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The importance of SMR for the energy supply worldwide and for Germany

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6 June 2025

SMR worldwide

With regard to nuclear energy, the International Energy Association (IEA) states (1):

"Globally, nuclear energy is the second most important low-emission energy source after hydropower.
Energy source for clean and safe power generation. In 2025, nuclear energy will produce more electricity than ever before.

At the same time, innovations such as the development of small modular reactors (SMRs) are changing the landscape of nuclear technology, the first of which are expected to go into commercial operation around 2030.

The positive developments for nuclear energy come at the right time, as the world is moving towards the age of electricity, in which global demand for electricity will grow six times faster than total energy demand over the next ten years, driven by the need for digitalisation, mobility, etc.

The momentum for SMRs is clearly increasing, but the success of SMRs will depend on whether governments can enable innovation and new business models and whether costs fall fast enough. If this is the case, there is a potential for SMRs of 40 - 120 GW of installed capacity by 2050.

Nuclear projects are traditionally difficult to finance due to their scale, capital intensity, long construction times and technical complexity. Thanks to the prospects of SMR, more and more private companies could take over the financing of SMR projects. As SMR investments are in the €2-3bn range (unlike large power plants at >€10bn), the initial investment can already be raised by several private investors. If, in the course of development, it is also possible to utilise the cost reduction potential of the modular design and scalability, this will open up great potential for a large number of applications after a relatively low entry threshold.

Thanks to the prospects of SMR, more and more parts of the private sector see nuclear energy as investable. Large technology companies building data centres can also use their high credit rating to facilitate the financing of SMR projects. Reducing the risk of cost overruns and delays also favours financing.

There are currently over 80 SMR projects underway worldwide in various countries and with different technologies. This shows that SMR technology is considered to be of strategic importance for the energy supply of individual countries, for the crucial competitive area of digitalisation and for other potentially important areas of application.

Germany: a return to nuclear energy?

Germany has said goodbye to nuclear energy at a time when nuclear energy is becoming indispensable for reasons of climate neutrality, competitiveness and the growing importance of electricity supply.

Recommissioning shutdown reactors is technically challenging. However, it may be possible to recommission 6 of the decommissioned nuclear power plants. The costs of recommissioning would have to be compared with the savings from the expansion of wind and solar power generation, including the necessary infrastructure and back-up power plants. Even if this comparison were to be in favour of recommissioning the decommissioned nuclear power plants, it must be taken into account that the former operators do not support this. It can be assumed that there will be a legal dispute lasting many years, which could slow down the necessary expansion of backup capacities based on natural gas. In addition, the current goodwill of parts of the population may change again.

The construction of new EPR-type reactors such as Hinkley Point (UK) and Olkiluoto (Finland) in the 2 - 3 GW power class requires investments in excess of €10 billion. Given the chequered history of nuclear energy in Germany, it is unlikely that investors can be found for this.

In a position paper published by the BMBF on 6/23 (3), the German government commits to the development of nuclear fusion. In the coalition agreement of 4/2025, the black-red coalition even set itself the goal of building the world's first fusion reactor in Germany. The position paper presents a programme for the development of fusion reactors, including the implementation of the corresponding infrastructure and the construction of reactors. Although the realisation of fusion reactors still appears to be at least two decades in the future, with

If successfully realised, however, Germany would have an almost inexhaustible, climate-neutral, base-load-capable, secure and import-independent source of electricity. Therein lies the immense strategic importance of nuclear fusion.

The implementation of SMR for Germany can be considered to be of comparable strategic importance.

Advantages of SMR for Germany

Germany has set itself the target of increasing the share of renewable energies in electricity consumption to 80 % by 2030. GES has shown in various analyses (4) that nuclear energy and CCS are indispensable for the future in terms of costs, technical feasibility, climate neutrality and the need for a base load supply, especially in view of the predicted dramatic increase in electricity demand for applications such as IT, mobility and heat pumps.

The SMR reactors can **guarantee climate neutrality and base load capability, as** is required above all by the strategically important IT sector. The currently prioritised highly volatile power supply from wind and solar is dependent on an expensive infrastructure and a high proportion of imported electricity and backup power plants. SMRs can significantly alleviate this complex situation. SMRs offer important advantages for **grid stabilisation** due to their flexibility in terms of installation locations.

The phasing out of nuclear energy in this country is largely due to concerns about **safety and the problem of final storage**, even though nuclear energy is in fact one of the world's safest technologies for generating electricity on a deaths per TWh basis, on a par with wind and solar energy. The design principle of SMRs promises fundamental advantages in terms of passive safety and reduction of the radioactive inventory, as explained in chapters G and H in (2). Like transmutation, certain SMRs offer the potential to reduce the radioactive inventory of radioactive waste and thus also to improve the acceptance of nuclear energy.

SMRs can also help to reduce the **import dependency of the electricity supply on neighbouring countries**. This dependency is becoming greater with increasing volatility in electricity generation and increasing import requirements. SMRs also help to reduce market price fluctuations as they represent a reliably available source of energy.

Since the phase-out of nuclear energy initiated in 2011, Germany has lost a great deal of **expertise and competent human resources in the nuclear sector.** If nuclear energy is predicted to play a prominent role in meeting the challenges in the energy sector worldwide, this will weaken our competitiveness, jeopardise the future opportunities of future generations and put new developments that are only made possible by nuclear technologies at a disadvantage. It should be noted that Germany must have a high level of expertise in the nuclear sector for its ambitious programme for the successful implementation of nuclear fusion. All the countries with which we are competing in the field of nuclear fusion are at the forefront of conventional nuclear energy and draw on the expertise and resources of conventional nuclear energy.

For Germany as a high-tech country and as a country that has operated the world's safest nuclear reactors for decades, it is long overdue to return to the nuclear community with research and development bodies. This will enable Germany to participate in the international exchange of ideas and to seek international partners in a targeted manner. With its special sensitisation to the safety of nuclear technology, Germany can also make a contribution to improving the safety of SMRs.

However, Germany's entry is also of strategic importance. Many new technological developments require a climate-neutral and uninterruptible power supply (example: power supply for certain industrial processes with SMR). It is important for Germany not to be left behind and to be able to keep up with international competition.

Recommendation

Whichever path the political decision-makers take, in view of the expected strong growth in nuclear energy and its strategic importance, a return to nuclear energy is highly recommended for Germany, not only on the basis of studies, but also experimentally and with a view to implementation. In this context, dialogue with international experts is of crucial importance.

It is therefore a firm recommendation that the German government should create regulations and conditions - similar to those for nuclear fusion (3) - in order to be able to investigate and implement the potential of SMR (and transmutation) and to participate in the international exchange of ideas and international co-operation.

(1) IEA "The road to a new era of nuclear energy" 10/2024

(2) Introduction: the importance of SMR for the energy supply worldwide and especially for Germany

(3) Position paper on fusion research, Towards the energy supply of tomorrow (BMBF, 6/23)