Nuclear power for a green deal

Every two months, Prof. Dr. Thorsten Arnhold, IECEx Chairman 2014-2019, provides an update on developments within the organisation.

Even for me as a German, 2022 began with a very good message from the EU headquarters in Brussels. The Commission announced the start of expert consultations on Complementary Delegated Act covering certain nuclear and gas activities.

"The EU Taxonomy guides and mobilises private investment in activities that are needed to achieve climate neutrality in the next 30 years. The existing energy mix in Europe today varies from one Member State to another. Some parts of Europe are still heavily based on high carbon emitting coal. The Taxonomy provides for energy activities that enable Member States to move towards climate neutrality from such different positions", the European Commission said in a press release on January 1.

The current situation in Europe with regard to climate neutrality is quite easy to illustrate by means of an app/website called "Electricity Map". At the time of writing on a grey rainy day in January, Electricity Map shows France in green due to more than 50% of its power coming from nuclear power plants (45GW out of total 65GW). Together with significant amounts of wind and hydro energy, the share of low-carbon energies is 90%, which results in a carbon intensity of 69 grams per kWh.

In Germany, 2021 ended with the shutdown of 3 (out of the remaining 6) nuclear power stations. Germany's nuclear power stations are some of the safest in the world with excellent maintenance which meant the facilities could have run for at least another 20 years. Unfortunately, they had to stop the production of climate friendly energy. So, what about the colour of Germany on the Electricity Map app? Brown! This means that only 50% of its power usage is from low carbon energy sources, resulting in a carbon intensity of 407 gram per kWh, which is roughly six times higher than the French value. What about the UK? At the time of writing, the share of low carbon energy is 68% and the carbon intensity is 183 gram per kWh.

France, the UK and many other countries do not even think about shutting down their climate friendly nuclear energy sources. On the contrary, for the time being, nuclear energy is making a comeback in the decarbonisation strategies of these countries. Some 400 new power stations are either on order, planned or under consideration (World Nuclear Association).

What are the arguments against this energy in countries like Germany? First of course the safety issue. I do not want to underestimate this. The blessing of the extremely high energy density which is expressed in Einstein's beautiful formula $E = mc^2$ can be transformed into a terrible curse if the system gets out of control. Since the start of the very first nuclear power station in 1951, the safety systems have been continuously improved and now represent the premium class of safety engineering.

The three major incidents at the Three Mile Island power station in 1979, Chernobyl in 1986, and Fukushima in 2011 provided unwelcome but helpful lessons to improve these safety concepts further. The International Atomic Energy Agency (IAEA) and the World Nuclear Association (WNA) established a close relationship with the global standard organisations ISO and IEC in order to define, fix and maintain the safety concepts in international standards. At ISO the Technical Committee TC 87: "Nuclear energy, nuclear technologies, and radiological protection" is dealing with the "standardisation in the field of peaceful application of nuclear energy, nuclear technologies and in the field of the protection of individuals and the environment against all sources of ionising radiations."

At IEC, the Technical Committee TC 45 deals with the preparation of international standard relating to electrical and electronic equipment and systems for instrumentation specific to nuclear applications since the very beginning of civil use of nuclear energy in 1950. The IEC TC 65 is responsible for the IEC 62443 family of standards that provides guidance on cyber security for critical infrastructures including nuclear power stations.

As I already wrote in the June 2021, the IEC Conformity Assessment system IECQ offers the IECQ Approved Process (AP) Scheme, which provides for the independent assessment and issuing of an international IECQ certificate of conformity for organisations that have demonstrated compliance with declared standards and/or specifications supplying component parts and services that are important to nuclear safety (ITNS).

The second argument against the use of nuclear energy uncovers a lack of knowledge about the physical basics and of understanding the principles of scientific and technical progress. It is about the safe disposal of nuclear waste. This topic is just an issue of the currently existing technologies. New types of reactors like the dual fluid reactors digest up to more than 90% of the nuclear fuel and the rest has such a low half-life period that final disposal depots can be easily found.

As a German, I am proud that the inventors of these reactors are Germans like me, but I am sad that they have to establish their company and pilot facility in Canada and I am becalmed by the news from Brussels. Why? It is because Germany will get enough energy in the future even when there is no wind in the night. ■