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IS IT POSSIBLE TO PROVIDE ENOUGH ENERGY NOT USING NUCLEAR POWER?

Distinguished participants of the meeting “Nuclear energy – global trends and perspectives in SEE”,

It is my great honor to address so eminent participants at the beginning of this conference which I believe is very needed at this moment and which is going, no doubt, to be very successful. Having spent a most of my professional life in energy problems I am looking with great interest to listen to very recognized speakers who have gathered in Montenegrin Academy of Sciences and Arts at this occasion.

One of the major requirements for sustaining human progress is an adequate source of energy. The current largest sources of energy are the combustion of coal, oil and natural gas. They will last quite a while but will probably run out or become harmful in tens to hundreds of years. But as climate change emerged it was necessary to rethink energy production. Today, 87 percent of all energy used is fossil fuel energy. To replace that with renewable intermittent energy like solar and wind power might look impossible. Solar energy theoretically might work but is not much developed yet except for special applications because of its high cost. But nuclear energy could do it: unlike solar and wind power, it is sustainable economically and in terms of providing continuous power. On top Nuclear energy is likely to remain cheaper.

In March 2011, the approx. US \$ cost to get 1 kg of uranium
as UO_2 reactor fuel (at current spot uranium price):

Uranium:	8.9 kg U_3O_8 x \$146	US\$ 1299
Conversion:	7.5 kg U x \$13	US\$ 98
Enrichment:	7.3 SWU x \$155	US\$ 1132
Fuel fabrication:	per kg	US\$ 240
Total, approx:		US\$ 2769

At 45,000 MWd/t burn-up this gives 360,000 kWh electrical per kg,
hence fuel cost: 0.77 c/kWh.

Fig. 1. The price of kWh related to fuel cost

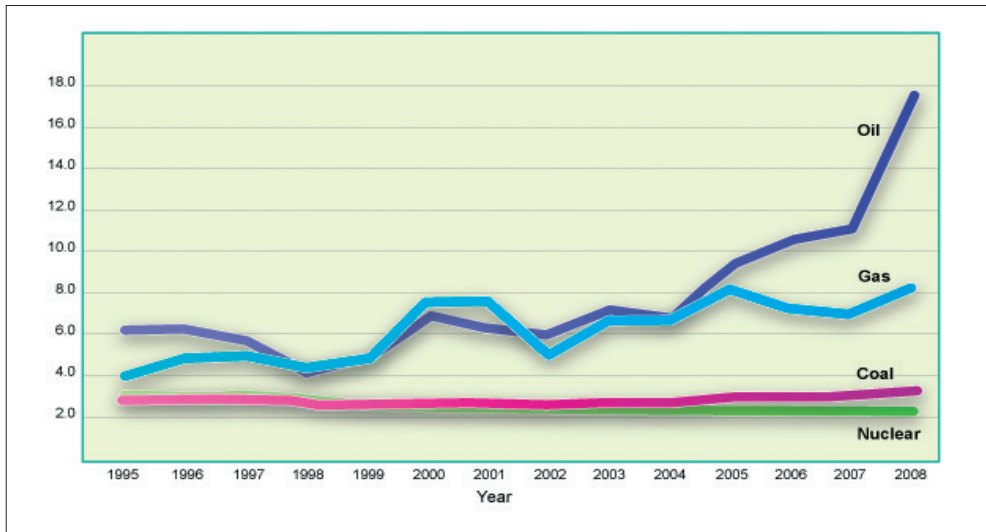


Fig. 2 Electricity production cost in USA in 2008 (World Nuclear Association)

Nuclear power generation began more than 50 years ago and now generates as much global electricity as was produced then by all sources. Some two-thirds of world population lives in countries where nuclear power plants are an integral part of electricity production and industrial infrastructures. Half the world's people live in countries where new nuclear power reactors are in planning or under construction. Some 437 nuclear reactors are currently operating in 30 countries worldwide, down seven from a maximum of 444 in 2002. More than 15 countries rely on nuclear power for 25 per cent or more of their electricity. In Europe and Japan, the nuclear share of electricity is over 30 per cent. In the US, nuclear power creates 20 per cent of electricity. Rapid expansion of global nuclear power would require no fundamental change – simply an acceleration of existing strategies. Nuclear plants have a high capital cost but a very low operating cost. There is a lot of risk up front but once the plant is running, over the 60–80 year lifespan it more than pays for itself. The main interest of the owners of existing nuclear power plants is however to prolong the lifespan for existing nuclear plants. Huge financial profits can be realized for any day longer which these plants can be kept in operation. Although this is much more lucrative than building new nuclear plants it might be not generally proper solution.

Frequently we are asked: For how long will nuclear power be available? Bernard Cohen has shown that with breeder reactors, we can have plenty of energy for some billions of years. His argument is based on using uranium from sea water. Other people have pointed out that there is more energy in the uranium impurity in coal than could come from burning the coal. There is also plenty of uranium in granite. Still there are some who claim that there is only 30–60 years left when natural

reserves of uranium are considered. They prefer to think on the torium or the sources at the Moon.

Nuclear power and ecologically-minded people – they have never been the good friends.

Nuclear power is seen as messing about with nature where we are no longer its master. Recent full life-cycle studies from the University of Wisconsin and the UK Atomic Energy Authority conclude that nuclear energy generates approx-

imately 2 percent of the CO₂ emissions per kilowatt as coal does, and 4 to 5 percent the CO₂ of natural gas. With the progress towards a zero-carbon economy, it is no wonder that many in the green movement were won over by the urgency of the situation, and became pro-nuclear. Then the change has or might come off the coast of NE Japan- Fukushima. Some of the latest political elections in Germany are the best proof of an actual possible attitude towards nuclear power, too. Of course, the issue is not so simple. *Some clame that if you tot up all the deaths and illnesses from nuclear power accidents, from Three Mile Island, to Chernobyl, up to the new black mark of Fukushima, as well as those from nuclear submarines they are still very low in comparision to projections for global warming.*

It is, especially today, having Fukushima accident, not wise and not recommended to talk on advantages of nuclear power. Even we have experienced this attitude while organizing this conference. But it is evident that nuclear power generation does emit relatively low amounts of carbon dioxide (CO₂). The emissions of green house gases and therefore the contribution of nuclear power plants to global warming is relatively little, the technology is readily available, it does not have to be developed first, and it is possible to generate a high amount of electrical energy in one single plant. Although not totally, but nuclear is one of the safest technologies we have ever invented. *A Columbia University study of 53,000 nuclear plant workers published in 2004 found that those people have less cancer and are healthier than the general population.*

Certainly there are disadvantages of nuclear power generation such as: The problem with radioactive waste which is still an unsolved one, it is technically impossible to build a plant with 100% security. A small probability of failure will always last. Nuclear terrorism and some more.

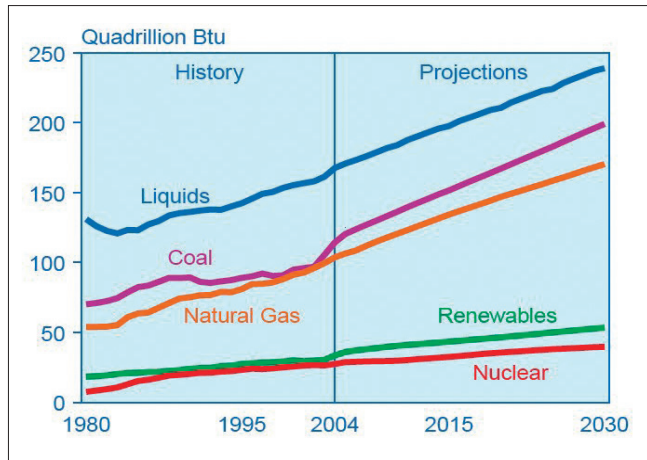


Fig. 3. World market energy use by fuel type, 1980–2030 (IEA Annual 2004)

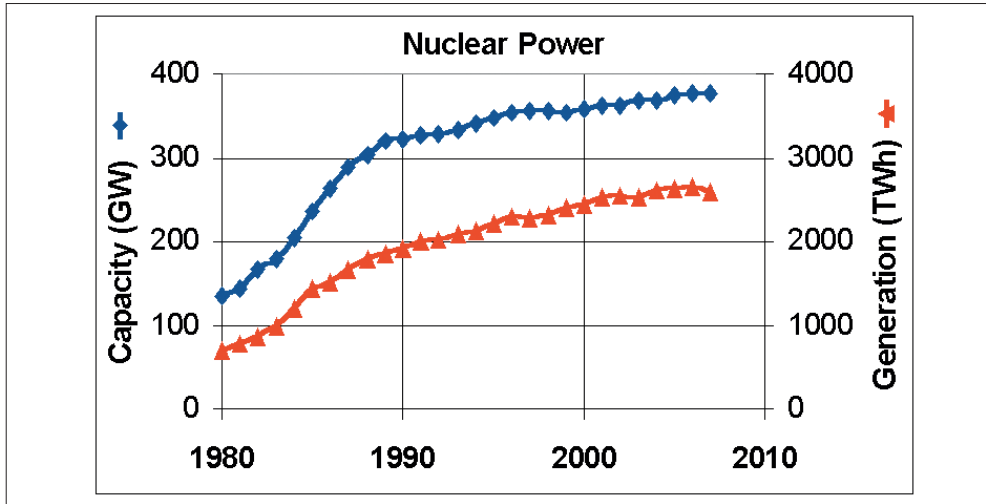


Fig. 4. Nuclear capacity in the world

Although some claim that the nuclear power is sustainable and green it would be hard to prove that. It is not renewable source of energy although by recycling and possibly using fusion the nuclear fuel can last for extremely long life.

The cofounder of Greenpeace Patrick Moore has stated that the fundamental mistake we made was to lump nuclear energy along with nuclear weapons.

One can go on analyzing how the nuclear power can affect our civilization, our lives. But the main question still stays: How can we provide enough energy in the world which population is exponentially growing and economic growth increasing? Can we do it in the way ecologists want to see? Can we practice many activities we have used to do not using nuclear power? Is it wise and economically effective, what many encourage today, to forget nuclear energy? Is there at all any solution for growing needs in energy demand without nuclear power? Many questions have to be answered. SE European countries experience a lack of energy. What is the place of nuclear power in such situation is the topic which is of interest for many SEE countries and all energy communities in the region. I am certain that we will have the chance to listen to many answers to those questions during the course of this conference.

Last but not least, let me wish you pleasant stay in Montenegrin Academy of Sciences and Arts and very successful conference.

Thank you!