ENERGETIC PANORAMA FOR THE 21ST CENTURY: BUSINESS AS USUAL?

History teaches us that the development of industrialized countries was based on fossil fuels (FF), first coal, afterwards oil and gas. Now, energetic policies and developments show that the world is failing to achieve a sustainable path. Renewable energies grow slowly, nuclear energy is stagnant and FF continue to hold a noticeable hegemony, presently representing an 81% and being estimated to remain at 75% by 2035. This is being propitiated by the governments. The subvention to FF in the last years has been 6 to 10 times that provided for renewable energies.

Currently there is an abundant production of non-conventional natural gas (shale gas) from fracking, a technology that, after drilling the well, fractures the bedrock by high pressure injection of water, chemicals and sand. This generates multiple micro-fractures that allow gas to flow to the surface. In the USA, the availability of low cost gas permitted that many carbon fueled thermoelectric plants shift to operate with gas, which in turn led to a marked reduction of CO_2 emissions, the lowest in the last 20 years. For a given amount of energy, gas burning produces about one half the CO_2 as carbon. However, considering the high global warming potential of methane, the direct emissions of this gas from the fractured oil wells can offset the supposed climatic benefits. Natural gas would be preferable to carbon only if methane leaks keep below 4% of the total production (*Interciencia 18*: 285-286, 1993; *Nature 493*: 12, 2013).

Despite the reduction in carbon use in the USA, it grows at a global scale, especially in emergent countries. Taking together China and India, in the last decade these countries added three thermoelectric plants per week. China consumes ~47% of the world carbon. For the future, China projects to build 363 thermoelectric plants; India 450. The impact on climate will depend in great measure on the development and implementation of CO_2 capture and storage (*Interciencia 35*: 873, 2010), but this technology has advanced little and it is not very probable that it be utilized by developing countries in the medium term.

The demand for oil-derived liquid fuels will continue to increase, especially for freight. The production of liquid biofuels, which could substitute for gasoline and diesel, has many limitations and progresses very slowly. The current consumption, 87.4mb/d (millions of barrels per day) is projected to grow up to ~100mb/d by 2035. The industrialized countries will reduce their demand by ~6mb/d and all the net growth will correspond to developing countries; almost half of it to China. It is worth noticing that in the decade of 1980 it was believed that in the mid term oil would be completely spent. However, due to new technologies, much non conventional oil (Venezuela, Canada), from offshore drilling (Brazil, Angola) and fracking (USA) has become available and takes us on the path to superabundance.

According to the International Energy Agency, energy demand will grow over one third in the period up to 2035; 75% of that growth will be FF, the fraction consumed by developing countries will go from 55% to 65% and the greenhouse gas emissions associated to energy will increase ~20%, pointing to a long term average temperature rise of 3.7ºC, far above the 2ºC considered as the limit to avoid disastrous environmental consequences. In practice, the energetic matrix for the 21st century continues to be dominated by FF, business as usual. Energy is the motor for development, but the FF are taking us, in an accelerated manner, to a climatic crisis of unforeseen consequences that, paradoxically, could curtail the sought development.

Eugenio Sanhueza
Instituto Venezolano de Investigaciones Científicas