. Stefan Schmidheiny was convinced that the „green” ecologist activities would not solve all the present urgent problems of the environment. He treated these problems in a business way, trying to make an interest for the economic groups in order to preserve a healthy environment. Companies from all over the world were invited to involve themselves and to finance ecological projects.

First years of WBCSD activity have gathered only few and vague ideas about what should be done. Meanwhile, workshop groups of WBCSD have published remarkable studies that contributed to the presentation of what direction need to be followed. Several case studies performed in all industrial sectors clarified the notion of „economic efficiency” and proved that the organisation of economic-industrial activities taking into consideration also ecological criteria is finally profitable. An example to be given is the international campaign to eliminate the Freon gas (because it destroys the ozone layer), campaign that was initiated by the chemical concern Du Pont and not by ecological organisations. One of the most interesting workshop groups of WBCSD is the „scenario unit” that draws up credible and logical scenarios grounded on possible evolution in the global economy and societies, scenarios that are put at the disposal of economic and political decision makers. These scenarios describe like real movies what will happen in 50 years’ time in the production and repartition of goods process taking into consideration the attention that is given now to the surrounding environment. Scenarios drawing up began in 1996, year when the antagonism between ecological organisations and multinational concerns culminated to a significant conflict. The mentioned scenarios identified three decisive forces for development like:

- Innovation and its influence on economic evolution;
- Dynamic increase of globe population;
- Interconnection and globalisation, phenomena that are in early phases and because of that are creating both problems and chances.

Environment affected by technology includes the air we breathe, the water we drink, and the sun heat we enjoy. Developed countries can afford to have expenses to filter the chimney smoke, to purify the water. They can also condition the pace of development by ecological regulation in order to maintain present pollution levels, especially greenhouse effect need to be maintained below the level of 1990 (Kyoto Protocol)<sup>1</sup>. The latter regulation could not be able to be respected by almost half of

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<sup>1</sup>Kyoto Protocol is an agreement negotiated in 1997 where 169 states committed themselves to reduce the emission of greenhouse gas effect up to 2012. Protocol did not come into force up to February 2005 because one of its articles stipulated that in order to be ratified; the protocol must be signed by minimum 55 states, representing 55% from the global total greenhouse effect gas emission. Although it has been signed by 55 states before year 2005, Kyoto protocol did not come into effect because the mentioned countries did not produce 55% from the greenhouse effect gases emissions. This is why either USA (with a 36% gas emission in 1989) or Russia (with a 17% gas

the mentioned countries. Statistics show that the objective was touched by Germany and Russia, while USA and Japan are still far away. The countries that are starting the industrialisation process have no rules, only pollution. Planet future is to be decided in countries like India, China, countries from Africa or Latin America. Future world will not resemble today Switzerland, Germany or USA. These countries are good wealth islands where people are struggling for any minor reduction in toxic gas emissions, the consequent results being afterwards followed in statistics changes. Who asks himself how potable water is assured for thousands of millions of people that are living in the vast surfaces of India can understand why the economists from countries with emerging markets think that the economic development is the only possible solution under present conditions. (<http://www.acunu.org/millennium/sof2006.html>). The new industrialised countries like China, Brazil or some states for South East Asia (the so called Asiatic tigers) consider that environment protection and durable development are important problems but not primordial. While the non-governmental organisations like Greenpeace are requesting higher and higher ecological standards on the occasion of international conferences, emerging countries are requesting primarily the “economic growth to increase”.

In the actually world, the majority of the inhabitants are living in the countries of the third world, not developed, countries that are driven by the idea to repeat the evolution cycle of the developed countries. As the informational era is developing, the sub-developed world acknowledges more and more the lack of balance that becomes factor of political destabilisation. These people want good wealth and no one can ask them not to burn any fuel in order not to damage the environment. International conference for population and development, Cairo 1994, has signalled a strong relation between the human population increase, the social injustice, material consumption and environment damage. At the end of XXI century, in case the population number of inhabitants will stay constant at

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emission) needs to ratify the protocol. In 2004, Russia ratified the protocol that enters into force only on February 16th 2005. Kyoto Protocol – UNO Convention on Climatic Changes (UNFCCC) is prioritizing the development of renewable power sources as solution for a durable power development. For the period 2008-2012, Protocol stipulates the reduction with 5% of CO<sub>2</sub>, CH<sub>4</sub>, HFC, PFC and SF<sub>6</sub> emission as compared with 1990. From 128 that signed the Protocol, 55 industrialized statuses have already ratified Kyoto Protocol. No matter the share in total atmospheric emission accumulation, the flexible mechanism application Emission Trading – ET, Clean Development Mechanism – CDM and Joint Implementation - JI gives to all participants the possibility to take part to international emission market.

After UNFCCC conference, European Union has outlined the development strategy of renewable power sources, insufficient and unfair exploited up to then, “White Paper (COM-97-599 final): Energy for the Future – Renewable Energy Sources” and has ratified Kyoto Protocol committing to a emission reduction of 8% as compared with 1990; „After Kyoto strategy” under drawing up imposes a 15% reduction up to 2050.

6.4-6.5 milliards, the global economy will need a power consumption of 9 times more than the actual one. According to some forecasts, at the end of XXI century, the world population will number at least 10 milliards inhabitants, meaning a power consumption of 45-70 times more than the present one. Today's, 90% from the energy produced in the world is obtained using different technologies, by fossil fuel combustion, meaning CO<sub>2</sub> evacuation in atmosphere (Iancu Stefan, 4-1999). While changes produced in the globe climate are the result of exploiting the energy produced by the combustion of fossil fuel, the intensification of the power production using the same technological procedures means the worsening of the climatic changes. If someone has any doubts if the climate deterioration will produce or not, let's remember that the mankind is doing a huge experiment at planetary scale and due to the fact that Terra is a complex system we do not know how this experiment will end up. A negative effect will not be able to be immediately stopped. European commission has presented in 2007 a new proposal package regarding petroleum companies that concerns the reduction of greenhouse effects resulted from activities of production, distillation, transport and combustion of fuels. European executive regulations proposed the reduction with 10% of the polluted gas emissions in the period 2011-2020. European Union objective for year 2020 is the reduction of carbon dioxide emission with 500 million tons. These regulations represent the result of European block efforts to comply with the norms imposed by Kyoto Protocol regarding the reduction of polluted gas emissions that are responsible for the global warming up. At the end of 2006, the White House has declared closed the debate on climatic changes, recognising the human factor contribution on global warm-up and has suggested the obligation to reduce the consumption of fossil fuels in favour of redeemable power sources. Under the democrat leadership, USA Congress investigates the way Bush administration has altered the scientific reports on climatic changes, drawn up by American experts (Moraru Gh., 2007). China, the country of 10 of the most polluted cities all over the world<sup>1</sup>, has planned to invest 200 milliards US dollars in the following 15 years in order to increase the utilisation of redeemable power and the reduction of household power consumption. The 33<sup>rd</sup> G8 summit, organised in 2007 June 6-8 2007 at Heiligendamm – Baltic Sea, has become a reference point in the evolution in the following decades of the problem with climate warm-up. Germany and Great Britain have implied a progress on talks regarding the drawing up of a new treaty on climatic changes to apply starting with 2012 when Kyoto Protocol has expired. While USA and Europe are debating a way of solution the problem, globe warm-up cannot be disputed. Waiting costs will overpass several times the one of immediate actions.

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<sup>1</sup>China took the place of USA (although with a population of 5% from the total world population, USA consumed for several years one third of the planet resources and received the title of the main world consumer), becoming the biggest consumer of basis food, combustibile and metals (cereals, meat, petroleum, coal, steel).

For example, damages produced by Katrina hurricane in New Orleans could be caused also by the global warm-up. Global warm-up affects all of us, in different ways, the rich countries having more knowledge and resources to adapt them. Speaking about Namib and Kalahari Desert enlarging, Namibia's representative at UNO Security Council declared in 2007: „For my country there is a matter of life or death”.

„Green week” was organised at Brussels in the period 12-15 June 2007, under the slogan „Past lessons, future challenges”. Starting from the point that although is responsible for 25% from the total level of gas emission, USA refused to adhere to Kyoto Protocol because the implied reduction would affect the economic development, Manuel Basosso, European Commission president, emphasized the results drawn up at the last G8 summit, when an understanding was closed- the global warm-up is a global problem, needing urgent solution for emissions reduction.

Under these circumstances, the question is raised again: What should be done? Lester R. Brown through „Plan B<sub>2.0</sub>”<sup>1</sup> has make the following proposals that will, but in line the durable development, requests with the possibilities offered by the natural environment:

- forests protection and renewal;
- soil preserving and renewal;
- satisfying the nature need for water;
- protecting the biodiversity; including the renewing of the natural fish sources;
- use of new technologies<sup>2</sup> to contribute to the environment protection, resource economy, acceleration of material recycle process;
- transition from the economy based on fossil power sources (coal, petroleum, natural gas) to economy based on redeemable sources (wind, sun, geothermal, hydro energy, bioenergy, hydrogen etc.);
- promotion of a budget<sup>3</sup> in order to rectify Terra climatic condition.

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<sup>1</sup>In 2001, Lester R. Brown has set up the organization of ”Earth Policy Institute” and launched the book “Eco-economy” that proposed the setting up of a new science based on the collaboration between economists and ecologists, science to promote the development of a new global economy in harmony with the globe resources. New book of Brown „Plan B<sub>2.0</sub>” has appeared in 2003- first edition and in 2006 –second edition.

<sup>2</sup>A modern Aeolian turbine constitutes a power source comparable with petroleum well. Japan has design a vacuum tight refrigerator that consumes one tenths of the power used by the ones commercialised in the last decade of XX century. Hybrid supplied cars (fuel electricity) has a gasoline consumption of only 1 gallon/55 mile etc.

<sup>3</sup>The Budget of Plan B<sub>2.0</sub> provides for base social objectives (primary training, children pre-schooler and scholar assistance, reproduction health and family planning etc) 68 milliards U.S. dollars and for the objective for globe reconstruction (reforestation, erosion prevention and humus protection on the arable land, reconstruction of pastures, protection of diversification, stabilisation

Technologically, there are possibilities to catch and store in the land the emission of CO<sub>2</sub> in atmosphere and thus to reduce the greenhouse gas emissions and consequently, the climatic changes. Almost 60 % from CO<sub>2</sub> emissions are produced in stationary locations (thermo electrical power stations, refineries, gas processing installations etc.) and its catching can be realised by the use of one technology known in different industrial sectors (for example soda drink industry). Catching CO<sub>2</sub> costs, depending on the used technology, around 25-60 Euro/ CO<sub>2</sub> ton and should be optimised in order to apply it at great scale and reduce the costs by half. Storing can be successfully done in geological formations at deep salt aquifers.

If CO<sub>2</sub> catching and storing is advancing, reducing the costs to 20 Euro/tons, and the geological storage will prove itself like a sure method for the greenhouse gas reduction, then the new technology could be commercially introduced in the next decade on the condition the fiscal regimes and regulations to agree accordingly (European Network of carbon dioxide 2006).

Nanotechnology is dealing at atomic or molecular level, being able to restructure any atomic material in order to meet the proposed target. It will serve in the same time for the production of active elements for the water purification, air filtering, contributing in a significant way to the improving of the population health. Carbon dioxide, for example, could be moved away from the air doing a restructuration of its molecule, the oxygen being freed in atmosphere in order to remake the damage balance and the carbon being stored to realise new products. Today there exist molecular machines that can restructure the carbon dioxide molecule and the researchers are doing their bests to design new and better ones. Evolution trend is obvious and will accelerate as better molecular machine can serve to the design and build of even better machines.

By using the molecular nanotechnology, materials will be produced to insure the conversion of solar power into electric power, materials tough enough to pave the streets. In this way, not only a cheap power source will be created but also the possibility to create in deserts for example an ecosystem meaning that the deserts will no longer be destroyed, but on the contrary.

Nanotechnology does not only offering chances but also constitutes some ecological pollution source. More and more data gathered that proves that nanotechnological chemical products can pollute air, soil, water and being a danger for human health. Preliminary studies of State University of Arizona proved that nanoparticles accumulated in the food chain could later cause different

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of subterranean waters) 93 milliards US dollars. *Totally per annum the mentioned expenses are 161 milliards US dollars. Comparatively, the annual military expenses are summed at global level to 975 milliards U.S. dollars.*

problems (Karn.B. 2007). If responsible actions will be taken in nanotechnology development in order to protect both the health of people and of environment, these risks could be prevented. This is an opportunity for rationale action that was lost in case of semiconductor industry development. If research had done on possible implications on people or environment health of solvents or other chemical products as arsine<sup>1</sup> or trichloroethylene before their spreading in the environment, fewer polluted places would have been produced by the semiconductor industry. New nanotechnological production processes are in full development and if we do not protect the natural environment, we will be hit by unwanted consequences whose elimination will enormously cost.

There are voices that say there is no need to invest in nanotechnology field for the solving of power and environment problems. It would be enough to go back and live like farmers used to in order to find a solution to the environment problem. Those voices would need to see the population increase curve. The agricultural economy based only on muscular force could feed only 0.3-0.5 milliards inhabitants, meaning that the rest of 5.7-5.9 would find out that they would disappear. Who will make the selection of the people who will stay on the planet and of the people who will not?

Climatic changes have been generated by multiple causes; people can interfere only to reduce the greenhouse effect gas emissions produced by the combustion of fossil fuel. People interaction with nature is not a novelty, people tried to modify the nature from the very moment of first tools that were used to cut the forest in order to build the cities. Worldwide scientific community admits that undeniable evidence exists regarding the fact that people had contributed to the climatic changes. Of course, there are differences of opinions on the people impact share in causing the climatic changes. US Power department has proposed instead of reducing the polluted emission to move the main productive units across the ocean in emerging countries that do not have to respect Kyoto Protocol. The solution can be an argument in the process of political negotiation, but cannot represent a health and technical scientific thinking for the solution of a problem that affects globally the mankind. (Brown R. Lester, 2013)

Mankind does not have hundreds of years' time to solve the environment and power problems and this is why these need to be solved step by step. All the thermal power stations will not be suddenly closed down only to protect the environment. With the help of nanotechnology, a solar power industry will be created that will really be able to solve the existing environment problems by developing new power sources and by reducing the share of power production by the use of fossil fuel combustion. Gradual reduction of fossil fuel combustion for

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<sup>1</sup>Arsine – general name for some organic components derived from hydrogen arsenide.

power production up to its total elimination will lead to no more acid rains, will reduce CO<sub>2</sub> excess, will eliminate the combustion products that are today stored in the nature, will reduce the possibility of leaking the fuel from the pipes etc.

Scientists and engineers cannot control nature contribution to climatic changes, but research can identify solutions to the problems generated by the human actions; Kyoto Protocol offers opportunities in this way. It is important that scientists and engineers to be in the middle of the talks and not let behind. If climatic problems have also social roots or political dimensions, their solution by controlling the polluted emission can be obtained undoubtedly only by a fecund technical scientific thinking. Other problem that needs attention from the engineers is the reduction of power consumption by designing efficient power consumption equipment. The scientist and engineer's role will not be fulfilled only to convince people to participate to talks on the scientific rationale. This general interest problem should be debated in general public talks, sensitizing the entire world on problem content and of its solution emergency.

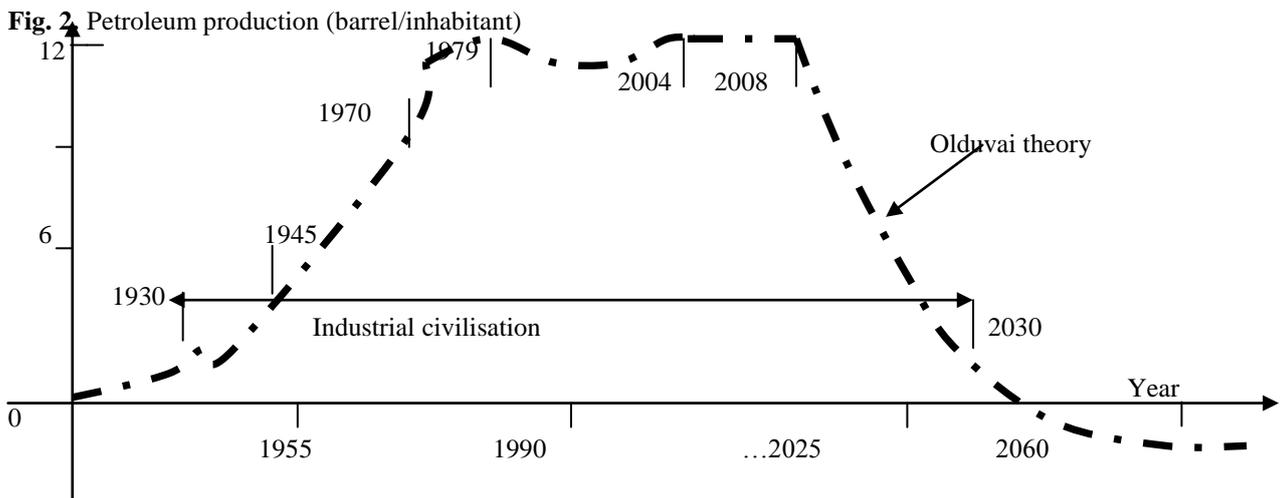
As a solution for any problem we got used to find first a technological solution to cancel the effects and only afterwards to treat the causes that lead to their appearance. The pollution problem does not let time to solve it in "classical way"; we will have to act directly to cancel the pollution causes: the unbalance between oxygen consumption and its production (forests cutting and fossil fuel combustion), greenhouse effect gases (CO<sub>2</sub>, CH<sub>4</sub> and NO<sub>x</sub>), slopping the noxious residues in nature. Today, the present solar power technology is not used massively because it is very costly. Of course, the analysis of economic effects play an important role in any industrial decision, but let's not forget that good feeling and predictions would play day by day a bigger and bigger role in the economic and political decisions that can influence the mankind fate.

In the report (<http://www.acunu.org/millennium/sof2006.html>), „2006 State of the Future”, it is estimated that taken as basis the year of 2000, the increase of gross domestic product in 2020 will be around between 32% and 62%, and the power demand between 38% and 111%. Another study, Olduvai<sup>1</sup> theory (The Social Contract, 2005-2006) presents that the power production will have an exponential decline starting with 2008 (Fig. 2.). Keeping in mind a 30% level, this decline will signify the end of industrial period started in 1930. Olduvai theory starts from the idea that no viable substitute exists for replacing the petroleum-the most important sources of energy. Irreversible decline of petroleum production and consequently of electric power production will lead to army conflicts and to decline of industrial civilisation to pre-industrial stage.

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<sup>1</sup>Olduvai –Tanzania- in Olduvai defile their important fossil deposits, numerous hominids rests belonging to the oldest Stone Age.

Contrary to Olduvai theory, the forecasts of active groups in high technology predict for 2035-2060 period to be realised the cold fusion nuclear reaction – no pollution and inexhaustible power source (<http://www.iscmns.org/iccfII/ppt/LewisRev.ppt>).



Though hundred years are necessary in order to have a balance of CO<sub>2</sub> atmosphere and environment problems need to be solved simultaneously with the increase of power production. It has to be found a technological methodology to produce power, cheaper and surer and more ecological than the one that used the combustion of fossil fuel (no secondary effect to damage the globe ecosystem) (Voicu Mihai, 2006). Examples of present alternative technologies are Aeolian, nuclear and solar technology etc. Aeolian energy can only constitute an additional source of energy. Having the present technology, the globe does not have sufficient windy zones to solve globally the power problem, to cover the energy need of the entire planet.

- Regarding nuclear power, nowadays there are known two theoretical ways for power production: by nuclear fission or fusion. After the painful experience<sup>1</sup> relatively recently lived ([https://www.google.ro/webhp?source=search\\_app&gws\\_rd=cr&ei=or2mUtPLavO4QT\\_uoHgAw#q=Chernoby1%2C+Three](https://www.google.ro/webhp?source=search_app&gws_rd=cr&ei=or2mUtPLavO4QT_uoHgAw#q=Chernoby1%2C+Three))

<sup>1</sup>Following a signed agreement between the European Bank for Reconstruction and Development (EBRD) and the Bulgarian Government of 1993, Bulgaria must close the old and considered dangerous Units 1-4 of the Kozloduy Nuclear Plant by the end of 1998. The agreement has been signed under certain conditions, including installation of new power generating facilities and modernization of Units 5 and 6. At talks due to be held in Sofia in March 1998 Bulgaria will try to convince the EU and the G-7 countries to withdraw their immediate demand for the closure of four 440 MW reactors of the Kozloduy N-Plant. The talks will have been attended by representatives of the World Bank, EBRD and the Energy Directorate of the EU. Bulgaria will present the latest results from reactor tests, as well as programs for the modernization of the units.

+Mile+Island%2C+Kozlodui) today, the industrial developed countries are more and more concerned for the safety functioning of the nuclear power station. Maybe in the next future will be discovered new technological means to store the residues that will stay noxious for tens of thousands of years. Modern human civilisation is only 200 years old, but we can admit that it can take care of the mentioned residues for a period of at least 20.000 years. With all these favourable options we cannot consider the nuclear power can solve the problem of energy because there is not enough Uranium produce the global needed power energy. Another technological solution can be the redeemable nuclear reactors with rapid neutrons. The latter will keep open the problem of world peace because will be very difficult to keep under control 185 countries with operating redeemable nuclear reactors whose products can become in any moment fuel sources for potential nuclear explosions.

The last possibility for power producing is the conversion of solar energy in electric one. Today the production of solar energy represents only 1% from the global need, although the present technologies support would be able to create at least 10 % from the total energy need. We do not have yet the necessary technology to realize the entire energy production needed for XXI century. The present data reveals that the price of photovoltaic energy is 5/2 times more than the price of conventional produced electric power. In order to equal the two prices, another technological leap needs to be done. It is justified for a consumer to use the photovoltaic energy if it is 2 km far away from the electric energy transport line. Theoretically, solar energy converters have been designed to work at smaller length wave than the light wave (400-1000 nanometre) and to be able to store the produced energy. All of these can be realised only at nanometre scale, using the nanotechnology.

Scenario drawing up does not represent the radical solution for the problems of Terra ecosystem. Any manager has the possibility to be informed on plausible prognosis and he need to know that “if you want a better thinking is better to think”. This is the start point, let’s hope our planet will improve the environment condition or at least these conditions will no longer deteriorate. Let’s hope in the next decade the air will be cleaner, the residues will be better stored or recycled; a better level of acknowledgement of the ecological problem will no tempt the statisticians to consider the state of environment superior than the one of the last decades; fact that is of no reality. Let’s hope the statistical improvement will represent real positive trends that exist in reality. Let’s hope....

## REFERENCES

- [1] Brown R. Lester, „Plan B 2.0. Salvarea unei planete sub presiune și a unei civilizații în impas”, Editura Tehnică, București, 2006.
- [2] Brown R. Lester, The New Geopolitics of Food How can we help those on the lower rungs of the global economic ladder cope with rising food prices? By Brown R. Lester, October 9, 2012; <http://www.theglobalist.com/the-new-geopolitics-of-food/>
- [3] Brown R. Lester, „India's Dangerous 'Food Bubble'” December 04, 2013 This Piece Originally Ran In The „La Times” On November 29, 2013.
- [4] Diamond Jared, „Collapse: How Societies Choose to Fail or Succeed” Penguin Group, New York, 2005.
- [5] Diane Coyle, „The Economics of Enough. How to run economy as if the future matters”, September 25, 2012; [http://www.earth-policy.org/plan\\_b\\_updates/2013/update119](http://www.earth-policy.org/plan_b_updates/2013/update119)
- [6] <http://www.acunu.org/millennium/sof2006.html>;
- [7] <http://www.iscmns.org/iccfII/ppt/LewisRev.ppt>;
- [8] [https://www.google.ro/webhp?source=search\\_app&gws\\_rd=cr&ei=or2mUt-PLavO4QT\\_uoHgAw#q=Chernobyl%2C+Three+Mile+Island%2C+Kozlodui](https://www.google.ro/webhp?source=search_app&gws_rd=cr&ei=or2mUt-PLavO4QT_uoHgAw#q=Chernobyl%2C+Three+Mile+Island%2C+Kozlodui)
- [9] Iancu Șt., 1999, „Tehnologie-ecologie: interacțiuni și efecte”, Revista “Inventica și economie” nr 3-1999;
- [10] Iancu Șt., 1999, „Soluții posibile pentru efectele ecologice ale tehnologiei” Revista “Inventica și economie” nr 4-1999;
- [11] Iancu Șt., 2007, „Technology, Ecology – Interaction, Effects and Possible Diminution of Effects”,
- [12] Communication at the National Autumn Session of the Academy of Romanian Scientists;
- [13] Orseille Jean et Chanaron Jean-Jacques “Le lobbying en faveur de l’hydrogène est bien organisé. A qui profite le spectacle?” La Recherche, October 2002;
- [14] Karn B, Matthews H.Scott “Nanoparticles”, IEEE Spectrum, September 2007;
- [15] Kupchan Charles, „Western dominance will wane in the 21st century, but what will take its place?” April 16, 2012, [http://www.earth-policy.org/plan\\_b\\_updates/2013/](http://www.earth-policy.org/plan_b_updates/2013/) ;
- [16] Moraru Gh., „Conferințe internaționale dedicate mediului ambiant”, Știință, Industrie, Tehnologie, nr.1/ 2007 ;
- [17] \*\*\*\* „Rețeaua europeană de bioxid de carbon (European Network of carbon dioxide 2006 “), Știință și tehnică, nr 3/2006;
- [18] The Social Contract, 2005-2006, The Olduvai Theory, Energy, Population and Industrial Civilization.
- [19] Voicu Mihai, „Secolul XXI sau Cum descinde secolul XXI din mileniul II”, București, Editura Academiei Române, 2006.