ENERGY & ENVIRONMENT: HARD CHOICES

PRESSURES RUN HIGH FOR DEVELOPING COUNTRIES

BY FIDEL CASTRO DÍAZ-BALART

The future of energy and its relation with the environment is a very complex and controversial issue. The well-known French scientist, Ilia Pirigogne, once said "The future cannot be predicted, but it can be designed". The ideas, meditations and concepts that follow are inspired by this thought, and are presented with no pretension of being thorough or conclusive — such pretension in science would be counterproductive — but only as the basis for a debate.

It should be understood that the only way to have a safe energy future is to produce and use energy in a way that is environmentally sustainable. This would have to be compatible with the environmental priorities of society, and be supported by a social consensus that accepts a basic premise. The premise is that for true economic development there must also be an equivalent human development where education, culture and knowledge are the main foundations for deciding which energy sources should be used and how they should be used in the 21st century for the well-being of humanity.

Thus, energy resources and technology would become vital factors in the modeling of economic and social progress. But their influence will depend greatly on their interaction with an important number of other determining elements such as: environmental policies, further development of world trade, economics, communications, and information techno logy — elements that will bring together great changes in the habits and ways of life of the world population.

Almost needless to say, this scenario must be accompanied, on a global scale, by the necessary political and social changes, with legislation and rates that will allow measure of equal opportunities, social justice and access to development, which an important part of mankind is deprived of in the world today.

Energy Needs vs. Sustainable Development. No better example to illustrate this bleak reality than the figures presented by well-respected international agencies, such as the United Nations Development Programme (UNDP), the World Energy Council (WEC) and the World Bank. They show — even excluding the huge annual military expenses — that one-fifth of the world population, which lives in countries of highest income affiliated to the Organization for Economic Cooperation and Development (OECD) — holds 86% of the world gross industrial product, 82% of the world export markets, 68% of direct foreign investments, 91% of Internet users and controls 71% of world trade. They also show that one-third of the world population of 6 billion — a population that has quadrupled in the last 100 years — has no access to commercial energy. This contrasts with a sector of less than 20% of the world population that consumes 80% of global energy production. Very little progress has been made to cope with these needs.

There are other urgent problems that should be examined. For example, a report by the International Water Management Institute states that the scarcity of water for irrigation in the future could cause, by mid-century, a 25% decrease in the production of cereals in India, a country that will be reaching a population of 1.5 billion at that time. It is also predicted that by that time one-quarter of the world population would be living in countries suffering from chronic scarcity or insufficiency of freshwater.

To sum up, since 1950, the world surface for cereal production per person has fallen sharply. Relatively few land surfaces remain available for culti-

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vating, due mainly to the expansion of industry and the building of housing.

According to the United Nations, this year for the first time the number of urban inhabitants in the world has surpassed the number of rural inhabitants, and in the year 2050 there will be 8 billion people on the planet. It is logical to wonder then, are there any environmental limits for the number of people and the quality of life the planet can sustain?

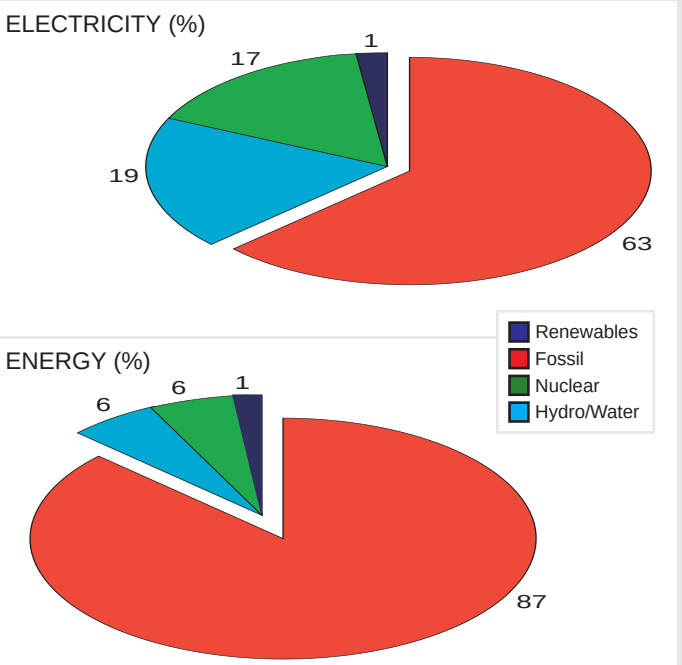
Unfortunately, economic globalization does not offer a solution to the aforementioned problems. On the contrary, it intensifies the asymmetry between those who have access to its benefits and those who remain excluded. In a global economy, energy supply efficiency is indispensable for a solid economic activity.

Within the context of sustainable development, paths and actions must be chosen that do not reduce today's environmental and social capital to unacceptable levels and that do not compromise future generations. This view found expression in terms of policy in the 1997 Kyoto Protocol, with the purpose of adopting wise decisions to reduce the risk of future climatic change. Unfortunately, until now, as witnessed during the latest Conference on the topic, the agreement has not found the necessary support, particularly from some highly industrialized countries that are responsible for a large amount of world pollution.

A second consideration leads to the assessment of some elements in the field of energy. In the coming 20 years, world energy demand is projected to increase threefold. *(See graphs,*

SHARE OF ENERGY SOURCES IN ELECTRICITY AND PRIMARY ENERGY GENERATION

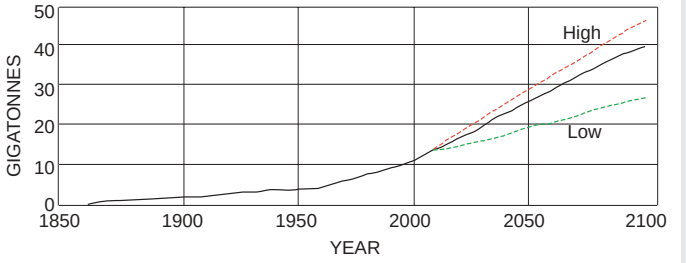
(PRESENT DAY DISTRIBUTION)



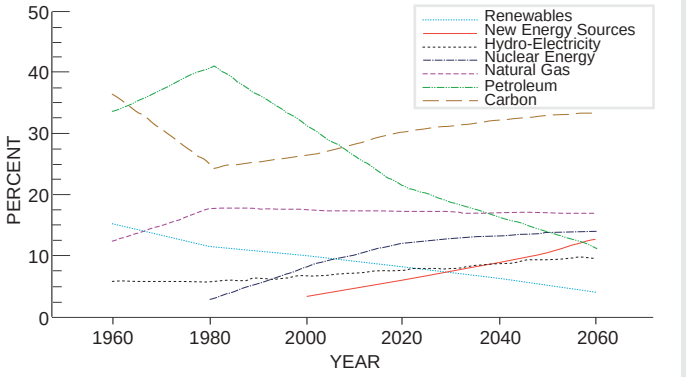
Source: WEC

GLOBAL ENERGY CONSUMPTION

(EQUIVALENT OF GIGATONNES OF PETROLEUM)



CONTRIBUTION OF DIFFERENT ENERGY SOURCES TO THE WORLD'S GLOBAL CONSUMPTION



page 26.). During this time, the main sources of electricity production (namely fossil fuels such as coal, oil or natural gas) are projected to decrease their contribution to comply with the demands of the Kyoto Protocol, a 12% reduction by 2010. According to some specialists, to fulfill this, assuming that 50% of the reduction could be achieved by means of an increased energy efficiency, the remaining 50% would inevitably have to come from the use of energy other than fossil fuels.

Averting an Energy Crisis. The issue then will be not only how to achieve the desired reductions of CO_2 levels, but mainly how to deal with the energy crisis that will develop in the decades to come. Recent studies consider three global economic growth scenarios which should correspond to the energy demand growth for the coming century. *(See graph, page 26)*.

As the WEC has found, coping with the increase expected in the low-case scenario would require:

- A greater generation capacity, to be added in the next 20 years, which would be larger than the total capacity built in the last century.
- 25 million additional barrels of oil per day, for a total daily oil consumption of 90 million barrels or 15 million tons.
- The potential for burning 3.5 billion tons of coal per year, for an annual consumption of 7 billion tons.
- An annual gas production of 4 trillion cubic meters, which is equivalent to the total gas reserve of the United States.

We must keep in mind the fact that conventional energy resources are not inexhaustible. In this light, sustainability must start with the efficient use of resources, and the optimal exploitation of the existing energy reserves with a minimal disruption of the environment by means of adequate procedures for the recycling and minimization of residues.

Studies show that known coal reserves can last for over 200 years, natural gas for 60 years, and oil for 40 years at the present day consumption rates. There are ongoing efforts to increase oil and natural gas resources by means of improved recovery techniques. It is estimated they will be able to at least double the basic resource.

Space does not permit the presentation of a detailed analysis in this essay on the role of technology in different conventional energy sources. But it is a fact that depending on the specific economies and new technologies, a future increase in extraction levels and use of fossil fuels could be developed such as stimulating the substitution of conventional fossil fuels by carbon-free fuels. However, financing the necessary investments and the instability of prices could then become major hindrances and obstacles.

A third consideration refers to the existence in the world energy panorama of other trends to face the future, mitigate the problem of greenhouse gases (GHG) and the day-to-day depletion of conventional resources. From the environmental perspective, although from different starting points, the most promising are renewable sources and nuclear energy.

There is, however, a persistent tendency to oversimplify and to consider renewable sources of energy always as "harmless" and nuclear energy together with fossil fuels always as "harmful". In the field of energy, this is not totally true and can be proved by data and experience.

At present only two non-conventional sources produce GHG-free energy in adequate amounts: hydropower and nuclear energy. They each produce around 7% of the primary energy used mostly to generate electricity. The remaining non-conventional sources together provide only about 1%.

In the coming decades, most sources of renewable energy and thermonuclear fusion — sometimes the object of wishful thinking — still pose considerable technical and economic obstacles that will prevent their significant contribution to the world energy balance. That leaves only five carbon-free sources that could have a significant impact around the year 2050: nuclear fission, biomass, solar energy, wind energy, and "de-carbonized" fossil fuels, mainly gas.

Nuclear Prospects. When it comes to nuclear energy, there is a strong base of experience and development. Important environmental advantages are associated with its use. It significantly contributes to reduced emissions of carbon dioxide in the world, on the order of 8%, a reduction similar to that attributed to hydropower. It also does not emit contaminants such as nitrogen and sulfur oxides, whose transformation into acid compounds in the atmosphere and their further deposition through rain or dust is causing acid rain with devastating effects on forests, lakes and buildings.

Other factors influencing nuclear energy's prospects are its safe and economic operation. This includes the effective

THE LATEST WORD FROM THE WORLD ENERGY COUNCIL

The World Energy Council (WEC) — one of the most authoritative voices on international energy development — recently issued a statement for 2002 that updates its conclusions and recommendations from the 18th WEC Congress held in 2001. WEC has Member Committees in over 90 countries, including most of the largest energy-producing and consuming countries.

The 2002 Statement underscores the WEC's central message: Affordable modern energy services for everyone are a key to sustainable development and peace throughout the world.

Concerning nuclear power, the WEC Statement sees environmental advantages. "For base-load electricity generation, the most effective means currently available to reduce CO_2 emissions are nuclear power and hydroelectric power. Countries with the highest proportion of nuclear and/or hydropower have the lowest CO_2 emissions per kWh. Nuclear energy and large hydro have advantages in terms of global warming, cost stability and high capacity factors that make them compatible with the goals of sustainable development for tomorrow's world."

The WEC recommends that governments and industry cooperate to build public support for nuclear energy so that this significant source of electricity can play its part in key markets now and in the future.

More information about WEC studies, reports and statements is available on the Internet. at http://www.worldenergy.org.

management and disposal of radioactive wastes. Such factors related to environmental, economic, and safety aspects will in the long run determine the role of nuclear energy in a sustainable energy future.

Meeting the Challenges. One could now ask, With our eyes on the future, what are the challenges for nuclear energy, and what should be done to guarantee that its contribution to face the demand for clean energy be fully and fairly considered?

To meet the challenges implies undertaking action in two directions. The first is to recover public confidence in nuclear energy's safety. Widespread understanding is the key to popular acceptance and this is a must if nuclear science and technology are to contribute with all their potential to resolve the many serious challenges of the future. The second is the use of nuclear energy exclusively for peaceful purposes and the demonstration of its economic competitiveness compared to other options.

One more aspect that should not be overlooked is to understand that nuclear science, the basis of nuclear energy, is common to every other peaceful nuclear application be it in medicine, agriculture, industry, science, or other fields. These applications hold sizeable benefits to society.

To summarize, it must be pointed out that energy development is a multi-stage process. For many decades to come, fossil fuels will continue to be the largest source of energy, with natural gas as the cleanest carbon-based energy source in terms of the greenhouse effect. With regard to technological energy development and growth rates, four stages can be outlined today.

The first stage extends up to approximately the year 2015 with an increase in the production and consumption of fossil fuels and other non-conventional sources through the existing technologies.

A second stage — overlapping the first — extends to 2050 with a combination of fossil fuels, nuclear energy and renewable sources, the latter two slowly expanding their share of the market.

By the mid 21st century electricity and hydrogen will take the lead in the energy race, especially for household consumers. Oil and gas will continue to play an important role in transportation until hydrogen becomes readily viable. New economic, social and environmental requirements will demand the additional use of other emerging energy sources, as well as new methods for the use and transportation of energy.

Finally, beyond the year 2050 and unto the 2100, new breakthroughs chiefly in solar energy and thermo-nuclear fusion will permit economic and environmentally sustainable energy systems at a global scale.

In short, the production and use of energy to fuel sustainable paths of development remains a pressing, continuing challenge, especially for developing regions of the world where populations and energy needs are rising the fastest. More needs to be done urgently by all countries to support steps and actions that will bring clean, reliable, and affordable energy to more of the world's people now as we embark deeper into the 21st century. ❐