

GLOBAL WARMING



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MINAS GERAIS



CREA-MG
Conselho Regional de Engenharia, Arquitetura
e Agronomia de Minas Gerais

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Energy, Environment
and Social Inclusion

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Foreword

How to deal with the ongoing climatic changes?

The planet Earth yells for help. The pollution in the great urban centers, the lack of basic sanitation in the developing countries, the deforestations, the burned-over forest lands, and the threats towards the water resources are problems of which origins are embedded in the existing industrial development blueprint in all countries, which increases the greenhouse effect each year, and therefore intensifies the climatic changes around our planet.

The survival of the living beings on Earth is threatened. The scenery faced around the world is worrisome as the great majority of scientists have declared that the global warming is irrefutable, and has been caused by the human activities. It's a consensus amongst the scientists that the living quality on the planet has been jeopardized, and the food production may be endangered as the global temperature step-ups, and may as a consequence become insufficient for the ever increasing world population.

We all must wake up from the childish dream in which we seem to be conceiving a planet with infinite and renewable natural resources, which's nothing but an illusion!

We all must be committed to the concept of a Sustainable Development that would be capable to provide us with the actual generation needs without venturing the future generations: our children, grandchildren, and so forth.

This brochure, which's published in partnership with the Regional Council of Engineering, Architecture, and Agronomy (Crea-MG) embodies an important contribution made by the Union of Engineers of the State of Minas Gerais, Brazil (Senge-MG) to help boost this discussion all around the world.

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Global Warming:

Energy, Environment, and Social Inclusion

The environment matters have become one of the greatest concerns of our time throughout the world. More and more, the public opinion has been focused on living quality, and on the future of the planet while it increasingly supports environmental groups and political parties that support the green deal.

A growing universal awareness of effects brought about by the world's population growth, the finitude of the available resources, the industrial pollution, the global climate changes, and the wasting stream of the mass consumption era. All these issues have now been seen as different aspects of the same problem – our inability to promote a sustainable development so far.

The technological advancements and the world's population growth have brought consequences to the planet. Manufacturing plants, vehicles, and the garbage along with the deforestation have already become a problem. And that has been happening because certain gases in the atmosphere, mainly the ones that come from carbon and have the potentiality of retaining heat, and then build up an insulating layer around the Earth. Such layer allows for the solar rays to pass through; however it prevents part of the heat generated on the Earth from escaping.

The phenomenon may be compared to a greenhouse, and that's the origin of the term "greenhouse effect" usually used to describe the heat retention mechanism in the atmosphere. The progressive accumulation of gases that cause the greenhouse effect produced by the humans in the atmosphere has now been considered a factor that contributes to aggravate the global warming by constituting a possible agent of the climate change.

If the current practice is not changed, the Intergovernmental Panel of the Climatic Change forecasts that by the end of the twenty-first century there will be an increase of about 3°Celsius on the atmospheric temperature with important consequences to the agriculture, and the demographic distribution around the world, which is already happening.

The governments have been increasingly prioritizing the reduction of the CO emissions (the most important gas of the greenhouse effect) and for such they have encouraged the reduction of the fossil fuels. On the legislative front – in great part as a response to the public opinion press – an accentuated change of attitude has been taking place from the 80's with the governments placing stronger positions on issues such as the residue disposal, air and water pollution, energy and transport policies.



Coordinated actions have been taken in order to halt such elevation by means of complying with the Kyoto Protocol that took place in 1997. The document is aimed to reduce the six main gas emissions that cause the greenhouse effect: Carbon dioxide, methane, nitrous oxide, HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and sulfur hexafluoride.

The blame has now placed on the industry that's been pressed to keep its pollution under control, and to minimize the production of all kinds of residues. The polluter-must-pay principle is featured in the environmental legislation and now bears down on its shoulder in most of the industrialized countries. The administrators must be aware of the environment issues, and the related legislations to mitigate the chance of their companies being prosecuted.

The legislation alone is not very likely to be effective to render permanent improvements to the environmental performance of the industry and commerce, or other common public activities. After all, it's up to the business community to manage the required changes to ensure an environment pollution reduction, and to promote a long-term sustainable development.

No matter how challenging it may be, we must face the following: As it's been, it cannot go on! If we want to save the planet, and the humankind, we must conceive and invent another way to live with each other, produce and distribute the goods we need, however we must be responsible and solidary at consuming and disposing our waste material.

As the Earth Charter emphasizes, we need a sustainable living style as our actual style may not be sustainable for 2/3 of the humankind.

To save ourselves, we must redesign the whole productive process to suit each ecosystem, and valuing everything the humans have invented in order to survive, from the cattle farming and agroecology to the modern technology with its immense potentiality to cooling the planet.

Reinventing the human being will only be possible by taking care of our habitat, the Earth, which's the dwelling of all our living systems.

Therefore, being respectful to the animals, watchful to our ecosystem, preserving the native forests and the wellsprings, being zealous with the air we breathe. All that is part of the human awareness evolution.

The first step is to get rid of the actual consumer's standards that have enslaved us. It's urgent to have in mind that our planet, with its seven billion of inhabitants, will always be the sum of each one's evolution. The day to change our attitude is about to go by!

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Energy, a short definition

The definition of energy is “the capacity of a physical system to perform work”. Energy exists in several forms such as heat, kinetic or mechanical energy, light, potential energy, electrical, wind, water streams, and may be stored in material such as fossil fuel – petroleum, coal, natural gas, which may be burned to “perform a work”.

Energy is best described in terms of what it can do. We cannot “see” the energy, but only its effects; we cannot make it, but only use it; and we cannot destroy it, but only waste it, that is, make an inefficient use of it. Unlike food and dwelling houses, the energy is not usually considered by itself, but instead by what it can be made of it. The energy cannot be created or destroyed, but only redistributed or converted from one form into another like, for example, Eolic energy transformed into electricity, or chemical energy into heat.

Understanding ‘energy’ means understanding the energetic resources and its limitations, and as well the environmental consequences of its use. Energy, environment, and economic growth (social inclusion) are strongly and intimately connected. For the next two decades, it’s been estimated that energy consumption will increase by 100% in the developing countries. Along with that

figured growth, it’s been noticed the declination of the urban air quality, and the serious and intense degradation of the soil and waters.

Originally, people added the draft animal power to their muscle strength, and also the water and the wind to help them do some works. The pre-industrial society relied only on renewable energy sources, that is, waterfalls and streams, eolic, solar, and the biomass. The switch to non-renewable sources started in the Eighteenth Century when a society on a increasing industrialization process started burning fossil fuels to produce steam for the railway locomotives powered by steam engines (invented in 1763), and to melt iron.

Nowadays, the fossil fuels represent up to 90% of our energy resource consumption, and we’ve been increasing the carbon dioxide emissions, which may irreversibly change the weather on Earth.

The proper use of energy calls for considering both, social and technological issues. In fact, the sustainable economic growth in this century, along with the living quality improvement of all inhabitants on the planet may only be possible by a well planned and efficient use of the limited energy resources, and as well the new energy technologies.



Analysis of the main sources of energy

Energy generated by fossil fuels

The energy generated by fossil fuels or mineral fuels are compounds of carbon used to feed combustion. Mineral coal, petroleum and its derivatives, and natural gas are the most known fossil fuels.

According to the biogenic theory – the most widely acceptable – other types of oleaginous substances extracted from the crust of the Earth such as petroleum would derive from the common mineral coal as it is abundantly found in underground mines. Fossil fuels are made of organic material decomposition by a process that takes thousands and thousands of years and, for that reason are not renewable within the short time relative to the human lifespan, although over the geologic time such fuels continue being formed in the nature.

For many decades, the mineral coal was responsible for putting in motion steam locomotives and ships. Currently, the mineral coal guarantees the operation of the Thermal power stations.

However, these fuels are finite, that is, the longer is the exploration time, the lesser it will be the available resources. And, the scarcer they are, the higher it's its price. Therefore, the interest in renewable energies

has been growing. Furthermore, the burnup of mineral fuels produces gases that increase the greenhouse effect.

The improvement of the control and use of the energy contained in these fossil fuels by the men has been a determining factor to economic, social, and technological transformations – and unfortunately, environmental – that have been taking place since the advent of the Industrial Revolution.

The Environmental consequences of the fossil fuels use

The environmental consequences of the industrialization process, and the consumption of fossil fuels are many. One of them is the increase of air contamination by gases and particulate material (PM) from the burnup of these fuels.

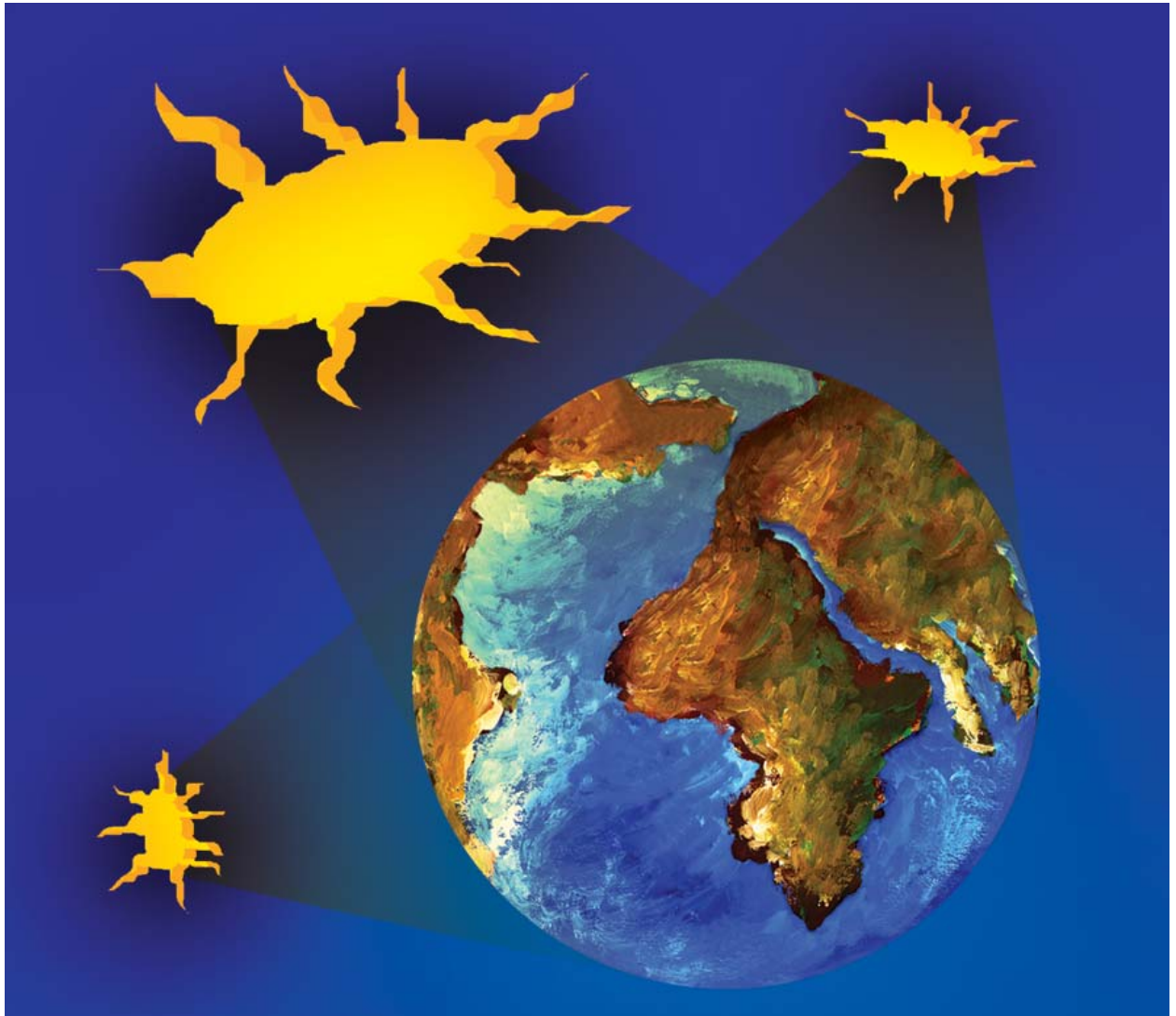
These gases that have boosted the greenhouse effect are essential to the survival of life on Earth. They keep some amounts of thermal energy, however what's been malefic is the high amount, and due to that it's been retaining more heat in Earth environment than we need, and moreover has been contaminating the air we breathe. This contamination generates a series of local impacts for the



human health. The acid rain brings us another negative impact.

The global climate change is another environmental problem, and it's caused by the intensification of the greenhouse effect. The emitted gases allow for the solar light to

enter the atmosphere, but prevent part of the heat in which the light is transformed from returning to the space. This heat arresting process is analogous to the one that occurs in the greenhouse – and there the name of this effect comes from.



Nuclear energy

1- Nuclear fission

The discovery and use of nuclear fission have already been seen as one of our most expectant hopes for a growing society that's been dependent on energy, and also as an

instrument of our destruction. Today, we're aware of the role the nuclear weapons have had over the history and the worldwide attitudes after the Second World War.

In 1939, the discovery of the fission with the release of great amounts of energy was



a remarkable historical event. Huge energy sources, however untouched, seemed to be at our reach, if such suitable technology could be developed. A war was tormenting the Europe, and therefore the development of an “atomic bomb” was the primary goal of those who were acquainted with nuclear fission. The uranium nuclear reaction in which a massive nuclei splits into smaller nucleus with the simultaneous release of energy, and in addition, many neutrons. The neutrons make it possible the fission cascade into other uranium nuclei, and then sets off a “chain reaction”.

From the nuclei fission the enriched uranium atom it's released a great amount of energy. The single nuclei atom where there are two kinds of particles: protons, which are positively charged, and the neutrons that are elementary particles with 0 charge and mass about equal to a proton. Around the nuclei, there's a region named shell or orbit of electrons, which are negatively charged.

One of two or more atoms with the same atomic number but with different numbers of neutrons is called an ‘isotope’. The uranium has two isotopes: 235U and 238U. 235U is the only one that may be split. In nature it's only possible to find 0.7% of this type of isotope. To be used as a fuel at a plant, it's necessary to enrich the natural uranium. One of the methods adopted is to “filter” the uranium through very fine membranes. The 235U is lighter and passes through the membrane before the 238U. Such operation has to be repeated many times, and it's a complex and quite expensive process. Only few countries have this technology in an industrial scale production.

After the war people used to think the use nuclear energy for peaceful purposes would represent the touchstone of an economic dependent on energy. In fact, it was thought that uranium fuel would be abundant, that there were methods to produce additional fissile¹ fuels, and the technology would be available.

The reactor at the University of Chicago was the prototype for the development of bib reactors and, in 1951, the first electricity generated by a reactor called ‘Experimental Breeder Reactor’ near Detroit. The uranium placed in metallic cylinders inside the nucleus of the reactor, which is made of a moderating material (usually graphite) in order to mitigate the speed of the neutrons released by the disintegrating uranium so allowing for the chain reactions. The temperature reduction of the nucleus reactors done by a liquid or gas that circulates in a pipeline around its interior. The heat then drawn is transferred to a second pipeline where the water circulates. By being heated up the water turns into steam (at the temperature up to 320° Celsius) that moves the steam turbine blades that will then move the generator, and will produce electricity. Then, the steam is again liquefied and taken back to the pipeline where it'll be again heated up and turned into steam, and so on.

¹ = Something that may be spontaneously split, or not – Definition of Aurelio Dictionary.

2 - Nuclear Fusion

This is the source of energy with great potential. There are essentially two options in the long run. One it's the solar energy,



which we classify into renewable solar radiant energy, eolic, hydropower, and biomass ones. The other one it's the nuclear fusion that some consider being our definite source of energy. Fusion is the coupling of two small nucleus to form a bigger nucleus while the fission is the split up of a very large nucleus (like uranium's) usually accomplished by the addition of a neutron to two smaller nucleus. In both cases, the end product mass is smaller than the original reacting nucleus. The lost mass is converted into energy.

The excitement for the fusion as a future energy source is based on several facts. Firstly, the fuel that could be used – deuterium (D) – is found in the ordinary water in which one out of 6.500 hydrogen atoms is isotope (a deuterium nucleus has a proton and a neutron). The full fusion of only 1gr of deuterium will release the energy equal to the burnup of nearly 9,250 liters of gasoline. The fusion of all deuterium placed in an Olympic size swimming pool could supply enough electricity for a city with 100.000 inhabitants for a year.

The energy released by a full fusion of the deuterium contained in 1.000 cubic meter of water corresponds to nearly 2 trillions of petroleum barrels, which corresponds to nearly two times the total petroleum estimated reserve on Earth. The water deuterium extraction is not too difficult or expensive, and the fuel required for the fusion of the deuterium is

essentially virtually infinite and quite cheap.

Another advantage of the fusion is the potential decrease of the environ pollution. The end products of the fusion reaction are the hydrogen, helium, and neutrons, and therefore we wouldn't have to worry about long-lasting radioactive residues from the fission reactors, although there are some radioactive portions from the reactor that deserves our attention. Furthermore, no material that could be used to manufacture bombs would be produced by fusion reactors, and the global warming would be of no concern.

The prospect for the fusion energy is not nonetheless a bed of roses. The technologic feasibility of fusion reactors is now opened to questionings. Billions of dollars have been spent since the Second World War in an attempt to succeed in getting a controlled fusion. Up to now, the production of energy by experimental reactors is less than the total input energy, although the scientists believe they're just about to reach the balance point. Also, there are significant economic concerns, and a very high cost of researches on fusion at many laboratories in the USA. Over the last five years, the federal funds for researches were dropped by 40%. The role the fusion will play in this new century may not be realized for many decades to come. What possibly make the fusion a winner will be accordingly determined by economical and environmental factors.



Renewable Energies

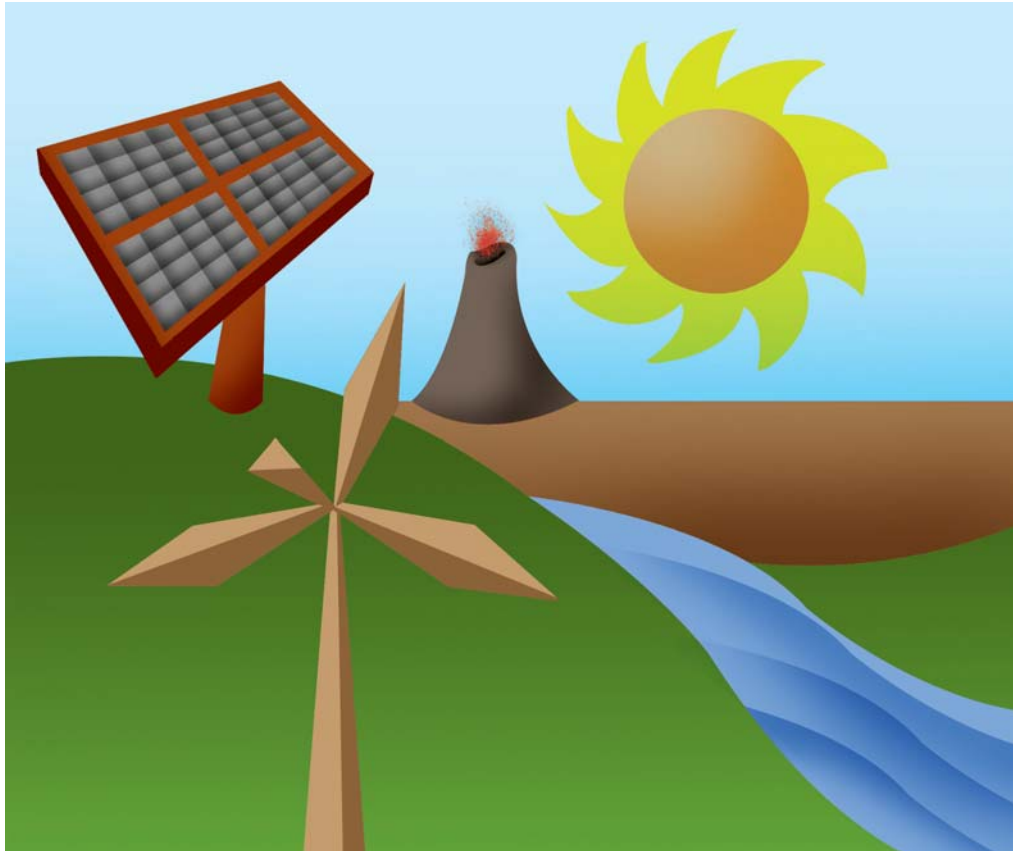
The renewable energy is obtained from natural sources that may be self-regenerated, and therefore would be virtually inexhaustible unlike the non-renewable resources. They are:

- **The Sun:** Solar energy
- **The Wind:** Eolic energy
- **The rivers and fresh water streams:** Hydropower

- **The Seas:** Tidal Energy
- **Organic material:** Biomass Energy
- **The Earth heat:** Geothermal energy

Renewable energies are taken as alternative energies to the traditional energetic pattern both, because their guaranteed availability, and for their minimized environmental impact.

Renewable fuels use elements renewable



by nature such as sugarcane used to produce alcohol, and also several other vegetables like castor-oil plant that's used to manufacture biodiesel, or even other vegetable oils that may be used directly on diesel engines with just a few adjustments.

Solar Energy

Solar energy is any kind of luminous/thermal energy from the Sun and its further transformation of such energy into any energy form usable by men both, directly for water heating up, or even as electrical power or energy in a mechanical form.

During the translation motion around the Sun, the Earth receives 1.410 W/square meter of energy, measured on a normal surface in a right angle with the Earth-Sun line. From that, nearly 19% is absorbed by the atmosphere, and 35% is reflected by the clouds. When passing through the Earth atmosphere, most part of the solar energy is in visible light form, and ultraviolet light.

Advantages:

- The solar energy won't pollute during its use. The pollution generated by manufacturing the devices required to make solar panels is fully controllable by using existing control procedures.
- The central require minimal maintenance.
- The solar panels have day-by-day become more powerful while their cost have been dropping, and that makes the solar energy more and more an economically feasible solution.
- Solar energy is excellent in distant

places, or hard-to-reach places as its installation in small quantities won't demand too high investments in powerlines.

- In the tropical countries like Brazil, the use of solar energy is feasible in virtually its whole territory, and in places far away from the centers or energy production its use would help mitigate the energy demand, and additionally would help avoid the loss of energy that would take place over the extensive powerlines.

Disadvantages:

- The prices are quite high compared to other energy sources.
- The amounts of energy produced may vary depending on the weather conditions (rain, snow, etc.), and moreover there will be no energy generation overnight, which will demand means of storing the energy generated during the day in places where the solar panels are not connected to powerlines.
- Middle to high latitudes (like Finland, Republic of Iceland, New Zealand, and the South of Argentina, and Chile) will have abrupt production drops during the Wintertime due to the less solar energy daily availability. Frequently cloudy places (like Curitiba, in Brazil, and London) are prone to have daylight production variations depending on the level of nebulosity.
- The solar energy storage means are less efficient compared to, for example, to fossil fuels (like coal, petroleum, and gas), hydropower (water), and biomass (sugarcane or orange bagasse).



Eolic Energy

Eolic energy is the energy generated by the wind. The term 'eolic' derives from Latin term aeolicus, pertaining or related to Aeolus, the Greek mythological God of Wind, and therefore its related to the wind.

In the antiquity, it used to be used to power sailboats, or windmills. On the windmills, the energy is transformed in mechanical energy used for milling grains or for pumping water.

Nowadays, the eolic energy is used to power aerogenerators – large turbines placed at very windy places. Such turbines have the shape of weathervanes or windmills. That motion produces energy by using a generator. It's necessary to gather in eolic parks concentrations of aerogenerators to make the energy production profitable. However, they may be used alone to power distant places far away from powerlines.

Eolic energy is taken as one of the most promising natural sources of energy, chiefly because it won't deplete. In addition, the eolic turbines may be used in both situations, where there's a powerline, or at segregated areas.

The world's capacity to generate electricity by eolic means was in 2005 nearly 59 Gigawatts, enough to supply the basic demand of a county like Brazil.

Hydroelectricity

The hydropower is obtained from the potential energy of a body of water. It's embodied in nature by water streams such

as rivers and lakes, and may be utilized by means of a difference in level, or a waterfall. On the other hand, the turbines may be used to power an industrial device such as a compressor, or an electrical generator aimed to supply energy to a powerline.

It's necessary to have a water stream in order to generate energy in a continuous form and time, and for such there must be a water supply for the lake, otherwise there will be a reduction on the water level, and a decrease of the generated potential over the time. The dams are artificial lakes built along a river to allow for continuous energy generation.

In Brazil, due to the great quantity of rivers, most part of the available hydropower comes from big hydropower plants. Rivers don't have a regular water stream over the year. In a rainy season the quantity increases, and to take the maximum possible energy supply of a river its outflow must be normalized in order to allow for the plant to work continuously at its installed potential.

Biomass Energy

Biomass Energy is the energy that comes from living material like grain (corn, wheat, soy, etc.), trees, and aquatic plants. Such living material is also found in agricultural and forest residues (including harvest remainders, and manures), and solid urban residues (urban garbage). The biomass may be utilized as fuel in three forms: solid fuels like wood chips; liquid fuels obtained from chemical or biological reaction on the solid biomass and/or by means of high temperature and high pressure processing.



Currently, the biomass supplies 3.2% of the energy needs in Brazil. Sweden and Ireland utilize biomass for 13% of their demands while Finland supplies 14% by the same means. Additionally, such resource is of particular use for developing nations where the high prices of petroleum slow down their development. As a way to store solar energy, the biomass features the advantage of lower cost of the collectors, and energy storage is already included.

The biomass may be converted into liquid and gaseous fuels in several stages, and the direct combustion to produce steam or electricity is already widely known. The biomass sources are being strongly considered as alternative fuels for mass transport vehicles, mainly to suit the new atmosphere pollution standards and policies.

Tidal Energy

Tidal energy is obtained by a similar manner as hydroelectricity.

A dam is constructed by making a reservoir by the sea. When the tide is high, the water fills the reservoir by passing through the turbine so producing electricity while when the tide lowers the reservoir is emptied, and the water flow away from the reservoir by passing again back through the turbine so also producing electricity. This type of source is also used in Japan and England. In Brazil, we have great tide amplitudes like, for example, in a bay named 'Baia de São Marcos, in the city of São Luis, the State of Maranhão, however the littoral topography make it economically unfeasible the construction of that kind of reservoirs.

Geothermal Energy

Geothermal energy is produced by the heat that comes from the underground of Earth where the temperature reaches up to 4.000° Celsius. The geothermal energy is produced by the decomposition of radioactive materials inside the planet, which leads some people to refer to the geothermal energy as a form of 'fossil nuclear energy'.

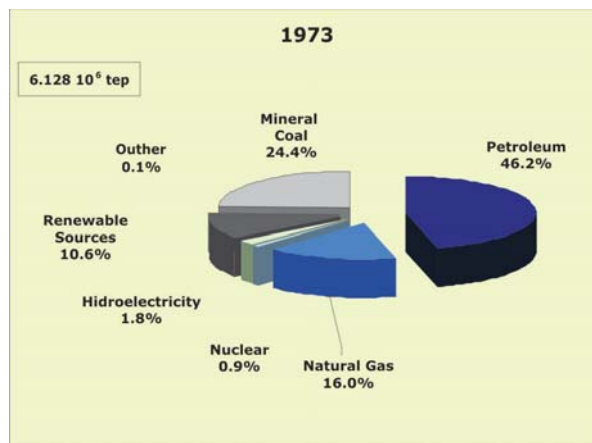
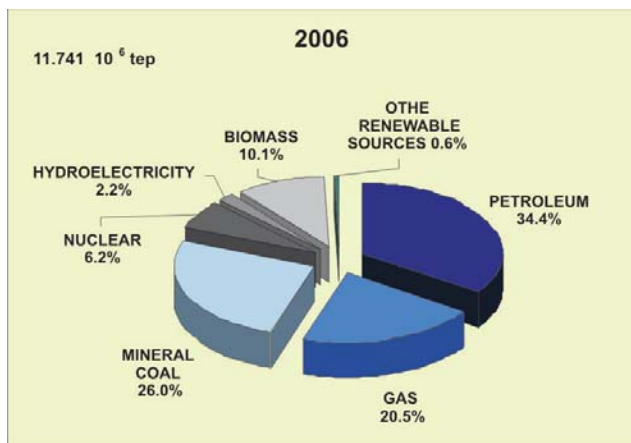
Volcanic craters, geysers, warm water and mud fountains are evidences of big heat reservoirs that exist on the underground storage areas. Although the quantity of thermal energy inside the Earth is quite large, its use has been limited to certain places. These resources are finite, and may be depleted in certain sites undergoing intensive exploitation. Nevertheless, the geothermal energy is a resource that may be better explored in more favorable places. Today, 4% of the electricity generated in the United States by the so called renewable sources comes from geothermal sources (that is, nearly four times the amount of the eolic and solar energy). Globally, the geothermal energy has been steadily increased at a rate of about 8.5% yearly.

This energy may be used as heat sources to heat up houses, water, or even be converted into electricity from the steam discharges. The electricity was produced from natural steam for the first time in Italy, in 1904. Today, many geothermal plants are being operated around the world. In Hawaii Island 25% of the electricity is produced from geothermal resources. In El Salvador the greatest part of its electricity comes from geothermal resources.

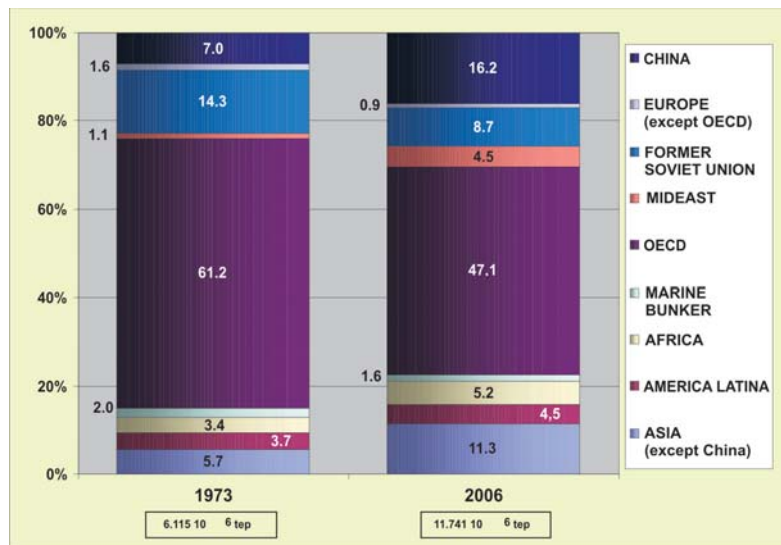


World energy statistics

Energy Offer by Source



Energy offer by Region



* Information Source: IEA - International Energy Agency



Analysis of the main environment issues

To better understand the great environmental issues that affect us today, and as well their relevance to the processes of a given organization, it's useful to consider them under the following aspects:

- Atmospheric emissions
- Discharges in the water
- Stratification of the residues on the ground
- Energy utilization
- Ecology and the environment

Atmospheric emissions

1. Acid Rain

Acid rain results from SO_2 and NO_x emissions that may travel long distances from the emission sources before being washed out by the rain, flog, or snow. The main industrial sources of SO_2 and SO are the electricity plants and big combustion plants that burn fossil fuels, and the ore reduction plants that treat ore with sulphite. Nitrogen Oxide is formed during every combustion process in the air, however the main sources of NO_x emissions are the hydroelectricity plants and the exhaust pipes of the combustion



engine-driven vehicles.

The decontamination goal demands also reduction of the NO_x emission levels by 15% (also based on the levels of 1980). The SO emission reduction target was fully reached in the middle of the 90's, however the target level for NO_x has been more difficult to be reached, and have been reduced only by 10% up to this time.

2. The Ozone Layer Decrement

The largest part of the ozone found in Earth atmosphere is on the 'Ozone Layer'



situated between nearly 17 km and 50 km above the sea level. It filters the harmful UV rays from the Sun that may cause skin cancer and eye cataract.

The Ozone (O) is generated by the solar light action on the normal oxygen, bimolecular. A significant decrement of the ozone layer was firstly noticed in 1984 over the Antarctic continent. The main cause was promptly identified as being chlorofluorocarbons used by that time in sprays, refrigerating appliances, foams, and cleansing solvents. Yet, it's known that halons used in the fire extinguishers, methyl Chloroform (Trichloroethane), carbon tetrachloride, and methyl bromide also spoil the ozone layer.

The Montreal Protocol (1987) discussed the halons and other substances that spoil the ozone layer, and stipulated that the use of them should be gradually reduced and banned in the production lines, distribution and use. Pressed by the consumers, the manufacturers agreed to give up using the CFCs (chlorofluorocarbons) quite before 1997 understanding that alternatives like HFCs (hydrofluorocarbons) and HCFCs (hydrochlorofluorocarbons) would be acceptable alternatives to be used during the gradual elimination period until 2030.

3. Other Air Pollutants

The main industrial air pollutants are nowadays the CO₂, NO_x, CO, black smoke, volatile organic compounds,

polychlorinated biphenyl (PCP), dioxins, and heavy metals, and additionally, odors from commercial facilities are also common problems.

Either in Brazil and in the USA there's a legislation aimed to control heavy metal emissions to the atmosphere, and the standards have become a lot more rigorous under the mechanisms set by the Kyoto Protocol.

Now, there are even control mechanisms in the European Union on emissions from public municipal and industrial incinerators, and the directive of the European Community (EC) on polluting gaseous emissions from the storage facilities of petroleum products may be extended to retail stores in the years to come.



4. Solvents

Pouring solvents into the water or releasing them into the atmosphere may cause a number of environmental effects, and may also be harmful to human health. In the water, the solvents may be toxicant, carcinogenic (likely cause cancer), and persistent.

The release of solvents in the atmosphere may spoil the ozone layer. Volatile organic compounds generate ozone on ground level, which has an important role in forming photochemical flog that may cause several respiratory disorders.

The European Union issued directive to control the solvent emission in the air. Also, it has already defined directives on the air quality and ozone emission regulations



from the ground level starting from several processes such as vehicle body painting, degreasing, dry wash, and printing inks and stuff.

The emission control of polluting gases is also a key step for a correct strategy for Air Quality Management, and that's why the United Nations has been seeking to make a worldwide agreement for gradual emission reduction by the countries.

5. Emissions from Vehicles

Vehicles account for nearly 30% of the total CO₂ emission in Brazil, and its largest part come from the road transportation vehicles. Such emission also contains particulated material, unburned hydrocarbon and lead. The reduction of vehicle use and engine emission are therefore a key-priority for the government, and it's part of the air quality target set by the Brazilian Environment Law of 1995, and by the Road Traffic Reduction Law of 1997.

Since 1993, the directives of the European Union on vehicle emissions made it mandatory for all vehicles to comply with the new CO and NO_x emission standards, and also particulated material exhausting, as the catalyzers. The installation of catalytic converters is mandatory since late of 1992.

England carried out a broader test, and more inspections of heavy cargo trucks on the road. Additives containing lead



for gasoline have already been banned of the Great Britain market, and fuels with ultra-low content of sulfur are nowadays widely available.



Discharges into the Water

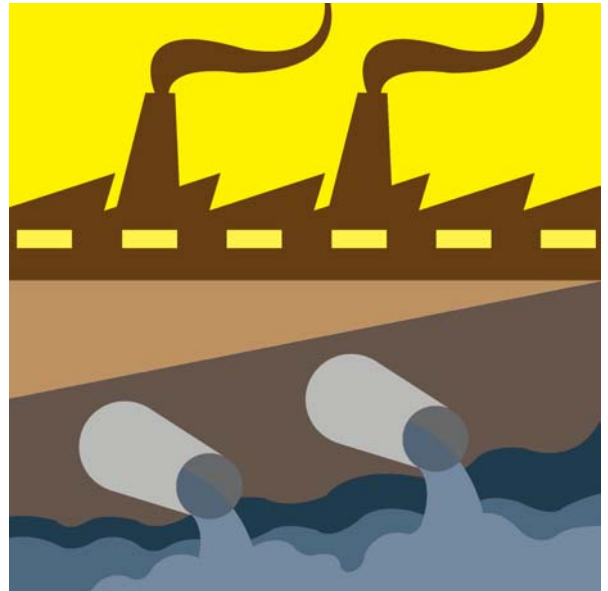
1. Effluent Discharges

Most of the industrial plants discharge their effluents in the sewage system to be treated by the water and sewer companies. The water and sewer company sets control parameters of the discharges and charges receiving and treating fees. Some types of industrial processes are in the scope of the Environment Agency and are subjected to even more strict management.

The discharges into 'controlled water

streams' like rivers, coast waters, and underground water beds are managed to ensure that all commitments set by the decontaminating departments are accomplished. Such departments are responsible for keep continuously reviewing their goals and control standards for river waters and analyzing all the licensing policies and monitoring the discharges into water streams. That's been resulting in more rigidity on monitoring and restraining the infractors.

The details of all authorizations for effluent discharges are available for public inspection by records done by competent control authorities. The costs of inspecting works are charged directly to the infractors by the environment



preserving departments, without appeals at courts of law.

2. Residue Water Treatment

The concept of 'residue water' encompasses the rainwater outflow, industrial and domestic sewage systems, and effluents from any type of process. Today, in Brazil, most part of the residual water is discharged into public sewage systems, and is channelized to the sewage treatment stations.

There a time in which it was usual to see industrial effluents being discharged into the sea through a sewer, or industrial sludge being transported by ship to be discharged into the ocean. That kind of

routine have almost ceased after the adoption of regulation on urban sludge discharges, and the construction of many new water treatment stations.

A water treatment station receives polluted residual water (influent), and treats it by using oxidant bacteria to clean the water that will be then channelized back through another receiving controlled water stream (usually a river).

The treated water may only be discharge when its level of oxygen has dropped to less than 20g by cubic meter of water.

3. Water Supply

Most of Brazilian companies receive water from the company that is responsible for the local water supply. Those which use very large volumes of water, or are located at distant areas are supplied by direct underground usually by artesian wells, or surface waters.

There has been a severe decrement of the underground water levels, and the level of the rivers over the last years of abnormally dry weather. The environmental agencies are then responsible for managing and keep the natural water resources. They also give incentive for an efficient use of water by promoting greater water recycling whenever it's feasible.

The water quality standards are based on the requirements of drinkable water,



and those are ruled by legislation and its suited control mechanisms. The water supplying companies have the obligation to supply appropriate potable water. Some local treatment, like the removing the nitrate from the water supplied may be demanded by the users like beer manufacturers.

The cost of the water supply both, in the public system and the water extracted from the underground or surface, have been substantially growing over the last years while the water conservation have already become a prioritized environment issue.

Disposal of residue on the soil



1. Packing Material

Packing material, and mainly its final destination, constitutes one of the flagrant environmental problems. Glass is the oldest and probably the bottling material that most recycled in the world. Aluminum cans and steel are being increasingly recycled while paper and plastic recycling have been growing fast. Soon, packing material recycling will become mandatory for all Brazilian companies over the “packing chain” in consequence of the regulations on packing residues issued in 1997.

The government is committed to stimulate the industry to reduce the unneeded package of goods and to promote the return of packages by the consumers to the point of purchase. The new obligations related to packing residues





set in 1997, and created by the Environment Law of 1995 set recycling rigorous goals such as the ones enforced by the packing residue directive. The final disposal of plastic materials is often done by incineration. Therefore, a directive aimed to control the emission of the municipal garbage incinerators was issued to set strict standards for polluting gas emissions.

2. Paper

In Brazil, there's a very remarkable interest and public opinion pressure for recycled paper use and for the reduction of the amount of paper used by the corporations. The main advantages of using recycled paper include the following:

- Energy conservation as the production

of paper made of recycled pulp demands less energy than to produce virgin paper;

- Pollution level decrease as the recycled paper processing demands a less amount of chemical reagents and other raw materials;

- Less amount of wood is required;
- Reduction of the residue amounts that need disposal, which alleviates the demand of sanitary landfills and reduce its taxation.

The paper recycling saving depends on its collecting efficiency, however a suited collecting system could do significant incursions in the importations. The long-term target is to reach a 'sustainable development' with raw material for paper production including replanting trees and recycling the paper garbage whenever it's economically feasible. Brazilian industry has currently been encouraged to obtain paper supplies from sources that comply with certified forest management.

3. Recycling

The recycling technology of recycling is quite stimulated at many industrial plants, particularly the ones of secondary metal such as copper, lead, and ferrous metal remainders. Recycling saves natural resources and the equivalent amount of demanded for primary production and transport. It also helps reduce the amount of residue discharged at sanitary landfills.

The taxation on the energy and residue disposal is growing quickly, and there's



been a great deal of incentives to incrementing the recycling. Brazilian government set a goal up to 50% for the recyclable domestic garbage recovery until 2010, and local authorities are stimulated to publicize their recycling plans.

4. Residue Management

The residue generators in Brazil and all the ones that import, produce, transport, keep, treat, or provide final destination to residues have been stimulated to act in a responsible way, and minimize the environmental impacts. On the other hand, the generators of controlled residue are obliged to hire only specialized haulers that are registered to do the final disposal of residues such as chemical, and hospital garbage. This kind of garbage can only be discharged at duly licensed disposal facilities.

The companies that store residue inside their own facilities must have specific license for such, and may be obliged to remove the illegally stored residues. Any transportation of residue outside their facilities must be duly documented, and the Environment Agency must keep details records of such residue transfers.

5. Harmful Residues

Harmful residues that used to be called "special residues" in the past are the ones that threaten life. This kind of residue has been specifically defined long time ago,

primarily by Environment Pollution Control Regulations.

To be sorted as 'harmful' the residue should feature one of the noxious properties named in the Harmful Residue list. Such residue require special handling to ensure safety disposal, and it's not allowed to be directly dumped at the landfills without being previously treated in order to make them harmless.

Most of the harmful residues are simply made of packing material that has been contaminated by its content or by other residues they have been in contact with.

6. Contaminated Soil

An area that's not severely contaminated to the point of being harmful to health, or threatening the underground waters is considered 'contaminated soil'. In such a case, an official notification is sent to the owner of the area requesting remediation and restraining measures.

Soil contamination is at the same time a matter of urban and rural planning, and an environmental issue. The contaminated soil decontamination may be extremely expensive, however it's very often unavoidable. The remediation methods include removing the contaminated soil to a safety landfill, local washing, treatment outside the local, future return of the material to the





area, insulation by waterproof material, and biological treatments in cases of organic or oily residues.

Energy Use

1. Sources of Fossil Fuel energy

The production and use of energy represent one of the most significant impacts on the environment. The energy generated by fossil fuels is the main responsible for the global warming the acid rain. Fossil fuels are mainly made of petroleum, and release CO₂, SO₂, and NO_x.

One of the today's priorities is to mitigate the dependency on fossil fuels

by reducing its demand, increasing its thermal efficiency, or by replacing it by renewable fuels.

In the United Kingdom, for example, it's been created a tax on Climate Change as a response to the agreements done at the Kyoto Protocol, however also with the aim of discouraging the option for fossil fuel use.

2. Renewable Energy Sources

As a response to the global warming, a determinative change is expected in order to adopt renewable sources of energy in the twenty-first century. The current available options include the use of biomass, biodiesel, gas from the landfills, eolic, tidal and solar energy, besides hydroelectricity, among others. The generation systems that combine heat and energy are quickly extending its market share.

In Brazil, the use of renewable energy is quite considerable, and has reached nearly 40% out of the whole energy used in the country. Our biodiesel has been attracting the world's attention and for that reason it has raised some controversy. Some researchers have stated that biofuels may directly and globally affect food demand, and incidentally, its price. Furthermore, we have the biggest hydropower plant in the world – Itaipu -, which's responsible for 40% of our



generated energy. Itaipu is also responsible for 100% of the hydropower used in Paraguay.

In places like the state of Ceará, on the Northeast of Brazil, eolic and solar energy have already been used, and also the tidal energy, however in lower scale. The natural gas obtained from the landfills has been used in some cities, which generates carbon credits.

The implementation of these energies is still expensive and significant, however they represent an advantage for the environment as they won't release CO₂.

3. Energy Efficiency

The total energy consumed during any activity may be considered as a product of two factors:

Energy demanded by the activity
X
the activity frequency.

In order to have an energy consumption decrease we'll have to change at least one of these factors. By changing the lifestyle, which means a conscious use of a smaller amount of fuel by means of changing our behavior, for example, by switching the air conditioning devices or by driving less in order to reduce the activity frequency. Or yet, by doing technical adjusts, which consists in using a more efficient fuel to

perform the same task, for example, by driving cars with more efficient engines, and so reducing the energy needed for such activity. The best possible technical adjusts for energy conservation is limited by the physical laws.

Nevertheless, there's still a great room for approaching improvements of energy conservation, specially the ones related to energy use efficiency to perform certain tasks. For example, a 20-watt fluorescent bulb produces the same amount of light as a 75-watt incandescent bulb, and lasts ten times longer. The initial cost of a fluorescent bulb is higher, however average electricity saving during 1-year period will pay off the investment. If we replace incandescent bulbs by fluorescent ones, less hydropower plants will be necessary.



The construction investment of an industrial plant to manufacture more efficient bulbs will be a lot less than the one needed to construct a hydropower plant. This type of economic concept is of crucial importance, especially in the developing countries.

The companies have constantly been encouraged to use the energy in a more efficient way. This efficiency has been sought throughout the world as the global warming issue affects the whole planet, and the consequences will affect both, the poor and the rich countries.

Ecology and the Natural Environment

1. Deforestation

The deforestation has global and local environmental effects.

Often, such practice destroys the living means of local populations that depend on the forests to obtain their fuels, food, and natural medicines, and is also prone to dramatically deplete their water resources, change the local weather conditions, and may lead to the soil degradation by eroding it. It's estimated that burned-over forests are responsible for up to a quarter of all CO₂ emissions done by humans. Without proper resource management, the deforestation leads to a loss of unrecoverable noble wood such as

mahogany and teakwood, and threatens the traditional market for these materials.

Some deforestation projects are connected to the needs of the local population, and are necessary to face the demographic growth. However, others are commercial enterprises conceived abroad. This is particularly the case of the tropical forests of South America, Western Africa, and Indonesians that have been quickly destroyed by urban development projects, wood extraction, and construction of dams, cattle farming, mining, and railway expansion.

The Eco-92, United Nations Conference on Environment and Development, held in Rio de Janeiro, brought a fundamental change about the way tropical forests are managed, especially in Brazil, however the deforestation is still taking place around the world. The Amazonian rain forest had 18.000 to 25.000 square kilometers of its territory deforested over the last years. Great part of it by illegally cutting down of trees for sale. This is still a problem the needs to be inspected more rigorously by the authorities and struggled in Brazilian territory.

2. Biodiversity Loss

The depletion of the vegetation and animals on the land, oceans and rivers has become a great deal for the people in general. There may have been 50



million of living being species over the Earth, but it's estimated that up to one third of them may be extinguished within a 30-year period, mainly as a consequence of the global population growth, and agriculture methods, and intensive commercial fishing needed to supply it. The loss of potentially valuable food sources, industrial supplies, medicines, and gene banks for animal and vegetal production is incalculable.

3. Noise and Disturbance

Noise is a general problem in the industry and the society. It constitutes the most common environmental disturbance, and may seriously affect the health and safety of the workers at the factories, although most of the complaints are against the noise that come from the outside, and not from the inside of the facilities.

The existing legislation on that is set by municipal departments, and the inspections have been quite ineffective. In the transportation sector, our governments continue pressing the manufacturers to produce engine with noise levels as low as possible.

4. Real Estate Properties

The issues related to real estate properties are all-encompassing and include the urban built environment with their historical, cultural, and

archeological sites, and as well the natural environment, the countryside, national parks, and wild areas.

Much of a nation cultural heritage degradation happens due to the excess of tourism activity, population growth, or excessive utilization, however it's partially also a consequence of administrative negligence, accidental damages, political instability, terrorism, and civil wars. The two last mentioned ones are more frequent in European countries.

In Brazil, some measures have been adopted with regard to the environment patrimony by planning processes, loans provided by national and local tax revenues. At ecological sanctuaries like Fernando de Noronha Island environmental taxes have been created for the tourists. The aim is to reach the goals of a 'sustainable tourism' as it involves allowancing and restrictions to the right of come and go. The ecotourism has been popularized more and more, however it may also means a threat to distant natural areas that have been untouched so far.

5. Sustainable Development

Both the economic development and the population growth exert tremendous pressure on our natural resources and systems. For example, the degradation of



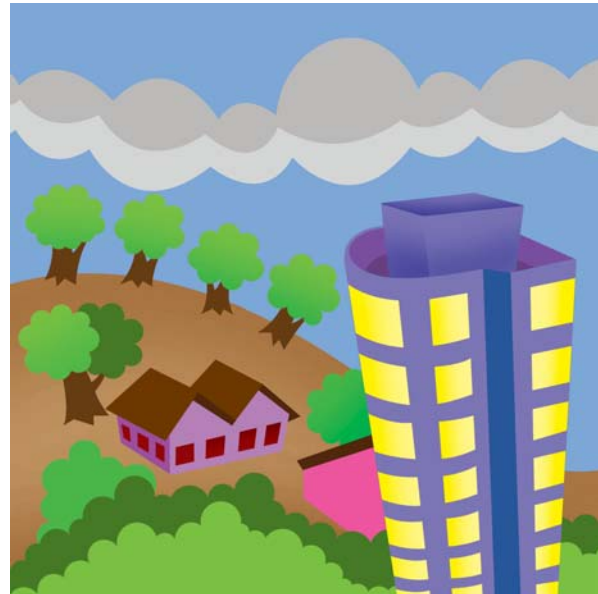
the soil and water resources makes it extremely difficult the expansion or the food yields. Many of the environmental problems related to the increase of energy supply to support this growth have been implemented.

Sustainable development is the type of development that meets the need of the present without compromising the capability of the future generations to meet theirs. It implies the protection of the natural systems necessary to supply food and fuel simultaneously to the production expansion to meet the needs of a growing population.

The means to reach this aim will be different in the developed countries and in those in ongoing developing process. The industrialized countries have a special responsibility to lead the sustainable development because their present and past consumption levels are disproportionately great. In terms of per capita consumption, the developed countries use much more the resources of the planet than the developing countries. The developed countries have also financial and technologic resources to develop cleaner and less intensively consuming technologies.

For the developing countries, the sustainable development is the utilization of resources in order to improve their living quality standards. One-fifth of the Earth population has

an annual per capita GNP (Gross National Product) less than US\$500. They also face serious health problems. The citizens of the poor countries usually have limited access to potable water and sanitation, are undernourished, and lower education level. Half of the population of the developing countries are illiterate; their average lifespan is 90 deaths of newborn babies against 8 out of 1000 in the developed countries. These countries must guarantee the human basic needs, stabilize their population growth, fight the poverty and, at the same time, conserve their natural resources that are essential to the economic development, which's a very difficult endeavor.



The Kyoto Protocol

The Kyoto Protocol is one of the most important treaties regarding the environment that's been agreed around the world. The protocol was signed in the Japanese city of Kyoto in 1997, and the 84 participating countries agreed to mitigate the emissions that have been contaminating the planet. From that event, the greenhouse effect and the consequent global warming called the attention of the worldwide authorities.

The international action to fight against climate changes started in 1992, when the United Nations Framework Convention on Climate Change (UNFCCC or FCCC) was opened to be signed by the top member countries during the Earth Summit held in Rio de Janeiro in 1992.

The treaty signed in Kyoto set goals for reducing the gas emission that cause the greenhouse effect. The international agreement is aimed to reduce the gas emission by the industrialized countries, and to ensure a clean model development for the developing countries. The aim of the protocol is to reduce by 5.2% the gas emissions responsible for the greenhouse effect based on the levels of 1990 for the commitment period of 2008-2012. It imposes differentiated reduction levels for the 38 countries considered the main releasers of carbon dioxide (CO₂), methane

(CH₄), and other polluting gases.

The reduction set for European Union was 8% compared to the gas emissions of 1990. For the United States, the estimated reduction was 7%, and for Japan, 6%. For The reduction levels for China and the developing countries like Brazil, India and Mexico have not yet been set.

The Kyoto Protocol includes the decisions made at the Intergovernmental Panel on climate change conjointly set by the World Meteorological Organization and UN Environment Program in 1998, and also the Montreal Protocol on the



substances that destroy the ozone layer.

As the goals set by the Kyoto Protocol are to be accomplished up to 2012, and a second Kyoto Protocol is planned for the period of 2010-2030, and should include other countries to the current signers. However, no goals have been set up to this time, and even the first run of the Kyoto Protocol has been actually effected by most of the original signers in 2004. Today, the Kyoto Protocol has finally enforced and legally has obliged all the cosignatory countries to meet its commitments. However, outside the European Union, little enthusiasm has been noticed regarding the Kyoto Treaty.

Flexible Mechanisms of the Kyoto Protocol

To help the signatory countries and the companies to conform to the gas reduction goals set by the Kyoto Protocol, the so called 'flexible mechanisms' are accepted:

- International Emission Trade (IET)
- Joint Implementation Scheme (JI);
- Clean Development Mechanism (CDM).

The basic principle of the Emission International Trade is to establish legally binding obligations for industrialized countries to reduce their emissions of six of the gases that cause the greenhouse effect, and meet such a commitment by

implementing their own reduction programs, or by purchasing unused portions from countries that are below their committed target, or are outside the Kyoto treaty. It's the so called Carbon Credit Market, the most known flexible mechanism stipulated by the protocol.

The other two mechanisms (JI and MDL) allow the developed countries for compensating their gas emissions of greenhouse gases by means of investments in emission reduction projects.

For example, forest plantation projects in other countries may generate carbon credits for the investing country.

The flexible mechanisms were originally created as international instruments to be traded and/or be shared among governments, however corporation may take part in them and, in fact, some of them have been developing their own internal mechanisms for such, and sometimes quite sophisticated ones. Shell, for example, has been marketing licenses on the international market at the unit value of 100 tons of CO₂ or its equivalent in methane, among their several operations spread around the world. Other multinational companies have acted in a similar way.

Carbon Credit

The carbon credit is directly connected to the Kyoto Protocol as the document determines a maximum allowance of



carbon dioxide the developed countries are allowed to emit. It was a mechanism created to compensate the greenhouse gas emissions. These credits create a market aimed to reduced these gases by crediting a monetary value for the pollution produced in the planet.

One ton of CO₂ (carbon dioxide) is equivalent to one carbon credit. The equivalent CO₂ is the result of the multiplication of the emitted ton by its global warming potential. The carbon credits are certificates issued when there's an emission reduction of greenhouse gases. This credit may be negotiated in the international market.

It's still an accounting formula to compensate the developing countries for the good work done for diminishing gas emission into the atmosphere. The industrialized countries are obliged by the UN convention to mitigate their gas emissions. It means that, for example, a Belgian company has not succeeded in mitigating its emission, it may pay a company from Costa Rica, or Brazil, for example, to mitigate its gas emission in its name. Thirty-seven countries signed a commitment to reduce their gas emission between 2008 and 2012.

So the carbon credit may benefit Brazil as a large part of the Amazon rainforest (the lungs of the world) is in Brazilian territory. Today, Brazil has 37 clean energy programs registered at the UN – United



Nations, the organization responsible for project certifications. That why it's become the world leader in carbon credit projects, a market the turns over about 9.4 billion Euros a year.

Carbon Sequestratio

(carbon dioxide capture and storage)

'Carbon devourers', specially the oceans and forests of the planet play an important role to control the content of CO₂ in the atmosphere by means of a mechanism known as 'carbon sequestration'. In a sum, the removing process of carbon dioxide from the atmosphere is done by the planet as natural protecting mechanism of our ecosystem.

The process is done by the oceans and



forests. Carbon dioxide is captured and stored by the oceans by simple dissolution while in the forests it happens by means of photosynthesis by the cellulose mass of the growing trees. The aggravation of the greenhouse effect could be occurring due to the difference between the CO₂ emission rates into the atmosphere from its removing capacity by natural processes.

The ocean is the largest carbon reservoir of Earth that stores nearly 50 times more carbon than the atmosphere while the terrestrial ecosystems (forest and soil) are considered as a big carbon swallow hole, especially soils.

All the plants, in fact – and not only the forests – goes continuously through carbon sequestration processes. For a

long time, it's been acknowledged that some agricultures like soybean, linen seed, canola, and sunflowers show higher rates of carbon sequestration as they're cultivated and commercialized as seeds, oils, and refined product.

Therefore, these cultivations may be taken as carbon emission trade products. So, a harvest of sunflower, for example, may be used on a variety of purposes, including the following:

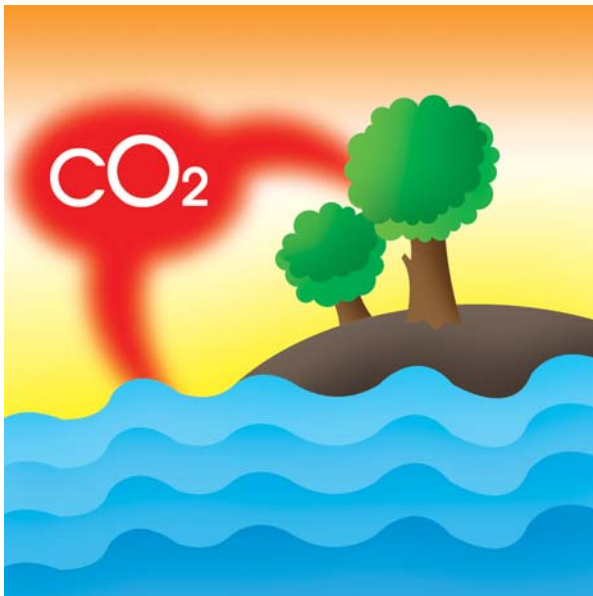
- Seeds and oils as food for humans and feed for animals;
- Refined oils (by a sterilization process), specially biodiesel;
- Exchange for the international carbon trade.

Significant Impacts

The answer for the question 'at what point an environment impact does become significant?' constitutes one of the most severe headaches when one endeavors to interpret the requirements such as the ISO 14001. As nobody finds it within the ISO 14001 own specifications, and there are stiff directives on the subject, there's always the likeliness that the evaluators assigned by the certificatory department to come to their own entirely arbitrary conclusions about the impact being, or not, really significant.

Many companies have adopted the following definition:

- The significant impact is controlled by



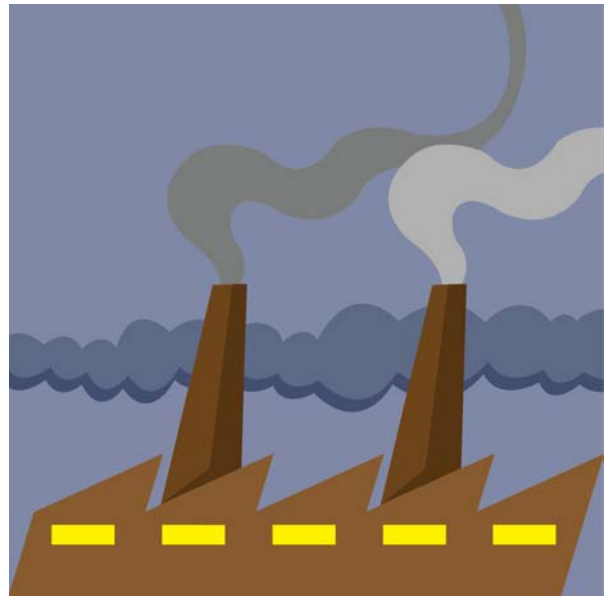
legislation or set by a code of conduct;

- The financial implications that may lead to a financial or legal responsibilities;
- It has a potential to cause environment damage that's dealt with in the emergency strategic procedures and contingency plans, also known as back-plans, worst-case scenario plans, or B Plan;
- It's acknowledged as a source of concerns to the consumers;
- It's acknowledged as source of concerns to the bankers, stockholders, and insurance companies;
- It's acknowledged as a source of concerns to local community, or it's a cause of complaints.

It won't exempt the inclusion of 'insignificant' impacts in the registry, however it would deserve the same attention level as the significant ones.

Some sectors have attempted to develop a more quantitative system that distinguishes the significant impacts from the others. An example regarding the furniture and wooden products manufacturers proposes a "Significance

Scale" that ranges from -10 (the most adverse impact) and +10 (the most beneficial impact). On such scale any impact grade out of the range of +/-3 is taken as greatly significant. Obviously, such scale is not universally applicable, however the general principle is valid. The grading concept of also acknowledges that some impacts are beneficial to the environment.



The Planet Can't Wait

Even the most skeptical ones have already agreed: the temperature on Earth has been rising, and a great part of the problem is caused by the human's actions such as the combustion of fossil fuels. Some divergences have yet remained about the impact magnitude on human's life. The solutions are also controversial.

See here 50 questions and answers addressed to the core of this issue. They altogether show that acting straightaway is a must.

1 - Is there any scientific doubt that the planet it's been incontestably warming up?

No. Not even the most skeptical scientists doubt it. Over the last 100 years the world average temperature has risen 0.75° Celsius. Also, there's no serious controversy on the fact that it's been occurring quite quickly. Between 1910 and 1940, therefore over a 30-year period, the average temperature around the planet rose 0.35° Celsius. Between 1970 and up to now (a 38-year period) it's risen 0.55° Celsius. Over the last 12 years the planet went through twelve consecutive temperature rising records.

2 - Besides the measurements, is there any other warming irrefutable



evidence?

The ice melting, especially in the North Frigid Zone, Arctic, has been shrinking each summer is a strong evidence. On the South Frigid Zone, Antarctic, the shrinkage is smaller, and there's even been an icy mass increase, although its area has shrunk. A paradox? No. Such increase is due to the regional warming, which's usually dryer than the Sahara Desert, and featuring more rain precipitations, which allows for more ice buildup.

3 - Do scientists have reliable instruments to assess the climate



changes?

The signals of the global warming haven't been made up on computers, but measured by precise instruments. The most reliable ones are the measurements made by artificial satellites and probes floating on the oceans, which provide us with real time information at every second. Indirect measurements are also taken as the one that detects the thickness and the extension of the so called permafrost, the ground that is permanently frozen in the Arctic pole. Even the color variations during the boreal dawns provide information on the Earth temperature. What's interesting is that all the measurements both, direct and indirect, points to the warming, with no discrepancies.

4 - Earth's temperature has natural warming and cooling cycles, so why the warming found so far is not being taken as natural?

Since the decade of 70's, therefore there have been about forty years, the scientists have forecasted that the planet has been entering a new glacial period so big it's been the severity of the Winters in the Northern hemisphere. Such forecast cannot be compared to the ongoing warming. There has never been a consensus on the imminence of a new ice age. That was mere speculation, but now, there's a worldwide consensus among

scientists of all tendencies that the planet has been warming. Less consensual, but accepted by the majority, it's the awareness that the warming process has been caused by the ongoing human civilization stage, mainly the industrial activities and the consumption model.

5 - For what warming periods Earth has already undergone?

Over the last 650.000 years at least four periods were identified. The first one occurred 410.000 years ago; the second one, 320.000 years ago; the third one, 220.000 years ago; and the fourth, 110.000 years ago. In all those cases, even without any human intervention, there was a concentration increase of gases that arrest the heat and aggravate the greenhouse effect. The most probable source of such gases were the great volcanic eruptions.

6 - If the meteorology cannot forecast whether next weekend will be sunny with 100% of certainty, how can it forecasts what's going to happen fifty or hundred years to come?

Forecasting the weather for the next weekend is actually more difficult than doing it reliably for in the long run. The climatic patterning deals with likeliness, and makes general statements about minimal global temperature changes. On the other hand, the short-term forecasts



deals with microclimate and its interaction with other more general climate events. These are random by definition.

7 – The estimation that the average temperature on the planet will rise up to 4 degrees until 2100 is reliable?

This the worst-case scenery predicted by the scientists at the IPCC - Intergovernmental Panel on the Climate Change that gathers the world's highest authorities and researchers in this subject field. It's catastrophic scenery, however in the opinion of the scientists, it'll only occur, if nothing is done. The most optimist projection realizes that the estimated temperature rise would be of 1.8 Celsius degrees. That would demand a reduction of 70% in the gas emissions until 2050.

8 – Over what topics do the scientists disagree?

Everyone agrees that the world's been warming. The main dissonances are about the human influence extension, and especially whether it's still worth to seek a drastic emission reduction of the greenhouse gases at whatever cost. The ones who disagree with such line of thinking suggest that all financial and scientific endeavors by all countries should be put at work to develop new technologies that would make it possible to the civilization to live with the effects

brought forth by a warmer planet.

9 – When did the warming become more intense?

The accumulation of gases started upon the advent of the Industrial Revolution in the 18th

century. The warming is directly proportional to the industrial activity. Hence, the more intense it gets, the more carbon dioxide (CO₂), methane, and nitrous oxide (N₂O) will be released into the atmosphere. The problems started being noticed recently because these gases tend to be accumulative.

10 – How much the global temperature has already risen?

During the 20th century, the average global temperature rose about 0.75 Celsius degrees.

11 – The former vice president of the USA, Al Gore was awarded with the Oscar, the Academy Award of Merit and the Nobel Peace Prize for its film that shows the tragic consequences of warming. All his predictions are right?

Al Gore chose showing the expected consequences as the worst-case scenery. He made an advertising movie, not a scientific documentary. An example, he points out the prediction that the sea level will rise 6 meter until 2100. The



Intergovernmental Panel of Climate Changes told about a maximum rise of 60 centimeters. Al Gore, the catastrophic forecaster, exaggerated by far. In his favor, some predictions have already been reviewed upwardly. The same scientist of IPCC consider now that it may reach a rise of 1.2 meters above the current sea level by 2100.

12 – Is the global warming caused by the human actions?

As it's been seen, Earth has already went by some warming cycles far before the humans have made the first campfire. What seems clear now is that the human activity has been contributing to speed up the average global temperature rising pace. It happens mainly due to CO_2 emission, which makes the heat dissipation to the space more difficult. Nowadays, the overall human activity generates more CO_2 than the nature. Before the Industrial Revolution, the emission by humans used to sum 290 ppm (parts per million) of CO_2 . Now they reach 380 ppm. One of the main reasons is the energy inefficiency. Just to give you an idea, a single incandescent lamp will have used up 250 kg of coal (calculation valid for the countries that generate electricity from mineral coal).

13 – Why does CO_2 rise the temperature?

The augment of the gas concentration creates a dome-like barrier in the

atmosphere that keeps the heat released from the Earth surface from being dissipated into the outer space. The heat remains arrested between the Earth surface and the gas layer, and that's why is called Greenhouse effect. The CO_2 is the main greenhouse gas as its presence is prevalent.

14 – Which other factors may concur to the rise of the greenhouse gas concentration?

Besides the human activity, natural factors contribute to climate changes, for example, the forest natural decomposition process, the increase of the Sun activity, and volcanic eruptions. However, none of these factors have brought forth changes at a speed the human activity has reached.

15 – What's the main single factor for CO_2 Emission?

The combustion of fossil fuels. It's alone responsible for about 80% of the whole global emission of CO_2 , and puts the world into a kind of dilemma. There's no development without energy consumption, and the availability of energy in large scale depends of coal, petroleum, and natural gas. The main reason is that the fossil fuels, when burned, release in gaseous form the carbon that was stored in the underground. That increases its concentration in the atmosphere.



16 – What's the role played by the deforestation and the forest burnout in this phenomenon?

About 18% of CO₂ emissions come from forest burnouts.

17 – What's the responsibility share of the developing countries in the global warming?

When it's historically analyzed, the complicity of these countries is small. The question is 'how they will behave from now and on. As they are usually very populated, and have great economic growth potential, they may become the great villains in the future.

18 – What's the Brazilian share, in particular?

The great concern about Brazil is about forest burnouts and the deforestation. These two factors alone are responsible for 75% of CO₂ emission in the country. If only the CO₂ emissions caused by the combustion of fossil fuels are taken into account, Brazil is the 16th greatest polluter in the world. However, when the overall environment devastation is accounted, the country jumps to the fourth position in the rank.

19 – Is it fair to expect that the developing countries will reduce their development rate to avoid contributing more to the global

warming?

This is a difficult question. Now, the South hemisphere has triggered its development and started allowing their population for better living conditions, the sustainability issue is spotlight (It wasn't not, over the time the actual rich countries were carrying out their industrialization process. The best the rich nations can do is to help the emerging countries have prompter access to the clean technologies.

20 – Is the temperature rising pace giving signals of slowing down?

No. Everything indicated that it's been the same and will continue so.

21 – Why should we believe the pace would remain the same?

The warming noticed today is one of the past actions with actual effects. In a short-term, there's no alternative energy with potential to replace the fossil fuels in large scale. To radically change the emissions, it would be required to very deep interventions, which would hardly be shortly feasible. The implementation pace of the measures set by the Kyoto treaty – the chief instrument of the countries and multilateral organizations to reduce the emission of the greenhouse gases – have been slower than it was expected. The treaty hasn't succeeded so far. The signers of the Kyoto treaty have reduced their emissions below the



benchmark set in the document they signed.

22 – Up to what temperature life on Earth will be feasible?

The experience in the deserts and tropical regions shows that human life in society is possible up to a steady temperature of 45° Celsius. That doesn't mean it would be bearable, if the whole planet had reached such temperature peak. The rearrange would oblige the humankind to seek new surviving strategies. On the other hand, not even the most pessimists amongst the scientists believes the global warming would embody a threat to the entire human race.

23 – Is there any risk of death of humans?

Yes. Many scientists believe the heat wave that killed over 30 thousand people in Europe during the summertime of 2003 has already been an effect of the global warming. If these heat waves become frequent, they will make more victims, mainly in the poorer countries (that have less protection alternatives), and the less resisting people like kids and the elderly.

24 – What are the predictable consequences to Brazil?

The most severe one would be the vegetation changes in half of Amazon area, which would become like a kind of

savanna or the so called Brazilian 'cerrado', from 2050. That's because the temperature in such region would rise at least 3° Celsius. With the average actual temperature of 25° Celsius rising to 29° Celsius, thousands of families would have to leave the Northeastern backwoods to seek milder climates. The sea level would also rise in the littoral cities like Recife and Rio de Janeiro.

25 – Is there any risk of the increase of diseases like malaria, yellow fever, or dengue, for example?

This is a controversial subject. The ones who disagree are in greater number than the ones who agree with that. The exception is for those diseases directly related to it like the dengue, which the transmitting mosquito would be reproduced in greater heat scale.

26 – Will the Glaciers completely melt?

No. The worst-case scenery estimated indicates that 2% of all glaciers would melt up to 2100. Such melting is what would lead to a sea level rising of 1.2 meters.

27 – What are the risks of the water to become scarce? Will the rivers dry out? May we say that the Northeastern backwoods become deserts?



The water availability won't change. What's going to change is rain distribution around the planet. Water availability will increase in some places, mainly places at average latitudes, and in the humidity tropical regions. There's an uncertainty regarding the equatorial regions. A full depletion of potable water may occur, however it wouldn't only be caused by the warming. It's also related to the pollution produced by the humankind along with the increase on the demand of water, mainly by the irrigated agriculture.

28 – Which other impacts may affect people's daily life?

The rains would be quite a lot more intense, and that would affect all the regions. Not only a higher incidence of hot nights heat waves are expected, but also more severe Winters. The temperatures would be extreme. If being kept, the current emission increasing pace – and by taking into account the economic and population growth projections, etc. -, there'll be a sea level rising, forest area reduction, floods in more humidity regions, and more severe dry weather conditions in the arid and semiarid regions.

29 – Will food supply availability be threatened?

It depend on the temperature rising. If the elevation is up to 2° Celsius (at most), the agricultural area may be increased by

incorporating vast areas in Canada, and in Siberia to the world's food yield. If the temperature rises above 4° Celsius or more – the whole world's agriculture may be impaired. Another problem is the rain precipitation change, which may bring forth more sever dry seasons in Africa and Southern Asia areas.

30 – May we expect that the warming would make life unfeasible in some regions of the planet, and impose mass population migrations?

One again, it'll depend on how much the temperature will indeed rise. In the worst-case scenery, there may occur mass migration of poor populations, as many as tents of millions of people, because the scarcity of potable water, and also for the agriculture. In the Southern Asia, a mass migration may come about because possible floods.

31 – May the rising of the sea level definitely come submerge entire areas along the littoral in some countries?

If the elevation on the sea level comes to be confirmed between 30 to 60 centimeters, the effects will be mitigated. However, the ice melting speedup in Greenland and in the West Antarctic has forced the scientist to review their previsions. An example: The Netherlands



have over 40% of its territory below the sea level. If the water elevation is small, it'll be possible to make up the problem by building some dykes. However, if it reaches the maximum limit conceived by the scientists, the country may lose a big part of its territory. During the 20th century, the sea level elevation along Brazilian seashore was up to 20 centimeters while the global average elevation reached up to 17 centimeters.

32 – May the global warming come to be the main cause of living beings extinction?

Yes. Over this century, and over the next one, the warming will surpass the two major current villains, which are the predatory hunting, and the fragmentation of some habitats.

33 – IS THERE ANY SPECIE BEING ALREADY THREATENED BY SUCH EVENTUALITY?

At least 74 species of frogs will disappear from the mountains in the Central America due to an increase by 1° Celsius on the actual average temperature. That changed the microclimate, and exposed the frog's skin to a fast and uncontrolled fungi growth. The amphibians around the whole planet are also jeopardized.

34 – May we expect any benefit

from the warming, or only tragedies?

The impacts are mostly negative as they disturb an already balanced system. However, there may also be some positive impacts like the increment of the agriculture in some places that are very cold today, which may bring forth some benefits to the human health.

35 – Doesn't the world have other problems that would demand more urgent approach than the global warming?

The starvation, the scarcity of water, and the diseases kill more people today. However, the world cannot dare to ignore the global warming. That's because, besides the disastrous effects, everything that may be done by now will only bring results forth some decades ahead. Furthermore, for many of the current problems, there seem to be coming about imminent technologic solutions. The hole through the ozone layer is an example. It'll be occluded in a near future, thanks to the measures already taken. About the warming itself, if the world would stop releasing the greenhouse gases today, the problem would take many years to be countervailed. Some boundaries have already being overstepped. The most observable example is the Arctic ice that may fully disappear by the summer of 2050. There's nothing else to be done but



starting acting now, instead of waiting five or ten years to start acting vigorously.

36 - How much will it be necessary to invest in the mitigation of the effects of the climate change?

At first, it was estimated that it would be necessary US\$150 billion US dollars yearly to accomplish the goals set by the Kyoto Protocol treaty. However the amount may be less thanks to the technologic advancements, and energetic efficient attained. Today, there already be technologies able to reduce up to 20% of the emission. There are other simpler examples like the light rendered by LED systems once the light-emitting diodes are 20 times more efficient than the conventional bulb lamps.

37 – Is it possible to fully revert the warming?

No. The most that may be attained it to speed it down. If the global emission are reduced to 60% and 70% until 2050, the temperature will rise 2 and 2.5 degrees until the end of this century. If nothing is done, it may rise between 4 to 5 degrees over the same period, which would bring forth disastrous consequences.

38 – To reduce greenhouse gas emission like CO₂ is it really the best thing to do?

What matters is net concentration, that is, the difference between the release gases

and the ones absorbed by the Earth. While the greenhouse gas emissions are reduced, investments in the carbon sequestration means of, for example, biologic means by expanding the forest areas, or geologic ones by storing carbon dioxide in the underground, which depends on a technology that's been yet developed, or yet by attaining higher energetic efficiency than the one attained so far.

39 – Is it economically feasible to reduce the CO₂ emissions enough to solve the problem?

If nothing is done, the world's economy will suffer an enormous shock. The Stern study (carried out by the former World Bank Chief Economist, Nicholas Stern) tells about annual losses of 20% off the GNP (Gross National Product) around the world (the total wealth produced by all the nations). In economy, what makes possible pay the price of a solution is the loss brought about by the inaction. The study estimates that the investment required to solve the problem may be up to 1% of the GNP.

40 – Wouldn't it be easier to solve the problem through technological development?

Even if a high degree of technological investment is reached, it will take time for that to take place. There's not enough time to wait for that without finding immediate



solutions to reduce the actual emissions.

41 – Alternative energy sources would meet our CO₂ reduction actual needs?

All renewable sources altogether would not be able to replace not even half the amount of fossil fuels used today. Therefore, it's necessary to reduce the CO₂ emissions by at least 55% until 2050. The role of the alternative energy sources is to boost such endeavor, and as well seek energetic efficiency.

42 – Wouldn't it be easier to accept the fact that the climate changes are unavoidable, and make investments in finding new manners to live with it?

Seek and find new manners to live with the climate changes is necessary in any case. The difference is about the intervention degree that will be demanded. It'll depend on the order of magnitude of the climate change.

43 – Individual attitudes like save paper and water, for example, may be any effective?

Only with individual attitudes it may be possible to promote changes in the consumption behavior with a significant beneficial impact. The planet must seek maximal product recycling, and make them more durable. If it occurs along with large

scale changes by, for example, substituting energy sources and optimizing the means of transportation.

44 – What's the responsibility share of governments and citizens like?

Due to the urgency, the governments must be the ones to start out carrying out such endeavors.

45 – Is it possible that the humankind attains plenty adaptation whatever it is the climate order of magnitude change?

Depending on the temperature rising levels, the adaptation may be unattainable due to the potable water scarcity, and also to supply the agricultural activities. However, it must be minded that the changes won't affect the whole humankind equally. For example, the population of Siberia will be benefitted while countries of Africa, Asia and Latin America will be negatively affected, which may bring about mass migrations.

46 – The carbon dioxide emission control set by the Kyoto Treaty will have any practical outcome?

The only practical effect of this treaty has been to trigger a great worldwide endeavor to develop alternative technologies. The conjointly effort of all countries is the only possible solution.



47 – Why does the United States keep refusing to sign it?

The main argumentation is the negative impact on the American economy competitiveness. The influence of the automobile and the petroleum industry on the American government decisions are really considerable. To avoid international pressures, the US government opt to invest billions of dollars in seeking cleaner technologies, and it's been indeed achieving better results than the other signers of the treaty.

48 – Are the governments and the international organizations already putting in effect any pragmatical endeavor?

Some countries like England and Germany have made significant advancements to reduce their emissions, and to develop new technologies to enable them to conform to the goals set for 2012 already in the next year. The European Union has started to impose more groundbreaking targets for 2020.

49 – Will the compensatory measures like the carbon credit market be capable of bringing global substantial outcomes?

The outcome is little because the carbon

market works based on compensations, that is, all the new trees planted in Brazil only compensates the CO₂ released by another country. It won't go beyond by, for example, promoting an effectual net reduction. Therefore, it's welcomed, but it's not enough.

50 – Is there still any remaining time frame to avoid the disaster?

Yes, there's still time to counteract the most negative upshots, but not all them. The Earth has already been warming, and the achievable goal is to effect means of preventing it from hitting a catastrophic warming level.



**Source: IPCC - Intergovernmental Panel on Climate Change*

By the Scientists: Carlos Nobre, José Marengo, Roberto Schaeffer e Suzana Kahn Ribeiro



Brazilian Legislation and The Environment

The Environment National Council of Brazil (CONAMA - Conselho Nacional do Meio Ambiente) set the national environmental policies by the Enactment 99.297/90. Its actuation range is consultive and deliberative within the scope of the National Environment System (SUNAMA - Sistema Nacional do Environment). The organization is comprised by technical chambers, workgroups, plenum, group of advisors, and the Environmental Policy Integration Committee (CIPAM - Comitê de Integração de Políticas Ambientais). The council is presided by the Brazilian Ministry of Environment and keeps a meeting schedule for every three-month period. It's an incorporated group representative of federal, state, municipal, business, and civil society sectors.

The control and preservation of the environmental resources in Brazil started being outlined in the decade of 1930's, and among the most relevant legal enactments approved that may be highlighted are the Code of Waters (Enactments 24.643/34, 24.672/34, 13/35 and Executive Order 852/38), the Fishery Code (Executive Orders 794/38 and 1.631/39), the Code of Mineral Waters (Executive Order 7.841/45), and the Mining Code



(Executive Order 1.895/40).

From that point, it may be noticed a very significant evolutionary process in the environmental Brazilian legislation that becomes a new environment deal and leaves behind it the fragmented and customized juridical approach that prevailed until the early decade of 1970's that used to deal with the environmental issues based on several laws on waters, mining, flora and fauna, hunting and fishing, etc., of which many of them are



still in effect.

As an upshot of the Stockholm Conference of 1972, the environmental issue juridical approach became broader and more integrated, especially from the time of the promulgation of the Brazilian Federal Constitution of 1988, when, in a new manner, added to the national constitution a specific chapter fully dedicated to the environment.

By doing so, it was given a whole new dimension to the environmental law that started then counting on suitable legal instruments to ensure the basic conditions to formulate and implement new environment policies, which were more consistent with the principles and needs of sustainable social and economic development. Brazilian legislation regarding the environment was benefitted from the new principles and directives incorporated in the documents approved at the Earth Summit, also referred as Rio Summit that was held in the city of Rio de Janeiro in 1992. Even being undeniable that since then there has been given to it a more careful and detailed juridical treatment to the environment issue to the point of the Brazilian legislation being considered one of the most advanced in

the world, it's impossible to hide that this big and accelerated legislative process has been hindering its correct application. It's evident the gap between its legal ordinance and the environmental reality in Brazil, where many of its principles and legal provisions in effect have not been achieved, or have been only partially achieved.

The explanation for this fact is apparently simple, however the problem is quite complex and difficult to solve. As the environment is broadly generalized area, which encompasses every and any human activity, and as the human behavior, as simple as it may be, produces environmental impact, its proper approach involves legal aspects (obligations and rights), and technical (environment engineering or how-to-do things in harmony with the environment). These two lines of thoughts about this issue require multidisciplinary knowledge and many clear definitions, even of the simplest subjects. That's why the environmental normalization matter from the administrative and legal point of view turns out to be above everything a matter of objectives and definitions, which not always happen.



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