

The Frontiers of Science: The New Economic Platform Based on a Fusion Economy and Man's Future in Space

ALAIN GACHET

Radar Groundwater Mapping: Turning Difficulties into Opportunities

Alain Gachet is the Chairman of Radar Technologies International, France. He titled his address, "Space Technologies Can Change the Groundwater Geopolitical Balance: Case Studies in Kenya and Iraq."



Dr. Gachet presented the WATEX (water exploration) program, which searches for underground water resources using radar mapping done from satellites. Today, when 1.1 billion human beings are without access to clean water, and water needs are growing with a growing world population, he said that science is the only way to “convert difficulties into opportunities.” The water used by mankind so far is only a fraction of what is there in the deep underground—the real source of water.

WATEX got into action in the 2004 drought in

Sudan and found water at a depth of 80 meters. Once drilling was done, the water was sufficient to supply 33 million people and make the trucking of water, at a cost of \$500 million, superfluous.

During the 2011 drought in northern Kenya, WATEX found a water basin half the size of Belgium, containing 200 billion cubic meters of water. By 2014, the Hell created by the drought in northern Kenya had been turned into paradise: The former drought zone was producing an abundance of vegetables from newly created arable land.

The WATEX approach is to make use of the characteristics of soil wetness and soil roughness that one can determine with space-based radar, and a particular difference between water and oil. This method was also used in Iraq, and abundant underground water resources were found in the country's eastern regions. The same could be done for Syria and other countries with large arid zones.

There was applause when Gachet showed a short video of African children refreshing themselves joyfully at a new water well and fountain—it was the first clean water they had experienced in their young lives.

RAINER SANDAU

Towards a New Era of International Space Cooperation

Rainer Sandau of Germany is Technical Director, Satellite and Space Applications, of the International Academy of Astronautics.

Dr. Sandau presented the work of his organization, the International Academy of Astronautics (IAA), from its founding in 1960. The IAA, which promotes interchange among researchers, technology developers, and astronauts internationally, has won 1,200



members for its effort to alert policy makers to the necessity of space exploration. Among the IAA regional secretaries is one in Syria, who has made important contributions to this cause.

When the International Space Station was first put into orbit around Earth, there were eight space agencies supporting the program. Since then, many new agencies have been created. There are 40 of them now, and the IAA has brought many of their leaders together at international summits—most recently in 2010, 2014, and 2015—under its motto, “Together to Space to Enrich All on Earth.”

ADELINE DJEUTIE

Nuclear Energy in Developing Countries

The third presentation in this panel was by Adeline Djeutie (Cameroon), who has worked with the International Atomic Energy Agency and is now an independent consultant in Vienna, in areas related to IAEA work. Her prepared statement follows.

Adeline Djeutie, independent consultant, former programme management officer at the International Atomic Energy Agency, Division for Africa, Technical Cooperation, entitled her presentation: “Sustaining Energy Development in Developing and Emerging Countries: What Role Could Nuclear Energy Play?”



erty alleviation possible without a reliable and sustainable supply of energy. Energy contributes to improving social conditions (health, education, food and decent living) and economic development (private sector development, investment, employment, industrialisation, and innovation). Yet, many developing countries are still not able to meet the energy demand needs placed on them, to incubate the necessary conditions that could trigger effective development and alleviate poverty. 1.4 billion people still lack access to energy, most of them in developing countries.

Energy plays a critical role in economic and social development. In fact, there is no development or pov-

erty. According to the United Nations world population growth forecast, population will increase from 6.7 billion in 2011 to 8.7 billion by 2035, increasing substantially the demand on energy. Over 70% of that in-

crease of demand is expected from developing countries led by China and India.

In regions like Africa, the energy poverty does not reflect the existing natural resources potential in many countries. In fact, Africa is endowed with various natural resources (oil, gas, coal, sun, water, wind, and uranium, for example) that could sufficiently fill the current and expected energy demand gap if some bottlenecks were overcome and adequate measures were taken.

As for specific examples, it is indeed a paradox that in the Democratic Republic of Congo, only 9% of the population has access to electricity, whereas the country has a huge hydropower potential¹. Nigeria, although one of the top oil producer countries in the world and member of OPEC, can supply electricity to only 55.6% of its population. Niger and Namibia are the 4th and 5th leading world producers of uranium, but only 14.4% and 47.3 % of their respective populations have access to electricity².

Access to traditional and renewable sources of energy has been limited, so far, due to several factors such as political instability, lack of investment funds, heavy domestic regulatory policies, technological barriers, small market size, and weak transmission connections within countries and with neighbouring countries.

Climate change and recent environmental disorders have been attributed to the retaliation of both natural and social systems to unsustainable use of limited natural resources and destruction of our ecosystem over the past centuries. We have witnessed some devastating environmental catastrophes recently in all continents, and developing countries have been most vulnerable to their long term adverse effects, which poses an additional challenge to their national development agendas. There has been an international clamour to urgently curb greenhouse gas emission (GHG) trends, and calls for greening the economy have reached a point of no return.

Renewable energy is promoted as a source of alternative clean energies. There are several financial and investment incentives for energy development policies from traditional donors and investors, that preferentially support energy from sources that are abundant and infinite like wind, solar, geothermal, and to some

extent, water. Nuclear power, that had its glorious years until the middle of the 1980s, seems to be portrayed as **obsolete**, and therefore discarded as a widespread viable option, from major energy policy and development discussions at the international level.

The End of Nuclear Energy Era?

Yet nuclear power has so far proven to be a clean and reliable source of energy. There were about 435 nuclear reactors in operation in the world by the end of 2014³, most of them in the U.S.A. (99), France (58), Japan (48), Russia (34), China (23), Republic of Korea (23) and India (21)⁴. Nuclear power has long contributed to the development of the industrialised countries. The Fukushima-Daiichi accident in 2011 has rightly sparked some hot debates and strong mobilisations at various levels, to phase out nuclear power programmes that are considered too risky and unsafe. The popular opinion of nuclear opponents still considers that energy salvation should come from innovation and technological progress in other renewable sources. But the unknown factor is whether the cost and capacities of other renewable sources could effectively replace nuclear in the respective national energy mixes, and also, if so, will the population be willing to bear the necessary cost?

In the meantime, despite some major slowdown in the industry since the Fukushima-Daiichi accident, and strong negative public perceptions about nuclear power especially in Europe, the reality is that many countries still rely on this source to ensure a stable and affordable supply of energy for their populations. Based on a study conducted by the IAEA, nuclear electricity still holds a big share in the energy portfolio of the so called 34 nuclear power countries. Between 1985 and 2014, nuclear electricity's share accounted for 76.9% in France, 47.5% in Belgium, 30.4 % in Japan, 19.5% in the United States of America and 15.8% in Germany⁵. This share is also very important in Central European countries (Slovakia—56.9%, Hungary—53.6%, Ukraine—49.4%, Slovenia—37.1%, Czech Republic—35.9%, Bulgaria—33.6%, Armenia—30.7%), and varies for the other nuclear power countries.

3. <http://www-pub.iaea.org/books/IAEABooks/10903/Nuclear-Power-Reactors-in-the-World-2015-Edition>

4. Same as above.

5. Same as above

1. Africa Energy Outlook 2014, IEA

2. <http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS>

At the same time, traditional nuclear power countries like Russia, Japan, the U.S.A., and France are expanding their nuclear capacity in order to increase the share of nuclear electricity, but the biggest shift is now seen in such emerging countries as India, China, Pakistan, U.A.E., and Turkey, which aim to expand energy production to support their fast growing economies and populations. These new trends trigger some prospects for analysis that could be further explored for other less developed countries' business models. In fact, the strong interest of emerging countries in developing or expanding their nuclear power programs, indicates the potential that lies in this source of energy, beyond its known risks. Such potential is worth further exploring, without any taboo or prejudgement.

Climate Change, Development, and the Role of Nuclear Power

After so many years of international development efforts, developing countries, along with the development-agency communities, have failed to implement energy policies that are consistent with the real needs, and commensurate with the challenges faced by these countries. With so many development priorities, developing countries have a lot on their plates, which makes it hard to keep up with the ever-changing international agenda. Climate change agreements are adding substantial challenges to these countries; thus their reluctance to strongly commit to and embrace the global effort to combat climate change. As regards energy, many, if not all of these countries are heavily dependent on international finance to support domestic energy infrastructure. Now such financial supports are offered to clean development technologies, except for nuclear. Looking at the development patterns of rich countries: almost all, if not all, at some point in their development, had to embark on nuclear power. The question to ask nowadays is whether socio-economic development is possible without nuclear power, taking into consideration current development indicators and energy demand forecasts, and comparing other successful development models.

It is indeed striking to see, from the list of nuclear power countries, that emerging countries in Asia and Central Europe are taking the lead in nuclear power de-

velopment investments, and their share is expected to grow steadily over the coming decades. It is obvious that as the standards of living and levels of development of some countries increase, so does the demand for quality in terms of water, air, energy, food and other commodities. Full and affordable energy supply remains the concern of developing countries for the time-being.

Taking into consideration that nuclear is a mature technology, for which particular safety requirements should be put in place, innovation and technological development could also contribute to mitigate some safety risks, bearing in mind that no zero-risk scenario exists in any technological breakthrough. Further considerations of the role of nuclear in development will be discussed during the session.

In her oral presentation and discussion, Adeline Djeutie said that there is an urgent need for a change of paradigm, to create a world free of fear, of need, and of disease, with freedom to develop energy as a key resource for economic and social life. She reported that in many meetings, when she said she was in the nuclear business, discussion partners distanced themselves, influenced by the ignorance and disinformation created by mass media campaigns, especially after the Fukushima accident five years ago. But the truth is that energy supplies globally, particularly in many African countries, do not measure up to the actual energy needs, which will increase further with the growing world population. There are African countries rich in uranium sources, but the population there mostly has no access to energy supplies. Congo has abundant water sources but no hydropower to supply its population. The fast-growing economies in southeast Asia show that with nuclear power, rapid development is possible, and there are not enough nuclear power plants in the world yet: only 405 of them are in operation now. More nuclear power is also the way to improve the world climate, but after Fukushima, the alleged end of nuclear power was proclaimed, launching a policy of fear. That has to be reversed, and Africa already has a significant skilled workforce to change policy, although now it is living and working in the diaspora outside of Africa.