Nuclear Energy and Sustained Development

by Dr. Stanislav Subbotin

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In the 21st Century, mankind will be faced with practically all of the consequences of that large-scale experiment in increasing "one's own" wealth, by utilizing "cheap" sources of energy, namely extracted organic fuels.

It should be realized clearly, that we currently have a civilization, whose viability is based on non-renewable processes, and cannot be separated from the rising production and consumption of electricity and various types of fuel for various possible means of transport. The raw materials resources from which these are derived (oil, gas, and coal), no matter how great they might now seem, can provide for the existence of this civilization for no more than 20-50 years, without serious political and economic disturbances; not to mention unpredictable changes in the functioning of the biosphere as a whole, local ecological disasters, and climate change.

No political and economic reforms will solve the oncoming problems, unless they have at their disposal a functioning power industry, which is a kind of core of any economy. It is necessary to develop and implement new principles and methods of obtaining energy, without large-scale intervention into the cycles of the biosphere. There must be a change of values, in order to stop taking resources from the Earth and from future generations, virtually without payment, for the sake of enriching individual countries and people.

Based on the unrestrained consumption of "cheap" energy resources, the modern economy is ignoring the laws of development of the biosphere, leading to the degradation of humanity as a biological species.

It is evident that the efforts of science to find new fuel resources ought to be accompanied by efforts to limit the use of them, at least by forecasting the consequences of these processes. It is necessary to expand the resource base, not so much for the sake of expanding the production of all sorts of "goods," as to increase the depth of reliable forecasting and planning for the further development of mankind. "Use, but do not abuse: Such is the law of wisdom. Neither abstinence nor excess bring happiness."—Voltaire.

The various energy technologies that use renewable energy resources, organic, and nuclear fuel, and thermonuclear fusion, should be seen not as competing, but as complementary in the creation of a harmonious structure of power production, capable of satisfying all of society's needs for different types and qualities of energy. Only if the composition of power production is harmonious, multifunctional, and multicomponent, will it be possible to spare society the effects of inefficient energy use, premature exhaustion of energy resources, and the need to use expensive energy resources, and thus to prevent the unjustified increase of the cost of producing energy and the attendant decline in social prosperity.

The definition of a society's sustainability is based upon its attitude toward resources. A society can be sustainable, if the rates of consumption of renewable resources do not exceed the rates at which they are replaced.

Of course, the utilization of renewable energy sources will develop during the 21st Century: wind, rivers, and tides, as well as non-renewable, non-traditional energy sources such as geothermal energy, etc. But it should be kept in mind, that there is nothing superfluous or unharmonious in the biosphere. These sources are renewable, only if the functioning

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"The only source of energy, capable of supplying humanity with high-quality energy on a large scale, for a long period of time, reliably and safely, is nuclear fission energy from heavy elements: uranium and thorium," writes Dr. Subbotin. Here, the Kalinin nuclear plant in Russia.

of the biosphere is not disrupted, i.e., only if there are merely minor perturbations; and it remains to be scientifically determined, what constitutes a minor, tolerable disturbance.

There are great enough renewable energy resources, to allow the solution of some tasks. But for renewable resources really to become available to mankind, in the forms in which humans have grown accustomed to using energy—where it is wanted, when it is wanted, in adequate quantities, and of the needed quality—requires the investment of enormous intellectual resources (which potentially are capable of sustained growth) and material resources (chiefly nonrenewable).

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A developed nuclear power industry will make it possible to free up organic resources to meet mankind's needs for chemical energy, clothing, food, construction materials, etc. The reserves of nuclear fuels, which so far are not used for any other purpose than generating power, are quite sufficient for solving the problems of harmonizing human society and the biosphere, on its pathway to becoming the noösphere, without trouble or political tension. Furthermore, nuclear fuel does not burn; rather, it turns into the products of fission, among which are extremely useful nuclides for technogenic civilization, from alkaline metals, to the noble metals and gases.

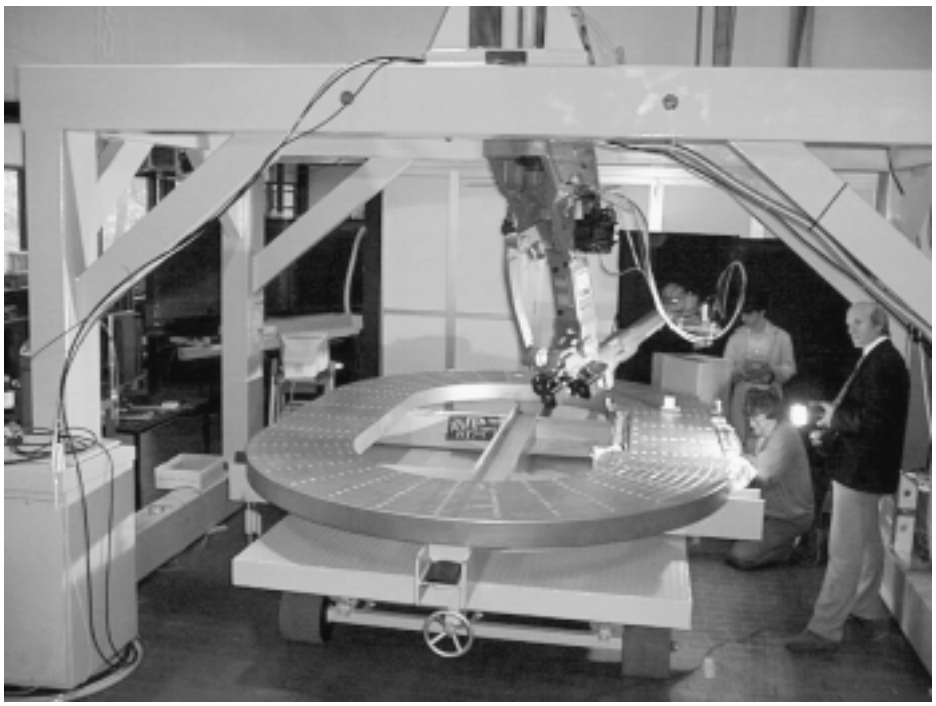
The use of nuclear power opens up a new evolutionary process, which implies a new technological revolution.

It should be noted that nuclear power is currently beginning more and more to be seen as a quasi-renewable energy technology. This is because a properly organized nuclear power industry, with a complete fuel cycle for the actinides (thorium, uranium, plutonium, etc.) can maintain, or even increase, to the extent needed, the neutron potential of the system. The fuel resources for nuclear power (uranium and thorium), in that case, are practically unlimited; and it is possible for the nuclear power sector to include high-temperature nuclear reactors, which are capable of producing hydrogen from water at fairly high rates of efficiency.

In a new power generation system, acceptable for long-term and large-scale use, nuclear power will be not only an efficient power source, but will also perform the control function of keeping CO_2 emissions into the atmosphere, as well as radiation, at proper levels. And some of the funds, economized in the organic-fuel power sector through measures to prolong its existence and make it more efficient, should be used for creation of a nuclear power sector, adequate to the requirements of sustainable development.

The Structure of the Nuclear Power Sector, Necessary for Its Sustained Development

. . .Work on nuclear and thermonuclear power not only provides an example of how to organize scientific research, experimental design, and international cooperation on the large-scale use of hydrogen and renewable resources, but it also helps in achieving a better understanding of processes taking place in nature. It becomes clear that just as much of an intellectual and material investment needs to be made



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Construction on a research module for the International Thermonuclear Experimental Reactor. "Work on nuclear and thermonuclear power not only provides an example of how to organize scientific research, experimental design, and international cooperation on the large-scale use of hydrogen and renewable resources, but it also helps in achieving a better understanding of processes taking place in nature."

in the large-scale utilization of natural processes (so-called renewable resources), as is done in the area of nuclear power and controlled thermonuclear fusion. Therefore, in a global, liberalized financial market, conditions cannot be created for conducting the needed profound and extensive R&D work, without the relevant studies being done in the nuclear power area, and without political steps at the government and international level; nor will there emerge serious interest in nuclear energy as the basis for sustainable development, in hydrogen as an ecologically clear fuel, capable of substantially helping mankind to move onto a path of sustainable development.

The world economy is now in a transitional period, and the future of civilization, whose main wealth is people and natural resources, depends on shifting into a new technological and economic phase. . . .

Although it has been termed global, and pretends to be a mechanism for sustainable development, the economy has really not become global, never mind guaranteeing the possibility of following the principles of sustainable development. In the form in which it currently functions in the advanced countries, the economy cannot become global and sustainable. In a global and sustainable economy, the various regions where the participants in this economic process live should be equally important, and the interests of all participants should be equally satisfied, at least potentially. So far, only one of the parties to the economic mechanism is becoming global. All of mankind is of necessity being drawn farther and farther into the process of providing steady development for the "developed" countries. This process cannot be a prolonged one, either for the developed, or, most assuredly, for the "developing" countries. . . .

It is not entirely clear, how, in what direction, and on what scale the gas, oil, and coal industries will be transformed. There are many views, ideas, proposals, hypotheses, theories, strategies, and conceptions about this. But, however we might improve them, they are insufficient, particularly due to limited resources and ecological impact. These technologies have to be supplemented by "renewable" energy sources and nuclear power sources. . . .

It should be noted that small-scale nuclear power has its own very important task in the world: It can be the basis for activating growth points, in a global economy with sustainable development, in places where economically efficient activity would otherwise be impossible. It serves as a kind of "emergency" source of energy, being an energy source for making economic breakthroughs, achieving growth along a front of modern economic acceptability and efficiency (i.e., to expand the areas in which people can live normally and pursue normal economic interests).

The Components of a Mechanism for Sustainable Development of the Power Industry

The development of the power industry in the 21st Century depends on the economy, and on politics, science, and education. These parts may be seen as separate today, but in the future they will be closely interwoven. Science and

education must plant now, what will be reaped in 20-30 years through the economic mechanism. And in order to satisfy those requirements that can be anticipated now, political decisions must be made already today, both at the government level and internationally—to organize the kind of science and education that can provide for both the expected, and the not-yet-anticipated needs of mankind in the 21st Century, with respect to the quantity, reliability, and safety of power generation and energy consumption, taking into account the need to mitigate and eliminate both the expected and the unexpected effects of our large-scale intervention, which we still only poorly understand, into the living organism of the biosphere, with our mechanical devices and "prostheses." In all of this, the economy ought not to be an end in itself, but a mechanism, which can adapt to new opportunities, new resources, and new requirements, and address not only the immediate tasks of existence and survival, but also the long-term objectives of sustainable development.

The Inevitable Incorporation of Russian and CIS Resources Into the World Economy

Russia possesses huge reserves of extractable hydrocarbons and other mineral resources.

Currently Russia is viewed as a source of fossil fuels and an energy bridge between Europe and Asia. It is clear that Russia should and will export gas, oil, and in the future also coal, as well as electricity, but it is important to determine what the scale of such exports should be, and what Russia should receive in exchange.

It is forecast that Russia will export hundreds of billions of cubic meters of natural gas to Europe and Asia during the coming century; pipelines will be built, as well as transport infrastructure for LNG deliveries; high-tension power lines will be laid to Europe and to Asia. But the world as a whole will lose, as will Russia, if Russia is used only as a supplier of organic and mineral resources.

Russia possesses one extraordinarily valuable renewable resource, without which it would be impossible to survive the great array of crisis situations, expected in the 21st Century. That unique resource is Russia's intellectual, and scientific and technological potential, which came into existence as the result of the historical, geographical, and linguistic conditions of life in this multinational state, which has synthesized in its culture the achievements of science, technology, thought, and spirit, of both the West and the East. Without such a synthesis of cultures, without the intellectual conceptualization of the past, without a shift in the development paradigm, including changes in the perception of spiritual and material values, all the technical or economic measures, and all the organic and mineral resources in the world will not suffice to create a sustainable society, or even to survive the 21st Century without big upheavals, since practically all crises are fundamentally intellectual in nature.