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SHOULD WE AND CAN WE LIVE WITHOUT NUCLEAR ENERGY?

Gernot Klepper, Sonja Peterson and Sebastian Petrick

As Japan is struggling to avoid a major nuclear disaster, world leaders, policy makers, academics, and citizens are asking to what extent the world is relying on nuclear energy and how feasible it would be to renounce it.

In Germany, for example, the weight of nuclear power in total energy output has been continually decreasing. Whereas in 2000 almost 30% of the total electricity supply came from nuclear energy, by 2010 the number had decreased to 22.6%. During the same time the share of renewable energy went from 6.6% to 16.5%.

Whether or not Germany can completely phase out nuclear energy in the very short run depends on whether the peak load – the amount of energy demanded during the periods of particularly high demand, such as during summer months with increased use of air conditioning – can be produced without it. In principle, the overall energy-producing capacity in the country can serve such periods of high demand without resorting to nuclear energy. However, the energy market in Germany is regionally segmented, with most of the energy demand and nuclear power plants concentrated in the south. Lacking sufficient transmission grids, renouncing nuclear-generated energy completely and immediately would jeopardize Germany's ability to guarantee that all of its regions will always have electricity available in sufficient quantities.

The medium term outlook is another matter. Whereas there is no consensus in the existing literature about Germany's prospects to renounce nuclear energy, about related deadlines or about investments into alternative technologies, most studies agree that the scheduled phase-out, as it has been agreed upon by the red-green coalition in the year 2000, represents no risks to the country's energy security. In accordance with the agreement, seven of the oldest nuclear power plants in Germany would have been shut down already or, at the latest by 2012, would go off-line. Germany's youngest nuclear plant would be in operation until 2022. The studies that deem nuclear phase-out as possible assume that alternative energy sources will not be the only way of dealing with resultant energy shortages: some tuning will take place on the demand side. Improvements in efficiency, energy savings, development of renewable energy sources, cogeneration (combined production of electricity and heat), as well as access to flexible reserves of conventional power plants, may all play a role in addressing potential energy shortage. Some studies promote additional development of gas and coal plants. A big role is assigned to the development of a Europe-wide electricity grid.

At the international level, most studies assign nuclear power an important role in meeting ambitious targets related to climate change. However, we do find studies that show that even the ambitious targets – the target of keeping the Earth from warming by more than 2 degrees, the so called 2-degree goal – can be achieved without the use of nuclear energy. Prerequisite for such a scenario is large-scale development of alternative technologies, especially carbon capture and storage, and bio energy. Of course, in the long run even carbon capture and storage is only a temporary solution. Still, risks related to this technology are far less than those related to nuclear energy.

In addition to technical feasibility, we must consider welfare losses ensuing from abandoning nuclear energy. In case of Germany, even the official study commissioned by the government implicitly shows that compared to the 2000 phase-out schedule, additional deadline extensions lead to virtually no welfare gain. Other studies suggest that in the long run electricity production via renewable energy sources is more cost-efficient than that based on nuclear power. Nevertheless, it remains to be seen how quickly costs accumulate if the phase-out should take place quicker than scheduled and all of nuclear power plants have to go off line. This will depend on the speed of the scaledown, on the keenness to further develop renewable energy know-how and on the efforts to improve energy savings through smart technologies.

At the global level, the evaluation of the welfare losses associated with the scaledown of nuclear energy is difficult and uncertain. In general, the estimates of welfare losses are acceptable, as long as it is possible to employ alternative technologies. In addition to large scale use of carbon capture and storage technologies, the magnitude of the costs depends on the availability of bio energy and renewable energy sources such as wind- and solar- energy. Even the costs associated with the complete phase-out of nuclear energy in view of the ambitious 2-degree goal are estimated to be reasonable.

What conventional cost-benefit analyses of nuclear energy fail to consider are the waste disposal costs and, more importantly, the costs of a potential accident. As we have already seen from the Chernobyl catastrophe in 1986 and are currently observing in Japan at a – hopefully – smaller scale, such an unlikely but disastrous accident can lead to losses of unparalleled magnitude in economic terms but above all in health threats. The disaster in Japan shows that conventional cost-benefit analyses are not helpful in the context of nuclear power. The unfolding events in Japan would have been estimated as virtually impossible and yet, here we are witnessing it. In conventional analyses, expected costs of a low probability event, even with immense losses associated with it, would be estimated as low. To bring it closer to home, however unlikely Germany is to confront a mishap as the one witnessed at Japan's Fukushima plant on its soil, a similar event can happen – not necessarily induced by an earthquake or another natural disaster but due to event(s) that we cannot fathom at the moment. The question, therefore, is whether societies are ready to expose themselves to such an improbable accident with potentially catastrophic consequences or whether they decide not to expose themselves to such risks in the first place.

Furthermore, conventional cost-benefit analyses focus on the use of cheaper energy and the associated economic prosperity. The accurate costs of nuclear energy should also include possible dangers to life and public health. Thus, in the worst case scenario in Japan, well over 30 million people may get exposed to radiation and vast areas of this already densely populated country may be inhabitable for centuries due to radioactive contamination. To translate such losses in monetary terms and use them in cost-benefit analyses is hardly a morally acceptable matter. One should rather ask whether the losses associated with the phase-out of nuclear energy are not a fair price for preventing such catastrophes – in Japan, Germany, or elsewhere in the world – from happening.

For the countries which already invested in nuclear energy, it is not a matter of whether or not to phase out nuclear energy, but rather of the speed at which such a phase-out should take place. The faster the scaledown, the faster a country like Germany should invest in renewable energy sources, build up potential for carbon capture and storage and develop the necessary infrastructure. The pace will ultimately depend on the political goodwill and the magnitude of investments that the country is ready to shoulder. Obviously, there is a need for a coordinated energy policy across the European Union since, in the long run, the restructuring of the energy sector and the phase-out of nuclear energy, without an increase in energy prices and cross-border trade, will not be possible.

For the countries that currently do not own any nuclear power plants, especially many emerging economies, the question arises whether the investments required for the development of nuclear energy would not be put to better use in the development of renewable energy sources. The climate for such a decision has never been better: last years have seen significant technological progress; decentralized systems make more sense for most regions; natural conditions for renewable sources of energy are cheaper than in Germany.

The choice whether to commit to nuclear energy or renounce it is first of all an ethical and political one. Societies have to decide whether they are willing to expose themselves to unlikely but appalling risks. From the economic point of view, the only remaining question is how quickly and with which cost-efficient measures we can best implement the phase-out of nuclear energy.