# SUSTAINABLE NATURAL RESOURCE UTILISATION IN OUR FUTURE

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## Abstract
Owing to the unstoppable population growth and the exponentially increasing energy consumption we have crossed the limits of the Earth's biological carrying-capacity. It must be realized that we have come to the end of an economy based on the use of cheap fossil fuels. In this century humanity must return to the basics of life on earth and consider global challenges.Increasing energy efficiency and the use of environmentally sound technologies are important issues of cost-effectiveness in the economy. Our goal is to develop and generalize technologies with low carbon intensity throughout the total life cycle in order to reduce the effects of pollution and climate change.The dissemination of renewable energy sources is inevitable in the long term. The honest exploration and discussion of the time of introduction, the methods, and the potential problems and doubts are necessary to secure our future.The “green economy” can boost job creation and the local energy production methods as well as the autonomous energy supply for small communities as the basis of sustainability can play a greater role. Energy import may be reduced through sub-regional and autonomous local energy production and supply solutions based on renewable sources and through the promotion and implementation of a more energy conscious lifestyle.
**Key words:** sustainability, renewable sources, green economy, pollution

## Introduction
The new idea that builds on the recognition that the Earth is a finite world, the resources are not endless, and thus the vision of continuous growth cannot be sustained can be traced back to the 1960s. Global problems had already occurred by then, and trends calculated from the data indicated a rapid disaster for the future. Global problems include population growth, pollution, rapid depletion of resources, the global growth of poverty, loss of biodiversity and climate change. The population explosion in recent decades the vagaries of industrial and technological development, and the explosive growth of consumption has upset the harmony between people and nature and human activity is a direct mortal threat to our planet’s wildlife. The climate change that threatens the entire human race - and has been proven to accelerate due to human activities - requires quick action. Greenhouse gases must be reduced and we have to prepare for weather anomalies associated with climate change. This book deals with energy use and energy diversity at world-, European- and national levels. Changes and trends will be presented and analysed.Increasing energy efficiency and the use of environmentally

sound technologies are important issues of cost-effectiveness in the economy. Our goal is to develop and generalize technologies with low carbon intensity throughout the total life cycle in order to reduce the effects of pollution and climate change.

## Data and Methods

In the following sessions, the paper focuses on sustainable development, which means different opportunities, production, consumption of the fossil, and renewable energy sources, however, the motivation and the future goals have become the same for all over the World.
The methodological approach is mainly descriptive. The analysis will be based on relevant statistical data from secondary sources from national and international literature.

## Results and Discussion

## Humanity and energy

Nowadays population growth seems to be unstoppable as the number of the world population exceeded 7 billion in 2012. Since 1960 the population of Africa almost quadrupled, that of Latin America tripled, while the number of people in Asia has grown by two and a half times.According to the estimates by IEA – WEO (International Energy Association World Energy Outlook) (2012) (1) by 2035 the population of the world will have exceeded 8,5 billion. Around 2025 the population of India will be larger (1,5 billion) than that of China.Over the past two centuries in Western countries the so-called modern demographic cycle went through all the phases. Europe's population increased fourfold, the number of births per woman fell from 5 to under two, the birth and death rate dropped from 35-40 per cent to 10%. Life expectancy increased from 30 years to 75-80 years. This change is called the "demographic transition".(2) Countries with high birth-rates will have to go through similar phases so as to stabilise their population but this will only happen in the distant future.Africa and India should implement the transition through a much shorter time, because the longer the transition the more unfavourable the consequences of the rapid population growth will be considering the conditions for development.Population growth is associated with an increase in energy demand. Changes in energy policy are inevitable, but even so the demand for energy is expected to increase by 1.2% a year and between 2010 and 2035 it is likely to reach a 30% growth.90 percent of energy demand growth is generated outside OECD countries, and fossil energy sources will be determining in the future.It is expected that by 2035 their rate will decline from the current 85% to 71%, while the proportion of renewables will grow slowly from 13% to 18%.IEA – WEO 2012 data reveal a slow decrease in coal production and an increase in the consumption of natural gas (Table 1).

Table 1: **World energy demand growth in Mt oil-equivalent units**

| | **1990** | **2010** | **2015** | **2020** | **2030** | **2035** | **Average growth rate for the total 2010-2035 period** |
|---|---|---|---|---|---|---|---|
| Coal | 2 231 | 3 474 | 3 945 | 4 082 | 4 180 | 4 218 | 0,8% |
| Crude oil | 3 230 | 4 113 | 4 352 | 4 457 | 4 578 | 4 656 | 0,5% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Natural gas | 1 668 | 2 740 | 2 993 | 3 266 | 3 820 | 4 106 | 1,6% |
| Nuclear | 526 | 719 | 751 | 898 | 1 073 | 1 138 | 1,9% |
| Water | 184 | 295 | 340 | 388 | 458 | 488 | 2,0% |
| Biomass and waste | 903 | 1 277 | 1 408 | 1 532 | 1 755 | 1 881 | 1,6% |
| Other renewable | 36 | 112 | 200 | 299 | 554 | 710 | 7,7% |
| Total | 8 779 | 12 730 | 13 989 | 14 922 | 16 417 | 17 917 | 1,2% |

Source: 1

Kempf (2013) (3) stated that the concept adopted by the OECD biomass will replace fossil energy. Biotechnology (DNA transformation of plants) and synthetic biology (production of new varieties) will be able to produce oil substitutes. The idea may be fruitful in the long run, but without the moderation of growth it has no reality. The new economic system is organised by giant corporations according to the principles of the free market, which raises many doubts from an environmental point of view. The system is already in operation in Argentina, Brazil and Indonesia in sugar cane, GM soya and palm oil cultivation causing significant environmental damage.

In addition to fossil fuels (78,70%) the use of renewable sources (18,30%) is also increasing, especially in the traditional biomass energy supply (Figure 1)

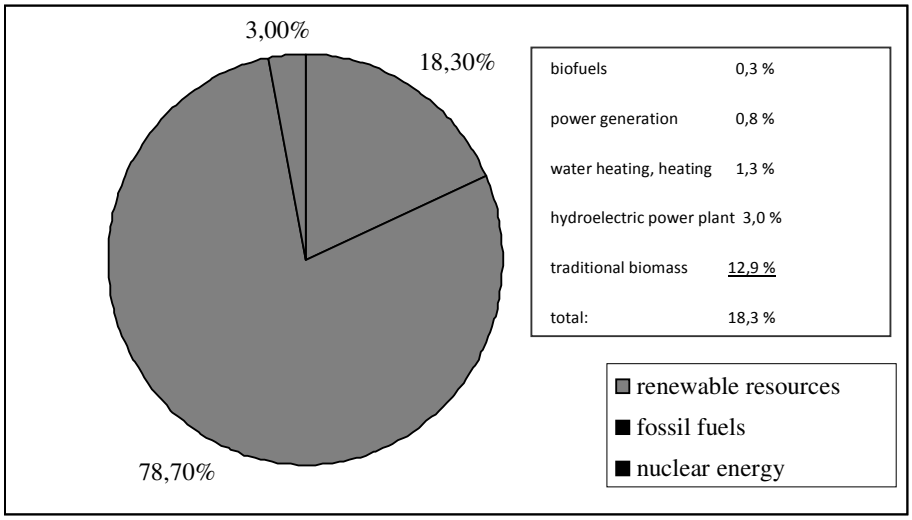


Figure1: **The global distribution of energy consumption by energy source**

Source: reference (4)

Traditional fossil fuel extraction yield peaks are not distant:
oil - between 2010-2020
coal - 100 to 150 years from now
natural gas - from 120 to 150 years from now

235urán - 100 to 120 years from now
238urán - 10,000 to 60,000 years.
The non-conventionally exploited oil and gas reserves allow the relatively inexpensive further use of fossil fuels. In the U.S. shale gas production decreased the price of gas by a third, and the U.S. could become an exporter. This offers new opportunities and capital investments for the energy-intensive industries in the U.S. (chemical, aluminium, steel and fertilizer production etc.). The liquefied form of gas (LNG) can be exported so there could be a unified gas market. The world's gas production is growing continuously and so do the unconventional production methods.Shale gas exploration in many cases leads to significant methane emissions, which will further fortify climate change. Another disadvantage is the considerable consumption of water and chemicals, which may cause environmental pollution. Falling energy prices in the U.S. may create the illusion that fossil fuels will not run out, and there is no need to save and find alternative solutions.
The changes are expected to slow down energy consumption generated from renewable energy sources as fossil energy will be competitive for a long time. Nevertheless, the fact is that the changes are inevitable owing to the climate change.The use of nuclear energy is a sensitive issue, and opinions differ worldwide. However, the development of nuclear energy seems to be constant and the sources of uranium will last for a long time. Considering the current use of uranium resources are sufficient for about 100 to 120 years.Instead of the current 439 nuclear reactors there may be as many as 1400 in operation in 2050 according to the International Atomic Energy Agency. Each year, about 30 power plants are built around the world, but the growing energy needs may increase this rate. Nuclear power production does not cause $CO_2$ emissions, so in principle with the higher number of reactors in 2050 it is possible to meet the UN expectations of reducing $CO_2$ emission by 14 million tonnes. Uranium is available in politically stable countries so unexpected events cannot cause a crisis in the energy market. It is expected that the proportion of nuclear power will increase quickly.

**Energy and environmental policy, international agreements**

It became obvious in the 1970s and 80s that human activity causes global environmental impacts. From then on the monitoring of the state of the environment became conventional. At that time it was $SO_2$ emissions related "acid rain" which caused the main problems. After a while it became clear that one of the major causes of anthropogenic climate change is the growing atmospheric concentrations of greenhouse gases resulting from the consumption of fossil fuels.Due to the global effects the problems cannot be handled by individual nations thus international cooperation is needed. The rapid deterioration of the human environment led to the development of the first global program, which took place in Stockholm in 1972. The UN Environment Programme (UNEP - United Nations Environmental Programme) was established to coordinate and manage international cooperation.
During the 1979 World Climate Conference in Geneva a decision was made to implement the World Climate Research Programme (WCRP - World Climate Research Programme). In 1984, the UN General Assembly established the World Commission on Environment and Development. The Norwegian Prime Minister Gro Harlem Brundtland became the chairman. They released the report "Our Common Future", which first formulated the ideas of sustainable development. They declared that the economy can grow only if the environment is

preserved.In 1988 the Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change, IPCC) was established. So far it has released four evaluating reports (1990, 1996, 2001, 2007), the fifth report is being published currently.

The EU Sustainable Development Strategy was adopted during the 2001 Gothenburg European Council.

In 1992 the United Nations organized the World Conference on Environment and Development in Rio de Janeiro, which relied on the report "Our Common Future". Important documents on sustainable development were adopted during the Rio conference such as the "Tasks of the XXI. Century" (Agenda 21) document, which provides a comprehensive program of sustainable development, the Rio Declaration which includes the principles of sustainability, and the principles of sustainable forest management. The Convention on Biological Diversity and the Framework Convention on Climate Change, which are also referred to as the "Rio Conventions", were opened to be signed.

At the end of August 2002 the World Summit on Sustainable Development were held in Johannesburg, South Africa. The conference's ideas were only partially successful. Instead of the "Declaration of the Earth" a much "softer" document was adopted ("Rio Declaration"), which contained only principles. However, the Climate Change Framework Convention and the Convention on Biological Diversity were signed by the majority of the participating countries. Mandatory standards were not adopted for the protection of forests merely a recommendation was formulated.

The Kyoto Protocol, signed in 1997, is an international agreement bringing together developed countries in which the participating industrialized countries oblige themselves to cut their carbon dioxide emissions to 5.2 % below the 1990 level within one decade .By December 2006 169 states joined the Convention; these countries were responsible for 61.6 percent of global $CO_2$ emissions.

The USA and Australia did not join. Although India and China did join, but due to the special treatment it was not mandatory for them to reduce their $CO_2$ emissions.

Commitments under the Kyoto Protocol are not enough to stop climate change, but because of conflicts of interest no agreements were signed in the following conferences (Copenhagen 2009, Cancun 2010, Durban 2011). At the end of 2012 in Doha at the UNFCCC (United Nations Climate Change Convention: United Nations Framework Convention on Climate Change) Conference it was agreed that the validity of the Kyoto Protocol had to be extended until 2020.[23] Further negotiations are in process in order to prepare a new global agreement, which should be ready by 2015.

## The role of different renewable energy sources

There are plenty of renewable energy resources available and it would be possible to satisfy our total energy needs from these sources providing that they were used in a sensible way. However, we are a long way away from this as only 18% of the energy we consume originates from renewable sources. The global energy need is growing continuously due mainly to China, India, and the developing countries.

The Earth's energy supply can be considered inexhaustible as the solar energy we receive is 1 524 000 EWh (1 EWh = $10^{12}$ kWh). The current world energy consumption is only 100 EWH. The next renewable energy source is the wind (30,800 EWH), followed by the wave

energy and sea water (7620 EWH), biomass has less potentials (1520 EWH) and finally hydropower (46 EWH) must also be mentioned. These figures represent global values. (6)
Technical potential refers to (*"from the technical point of view realistically exploitable within structural constraints")* the volume that can be achieved with current technology, which is still greater than the economic potential (which refers to the *„economically exploitable potential"*). Compared to the economic potential the actually (realistically) exploitable so called **sustainable potential** (i.e. the *"potential that can be utilised in harmony with social ecological factors")* is even smaller, more restricted**.**(7)
Table 2 summarises the global technical potentials of renewable energy sources.
Table 2: **Global technical potentials of renewable energy sources (IPCC, 2011)**

| Energy source | Global technical potential (EJ) |
|---|---|
| Solar energy | 1 575 – 49 837 |
| Geothermal energy (electricity) | 118 – 1 109 |
| Wind energy | 85 – 580 |
| Biomass | 50 – 500 |
| Geothermal energy (heat) | 10 – 312 |
| Energy from the oceans | 7 – 331 |
| Hydro energy | 50 – 52 |

Source: reference(8)

The amount of the potentially usable renewables could satisfy the current total energy demand of mankind no less than twenty times. The UN Intergovernmental Panel on Climate Change (IPCC) concluded that within four decades 80% of the total energy needs of mankind could be met using solely renewable energy. To do this, governments should create public policies on green energy policy. The technology of green energy production is still more expensive than the utilisation of oil, coal or natural gas. To prevent global warming the production of renewable energy should be multiplied by twenty times. This investment would require about 1 percent of the total global GDP. (9)

***Solar energy***

The use of solar energy is currently next to minimal, but it is evolving rapidly. Its utilization can be passive when it comes to the design and construction of buildings in order to make use of solar energy, and it can also be active when heat or electricity production is conducted. The solar thermal systems convert the sun's energy into heat, while the solar panels produce electricity from solar radiation. (10)
The utilisation of wind and water energy can be traced back to the sun's energy, and biomass energy also generates the energy content of plants - which are involved in energy production and use after conversion - through photosynthesis.
Table 2: **Potential annual solar energy production in different regions of the Earth**

| Region | Potential energy production (EJ) |
|---|---|
| Western Europe | 25 – 914 |
| Central- and Eastern Europe | 4- 154 |

| | |
|---|---|
| Former Soviet Union | 199 – 8 655 |
| North America | 181 – 7 410 |
| Central and South America | 113 – 3 385 |
| Middle-East and North Africa | 412 – 11 060 |
| Africa (Sub Saharan) | 372 – 9 528 |
| Asia | 196 – 6 469 |
| **Total** | **1 502 – 47 574** |

Source: reference (11)

***Windenergy***

Today wind energy has become competitive compared to many traditional energy sources. This resource - under certain wind-related barriers - is competitive and should be preferred because it does not trigger climate change. (12) The aggregate wind power capacity at the end of 2011 represented a nominal capacity of 238 GW, the distribution between countries is shown in Table 3.

Table 3: **Cumulative wind power capacity**

| Country | MW | % |
|---|---|---|
| China | 62,364 | 26,2 |
| USA | 46,919 | 19,7 |
| Germany | 29,060 | 12,2 |
| Spain | 21,574 | 9,1 |
| India | 16,084 | 6,8 |
| France | 6,800 | 2,9 |
| Italy | 6,737 | 2,8 |
| UK | 6,540 | 2,7 |
| Canada | 5,265 | 2,2 |
| Portugal | 4,083 | 1,7 |
| Rest of the world | 32,143 | 13,5 |
| Total top 10 | 205,526 | 86,5 |
| **World total** | **237,669** | **100,0** |

Source: reference (13)

Looking at the world market, China and India are increasing their capacities at a rapid rate and the two countries gave more than 50% of wind power market in the world in 2011. The distribution of installed wind power capacity in 2011 (MW 40.56).

The amount of the utilised wind power in the world tripled between 2008 and 2012. (14) The globally generated wind power exceeded 282,000 MW at the end of 2012.

***Hydro energy***

During the utilisation of hydro energy the potential energy of water is exploited in a way that electricity is generated in hydroelectric power stations. As a result of solar radiation water is in continuous circulation thus its energy resources are constantly renewed, which makes it a never exhausting “renewable energy source”. After the oil price shock of the 1970s

hydroelectric dams became increasingly competitive and became an instrument for the dissolution of fossil fuel dependency. Flowing waters have kinetic energy while still waters have potential and pressure energy. Hydro energy compose of all these energies. The world's technically recoverable hydropower capacity (according to estimates) is about 20,000 TWh, while the total global hydropower production is about 2,000 TWh, which is only 10% of the technically recoverable energy (Table 4).

Table 4: **The world's hydropower potentials by continents**

| Continent | Theoretical Hydropower-potential TWh | Technically utilisable-TWh | Total electricity generation TWh | Hydro-energy generation TWh | % of hydro-energy | Utilised technical hydropower potential % |
|---|---|---|---|---|---|---|
| Europe | 4 360 | 1 430 | 2 599 | 453 | 18 | 32 |
| North America | 6 150 | 3 120 | 3 202 | 642 | 20 | 21 |
| Latin-America | 5 670 | 3 780 | 370 | 281 | 76 | 7 |
| Africa | 10 120 | 3 140 | 234 | 49 | 21 | 2 |
| Asia | 20 430 | 7 530 | 3 475 | 564 | 16 | 7 |
| Oceania | 1 500 | 390 | 161 | 39 | 24 | 10 |
| **Total** | **18 230** | **19 390** | **9 962** | **2 028** | **20** | **11** |

Source: reference (15)

Today more than 160 countriesaroundtheworldgenerateelectricityusinghydropower and thetotalcapacity of theapproximately 11,000 hydropowerplantsworldwide is 874 GW. Half of thetechnicallyrecoverablehydroenergycan be foundin 5 countries, namely: China, USA, Russia, Brazil, Canada. (16)

***Geohertermal energy***

Geothermal energy is the internal energy of the earth's crust, which can be utilized for energy purposes. It can be considered as a source of clean and renewable energy as the heat from the interior of the Earth is virtually unlimited. The energy is accessible at any time of the year, unlike wind and solar energy. The constantly flowing heat from inside the Earth represents 42 million MW of power, so its utilisation is justified. (17)

The capacity of geothermal power plants in 2012 exceeded 11 GW. The rate of capacity expansion is dynamic.The main types of utilization and their distribution is as follows: heating of buildings (63%), baths, balneology (25%), horticultural greenhouses and soil heating (5%), industrial heat consumption and agricultural drying (3%), aquaculture and fish farming (3%) , snow-melting (1%). (18) The main heat utilising countries are shown in Table 5.

Table 5: **Direct heat utilisation in different countries at the end of 2009**

| Country | Capacity, MW | Annual use, GWh/year |
|---|---|---|
| China | 8 898 | 20 931,8 |
| USA | 12 611,46 | 15 710,1 |
| Sweden | 4 460 | 12 584,6 |
| Turkey | 2 084 | 10 246,9 |
| Japan | 2 099,53 | 7 138,9 |
| Norway | 3 300 | 7 000,6 |
| Izland | 1 826 | 6 767,5 |
| France | 1 345 | 3 591,7 |
| Germany | 2 485,4 | 3 546,0 |
| Holland | 1 410,26 | 2 972,3 |
| Italy | 867 | 2 761,6 |
| **Hungary** | **654,6** | **2 713,3** |
| New-Zealand | 393,22 | 2 653,5 |

Source: reference (18)

***Biomass***

Biomass is potentially the largest source of renewable energy, the annual primary production reaches 4,500 EJ, of which 2,900 EJ can potentially be used as bioenergy. The extraction of about 10 percent of the total amount is sustainable in the long-term. (19)

Almost 10% of the annual global energy consumption (approximately 500 EJ) originates from biomass-based energy production and biomass provides a significant part - varying from country to country -of renewable energy. Due to its limitations (industrial production, fertilizer use, changes resulting from land use) it does not necessarily guarantee the upkeep of $CO_2$ balance. (20)

Biomass energy can be grouped according to:

- generation level,
- mode of energy conversion,
- final product,
- storing possibilities.

## Sustainable development

A lot of people misinterpret the definition. The reason is that they can not distinguish between growth and development. It is important to declare that in economic terms sustainable development is not the opposite of growth. The condition for responsible management is the assessment of the supply of private and public goods and measuring value of such services taking into account the external costs and gains on a yield-oriented bases. (21)

Costanza (1989) created a definition from an ecological point of view. In his opinion, a condition is sustainable when the minimum conditions are provided for ecosystems so that

they are stable and resilient. Sustainability is a relation between human economic systems and a more dynamic but normally slower changing ecological system in which:
the survival of human life is provided in the long run,the individual has the possibility to ensure their own and their family's well-being,human societies and cultures are able to improve, but in which the effects of human activity are curbed so as not to destroy diversity, complexity, and ecological life-support functions" (22)Another example of an ecocentric definition originates from the OECD, according to which: Sustainable development is a development that does not harm the health of populations and ecosystems, and satisfy the socio-economic needs in a way that renewable resources utilised slower than the amount of time needed for their regeneration and non-renewables are used slower than the regeneration of renewable sources that can applied to substitute them. (23,24)
Ecological economics brought about a paradigm shift in economic thought by exploring the complex relationship between nature and society. Thus, the Earth as a global ecological system presents an absolute limit to society and the economy.
The principle of sustainable development nowadays has two interpretations (weak and strong). Weak sustainability means that social, economic and environmental considerations are equally taken into consideration in the decision-making process.
This is shown in Figure 2.

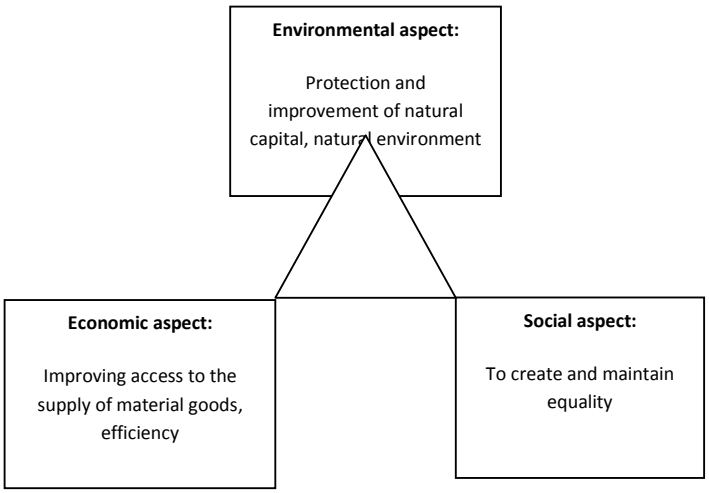


Figure 2: **Aspects of sustainability**

Source: reference (25)

The weak sustainability criterion states that the total value of natural capital, human capital and that of the man-made goods as capital cannot reduce over time. This idea assumes the unlimited mutual substitutability of capital goods and creates the necessity to financially assess nature which is reflected by the applied tools (e.g. the internalization of externalities). (26) The shortcoming of the theory is that it does not count with the undoableness of the changes caused in the ecosystem. (27)
In the case of strong sustainability the external environmental constraints must be abided by as such, which means that the emissions must not exceed the environment's capacity to absorb, the use of renewable resources must not exceed the rate of formation and the use of

non-renewable resources must not exceed the rate at which sustainable and renewable substitution occurs.

Sustainable development strategy is a long-term program for humanity. However, beside a global level implementation has national, local and micro-regional ones as well. Local levels have a crucial role in realising the objectives.

From the point of view of efficiency it is very important to distinguish the levels and areas of sustainability. (28) Global and long-term principles of sustainable development often unfold in the regional and local programs, which may be organized, regulated and controlled by the authorities of a given a level. It is possible at this level to mobilize, persuade and teach people to be responsive to sustainable development. (29)

LÁNG (2003) believes that sustainable development is based on three pillars. The Stockholm Conference created the natural environmental pillar, the Rio Conference brought the economic pillar to the forefront, while the Johannesburg Conference emphasized the social pillar. (30)

## Green economy and green growth

In the light of new data and research results we must realize that the growth paradigms used so far are unsustainable. The United Nations, the European Union and the OECD play a pioneering role in the development of methodology and the measurement of "green growth". We must strive to accomplish a synergistic relationship between economic growth and environmental protection with lower energy consumption. (31) To do this, three main objectives should be fulfilled:

- support for green growth,
- improving the quality of life of society,
- participation in the international fight against climate change.

In order to solve the climate crisis the net amount increase of greenhouse gases must be reduced by at least 80-90 percent. Currently it seems highly unlikely since China and India use huge amounts of coal, natural gas and oil in order to achieve fast development. It is worth studying the energy use of these continent-sized countries for the future of our civilisation may depend on them. The relationship between the use of renewable energy and food production is an interesting question since land use must be carefully considered in order to avoid hunger strikes.

## Summary

Economic growth, employment and future opportunities depend on the status of energy production and use. An alternative economic model is required which is characterized by energy saving, energy efficiency and the use of renewable energy sources. The current energy structure is not exchangeable for a long time thus we have to face anomalies associated with climate change. Due to the unstoppable population growth and the exponentially increasing energy consumption we have crossed the limits of the biological carrying capacity of the Earth. Currently humanity uses more than 1.5 times the of the Earth's natural resources and natural amenities. 80% of energy use today is based on the use of fossil fuels whose peaks in production yields are not far away.Increasing emissions of greenhouse gases cause global warming. The main culprit is $CO_2$ whose concentration in the atmosphere increased from the

1960 level of 320 ppm to over 400 ppm by 2013. The Kyoto Protocol, signed in 1997, is not enough to stop climate change, a new agreement is required. If current trends continue, by 2060 the Earth's temperature will increase by 4°C, which can have devastating consequences. World energy demand and consumption continues to grow, especially because of China, India and the developing countries. The answer could be the use of renewable energy sources whose potential amount could cover the full amount of potential energy needs of humanity up to twenty times. The potentials of solar energy are promising, but further research and development is required. The prices of equipment is rapidly decreasing, the international results can be adopted. The utilisation of wind energy is spreading fast on coastal areas, the technology is evolving rapidly. Developments in China, the USA and India are promising.

Wind energy combined with solar energy utilization forming a hybrid system may become a significant factor in autonomous power supply. Hydro energy requires significant investment, but because of the long lifetime of the power plant it pays off. The facilities may play a role in flood regulation and agricultural irrigation. Geothermal energy is a clean and renewable source of energy which is suitable for direct heat recovery and electrical power generation, too. The direct heat utilization is the general, especially for heating buildings. Heat pumps used in low depth is suitable for heating, or cooling.Biomass is potentially the largest renewable energy resource. Its energy recovery is versatile. Biofuels could substitute gasoline and diesel. In the EU member states are expected to increase the share of renewable energy in transport to 10% by 2020.

Biofuel production generates ethical and environmental conflicts and it is expected that 5-10 years from now second generation fuel production, which does not threaten food production, will prevail.

The world leaders should see that the current level of energy consumption cannot be held, while its increase cannot even be considered. The dissemination of renewable energy sources requires investments, profitability is expected only in the long term.

Political leaders think in terms of election cycles, curbing energy use would decrease quality of life, which they do not risk. Changes in behaviour can only be expected in the case of climate change and one can only hope that when it is recognized the negative trends are not irreversible.

The previously existing harmony between mankind and nature has ceased existing, the Earth's resources are finite, the exponential growth presents a deadly threat to our planet's wildlife. In countries with growing populations the severe lack of water and food can lead to the total destruction of the social order. The population of megapolises has increased tenfold over the past forty years, in 2013 there were 23 cities whose population exceeded 10 million. The excessive consumption of freshwater and soil erosion make the possibility of a further rapid increase in food production dubious.

By the use of fossil fuels 90 million tons of pollutants a day is emitted into the thin layer of the planet's atmosphere, which acts as a heat trap and accelerates global warming. In order to be able to combat the climate crisis humanity should take immediate, significant, and coordinated actions, but it has not happened yet. Should these processes remain unchanged, a significant extinction of species may occur, which was solely triggered by human activities. If we do not want to ruin the future of our children and grandchildren, any new era of economic growth must be less energy intensive.Under the leadership of Norwegian Prime Minister Gro

Harlem Brundtland the World Commission on Environment and Development worked out a detailed political plan about sustainable development. The Final Report was published in 1987 with the title of "Our Common Future". Sustainable development is a long-term program of mankind, which must be implemented at the global, regional and local level. A thrift life is the first step towards sustainability. In order to realize the goals environmental, social and economic conditions must also be met.

Sustainable development is often found to be unfolding in the regional and local programs. People establishing close cooperation with nature must adapt to the environment by using a decreasing proportion of import resources. It is necessary to preserve the biological diversity and strive to exploit the opportunities offered by sustainable land use, agriculture, and natural industry. Changes in sustainability are to be tracked by variable data analysis of natural environmental, economic and social indicators.

With the expansion of globalization the use of resources and their unsustainable exploitation have accelerated. The analyses unequivocally demonstrate that the state of the environment has continued to deteriorate and natural resources are wasted unnecessarily. In the future the process is expected to continue to worsen as the population – and in parallel with it consumption – grows exponentially

According to the Millennium Ecosystem Assessment, published in 2005, unprecedented changes in the ecosystem have occurred in the past 50 years. Demand for food, water and energy rapidly increased, which speeded up the changes. Due to the acidification of sea water most of the coral reefs have been destroyed or damaged, half of the mangrove forests have been destroyed, the frequency and intensity of floods and forest fires have increased significantly. More than 700 European species are threatened with extinction.

Essential life-sustaining systems thought to be ever-existent have been damaged; the water cycle, atmospheric composition, natural assimilation of waste, the reutilisation of nutrients, plants pollination, the delicate balance of the coexistence of fauna and flora have all been jeopardised.

According to some these ominous changes should be treated as a moral issue, companies and leaders of industries prefer an economic system which can be characterized with ruthless competition, selfish accumulation of material goods and excessive consumption. Our attitude should be fundamentally changed. The Earth is heading towards an economic collapse. Overshooting and collapse may be our future unless we learn to cooperate rather than compete with each other for the sake of our children and grandchildren.

From the point of view of climate change the reduction of air pollution would be the most important. Energy efficiency must be improved and cleaner energy sources as well as less polluting technologies should be disseminated. Over the past 12 years the emission of harmful substances has improved significantly in Hungary in every respect except for atmospheric particulate matter (PM 2,5). This improvement cannot be observed in the developing countries of the world thus the risk of climate change increases.

High $CO_2$ levels (over 400 ppm) can be dangerous if methane is released from polar ice sheets and the tundras because of warming temperatures, which can cause further rapid warming. We are now in unfamiliar territory.

Recent studies have shown that the growth paradigms used so far are unsustainable. Even the international organizations promote "green" growth, which is necessary and economically

feasible. The United Nations Environment Programme states that the green economy is to increase human well-being and reduce social inequalities while greatly reducing the environmental impact.

Green growth can be measured with already developed indicators and it helps to realistically assess the situation. The biggest challenges are:

- climate change,
- reduction of biological diversity,
- non-sustainable management of water resources,
- pollution and health effects of hazardous chemicals.

It can be declared that for the sake of development and sustainability the economic model based on conventional (fossil) energy sources must be replaced by an alternative economic model which is basically built on green technologies and utilises renewable energy sources on a large scale.

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