

of Tambora volcano in 1815, which had a ravaging impact on a big part of the planet (and also a significant influence on the course and the strategies of the Waterloo battle, probably!). In fact, the following year 1816 is known as “the year without summer”: in August, the temperatures fell down to about zero Celsius degrees in some areas of Europe and Northern America.

What can we say about the causes of these climatic events and of the present “warm” period? And what can we forecast for the future? In order to correctly interpret the climatic changes and their causes and forecast the future ones, it is necessary to start from the past and try to identify the phenomena that influenced and caused changes during the history of our planet [16-17]. For this purpose, we must use and combine knowledge from different research fields, since the science of climate is typically interdisciplinary.

Reliable instrumental measurements (temperature, humidity, etc.) are available for the last 100-150 years only. We must not believe that reliable models of the climate trends can be built on the basis of these data. Thinking that the climatic history of the last 150 years contains all the data that are necessary to understand the reasons of the present and future climate changes is unscientific. It is equivalent to believing that the last 150 years do not have a past and thinking that anthropic activities are the only causes of the global changes we are observing now (omnipotence attitude, indeed!) [17-18-19].

The environmental pollution of the last century is certainly due to the human activities, but the climate changes are a different matter and must be studied starting from previous climatic history. Synergy and collaboration are required between researchers of history and natural science and experts of instrumental records. Investigations, extended to the last millennia, about ancient geological sediments, archeological finds, historical archives and other documents, artistic creations, etc., matched and integrated with more recent instrumental data, can help interpret and understand the past and provide the baselines to forecast the next climatic and environmental changes and suggest suitable solutions to prepare our society to future conditions. The scientific disciplines related to the climatic issues are progressing; but the science of climate is young and still affected by many uncertainties. We should remember that 30-40 years ago, when the global temperature was decreasing, the scientists were prone to forecast a next new glacial age and suggested some actions that now seem to be naïve or even ridiculous. Then, after the inversion of the temperature in the 1980's, from the forecast of “Global Cooling” they have rapidly shifted to “Global Warming”: how can we be sure of our certainties after these failures?

Many researches are being performed to understand the influence of the dynamics of the solar system on the past climate changes: variations of reciprocal positions of the sun, planets and satellites, precession and eccentricity of the earth orbit, axial tilt, etc. Now the anthropic activities are added to the natural causes and certainly have an influence; but the natural phenomena cannot be neglected. During the history of our planet interesting periodical oscillations [20-21-22], having different periods (for example, 10 years, 20 years, 60 years, 1000 years and others) have been observed: they interact with each other and contribute to complicate the main trends. The causes of these periodical changes must be deeply studied.

The global circulation models identified, collected and referred to in the IPCC reports, which ascribe the climatic changes to the human activity for about 97%, do not consider

all these phenomena. If applied to some specific period and compared with instrumental data available for that period, such models have generally failed in supplying reliable representation of the climate trends: they probably overestimate the anthropic influence, because are prone to undervalue the contribution of natural causes. Is it realistic to state that these natural causes, which determined the climate evolution during the whole history of our planet, have now become irrelevant due to the increased influence of anthropic civilization? Perhaps in the future, after careful investigations of the dynamics of the solar system and further collection of instrumental data, some belief will be reconsidered.

4. OPEN PROBLEMS FOR THE MEDIUM AND LONG TERM

Humanity, during its long history, have faced many difficult and upsetting circumstances and solved a lot of problems to survive, grow and improve its way of living in the planet. The present society lives in a crowded world that has become rather small if we consider the continuous population growth, the progressive exploitation of resources, the huge environmental problems. These problems are interdependent with each other and mixed with other very urgent matters. It will not be possible to solve all of them simultaneously: suitable priorities must be identified.

Climate changes will probably not be the first priority, despite what many opinion leaders may state. The mitigation of the environmental impact is, of course, necessary to improve the quality of our lives. Gradual decreasing the use of fossil fuels and greater attention to energy saving, without depriving people from the indispensable resources, is one of the priorities. But we must not forget that the climate will probably change anyway, regardless from what actions we undertake: it is important to be prepared, not to be caught by surprise. This means that not only “mitigation”, but also “adaptation” is of paramount importance.

Anyhow, many other problems represent urgent priorities.

4.1) The rate of growth of world population should decrease, up to reach and stabilize an overall number of people consistent with the available resources. It is true that research and technology can make available some kinds of resources that now cannot be exploited; this issue occurred many times during our history. But, in spite of this consideration, a limit is given by the size and the overall recycling capacity of our planet. The road will probably be long; but we must take these aspects into account in setting and developing our strategies.

4.2) An acceptable level of education should be reached in the underdeveloped areas, to avoid that a large number of inhabitants become uncritical masses manipulated by the power of politics, economy, religion, ideology.

4.3) Excessive economic disparities among peoples are often origin of conflicts: the governments should act in order to reduce these disparities.

4.4) The resources of the earth are not infinite. New discoveries and new technologies will probably increase the reserves of materials and energy sources; but, of course, this process cannot continue indefinitely. Consequently, it is very important to preserve the resources of our planet. The idea of trying to populate other planets might be theoretically attractive, but we should better look after our old Mother Earth!

4.5) Under the pressure of the growing population and the interests of business organizations, we have allowed many areas to become overcrowded and we have intensely built roads, bridges, buildings, factories, cities, etc., even in unadvisable locations, often neglecting the inherent risks. Wide areas have been savagely deforested, while some others, formerly cultivated, have been abandoned, letting forests to grow in complete disorder; the maintenance of critical territories has been neglected. Nature does not forgive unaware or irrational behavior: the climate and the weather can suddenly change, the natural events can be violent and it is much more reasonable to properly act in advance rather than putting in place emergency measures after calamities.

4.6) Coming back to education, it is also important to explain the prominence of the previous problems to the public. Education should lead people to behave ethically in their everyday life, learning to correctly interact with the others, independently of their traditions, ideologies, religions. In the Western Society a very important relatively recent conquest, allowed by education, is the concept of parity of rights and dignity of each person, man or woman. This conquest should gradually reach all the world, even considering that each civilization should preserve its culture, without imposing it to other peoples. This issue takes us to speak about terrorism, which, unfortunately, is a very serious and upsetting problem being experienced by our society in the present years. The religious fundamentalism brings terrorism; but the roots of terrorism are also to be looked for within uneducated, unaware, underdeveloped masses of people. Once more, education and freedom are the keys for a reasonable answer to this problem: educated people can be driven and encouraged to engage themselves in improving their life standard without trying to get unlikely benefits by violent actions.

4.7) What about the scientific and the technological research? It has been the driver for our progress during the whole history of humanity and should always be considered a priority, without forgetting that it should always be linked and matched with moral conscience and ethical thinking.

5. CONCLUSIONS

The interaction among energy, economy and the environment is the basis of our life. The availability of big amounts of energy drives our activities, which, in their turn, have big impact on the environment and on the economy. The human trend throughout the history has been influenced by man's ability in exploiting the natural resources; the steep growth of the world population in the last two centuries has been mainly due to the use of fossil fuels, which still contribute to the total energy consumption by 80-85%. But the reserves of fossil fuels are not unlimited and, moreover, their use causes pollution and health problems.

Hence it is of fundamental importance to reorganize the energy systems; but we must consider that the world population of over 7 billion people (still increasing) needs a large amount of energy. The transition to a different balance between resources (from fossil fuels to renewables) is an epochal issue and will need a long time to be addressed, to avoid social conflicts and wars caused by shortage of the usual means of subsistence. It is a big challenge, which requires the support of science and technology, but also the development of a common perception on these problems.

Another important matter is the climatic situation and its connection with the environmental issues. The climate has always changed in the human history and beforehand: a superposition of long time trends, periodical oscillations and sudden events has been observed. It is very difficult to forecast the future climate. Science and technology can help doing it, but it is necessary to assess these changes considering the historical background, matching the instrumental measurements, only available for the last 100-150 years, with other "proxy" data supplied by scientific (and also humanistic) interdisciplinary researches.

The environmental status and climate are different issues and must not be mixed with each other. It is obvious that the environmental pollution is mainly caused by human actions; but how much do they impact on climate changes? It is not believable that the natural events, which have driven the whole history of climate up to the XIX century, have become irrelevant compared with the increased impact of human activities. The science of climate is very young; we should be humble and realize that many things are still to be discovered. Remembering that 30-40 years ago the scientists shifted from the forecast of Global Cooling to that of Global Warming, it is very difficult to have true "certainties" about climate.

We must start from the past and deepen our knowledge on the history of climate to correctly interpret it and try to set the basis for a reliable forecast of the future. Climate changes are a big and complex issue, but perhaps we have more urgent priorities, connected to human conscience, moral behavior and personal ethics. Some of them have been outlined in the previous section: they require wisdom, honesty, grandstand and long-term view, decision-making attitude. Will humanity be able to take decisions and behave in the right way?

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