Lawyer Insights

A comeback for nuclear power?

Given the growing imperative of increasing zero and low-carbon power generation around the world, can nuclear power now be considered part of sustainable development plans? Here, lawyer George Borovas puts the case for new nuclear power.

By George Borovas
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As the world's population continues to grow, so does the need for power generation. In recent years, there has been increased attention on how power generation affects the environment and over 110 countries have set sustainability goals and pledged to be carbon neutral by 2050. This, in turn, has made nuclear power generation, once again, one of the options that policymakers and governments are considering.

Nuclear power today makes a significant contribution to electricity generation, providing approximately 10% of global electricity. Nuclear power is the second-largest source of low-carbon electricity. According to the IAEA, the world currently operates a fleet of 443 commercial reactors, with a total installed capacity of 393 GW.

In advanced economies, nuclear is the largest source of low-carbon electricity, providing 18% of supply. Over the past 50 years nuclear power has avoided about 55 Gt of carbon dioxide (CO2) emissions, nearly equal to two years of total global energy-related CO2 emissions.

Nuclear energy is arguably one of the cleanest and most efficient sources of energy and has the potential to contribute significantly towards providing a sustainable, scalable and relatively economical option to meet the growing global energy demand. Nevertheless, its share of global electricity supply has been declining in recent years. And, as a result, despite the impressive growth of solar and wind power, the overall share of clean energy sources in total electricity is about the same as it was 20 years ago.

The world is currently able to meet only 39% of global electricity demand with low-carbon generation sources. The remaining 61% of the world's existing electricity demand is currently provided by carbon-intensive fossil fuels.

Accordingly, a range of technologies, including nuclear power, will be needed for clean energy transitions around the world. While renewables are expected to continue to lead, nuclear power must also play an important part. To achieve a trajectory consistent with sustainability targets – including climate goals – 85% of global electricity needs to come from clean sources by 2040.

Nuclear and ESG

The greater focus on the environmental awareness and sustainability practices of companies, and environmental, social and governance (ESG) criteria are an increasingly popular way for investors to

evaluate companies in which they might want to invest. Nuclear energy satisfies a number of important ESG criteria including:

- Nuclear energy outperforms many other low-carbon forms of energy because nuclear power plants produce carbon-free electricity 24/7 while requiring comparatively little land and materials, and producing low quantities of toxic waste.
- Nuclear energy is a demonstrably safe form of energy with one of the lowest death rates when compared to the mortality rates from other energy sources.
- Nuclear waste is fully accounted for, and its costs are considered as part of the development of a nuclear energy project.
- The nuclear power industry is one of the most highly regulated industries globally, with worker safety and local community impact continuously considered throughout the lifecycle of a nuclear power plant.
- The construction and operation of nuclear power plants requires highly educated and trained employees, increasing the pool of highly skilled workforce from which other economic sectors will benefit from as well.
- Staff engaged in the nuclear power sector have long-term job prospects and comparative job stability.

The Emirates Nuclear Energy Corporation (ENEC) started up Unit 2 of the Barakah Nuclear Energy Plant in August and connected the unit to the UAE grid, making the plant the first multi-unit operating nuclear plant in the Arab World.

Photo: ENEC

New plant construction and challenges

Currently 30 countries have already included nuclear power in their generation mix and have operational commercial nuclear reactors. In addition, there are 51 nuclear reactors currently under construction in 19 countries. Moreover, a significant number of countries have plans to develop or expand their civilian nuclear power programmes.

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The 19 countries developing nuclear projects are distinguished by their level of economic development. Countries with growing populations and rapidly increasing electricity needs, such as China and India, see nuclear power as a reliable source of energy that can fuel economic expansion, provide electricity and improve living standards. By displacing coal-based power generation and heating, expanded use of nuclear power is also welcomed for its contribution to improving air quality.

Similar circumstances are seen in many countries constructing their first nuclear power plants (NPPs) such as Bangladesh, Belarus, Turkey and the United Arab Emirates.

Another group of countries constructing NPPs consists of relatively higher income industrialised nations with established nuclear programmes, but with slower economic growth and stagnant (or declining) per capita electricity needs. Despite this trend towards lower consumption, new NPPs remain an attractive option to replace ageing reactor units and to secure stable, predictable electricity supplies for the long term.

Based on an analysis of all of these new-build programmes, successful nuclear projects in the recent past have been delivered by:

- using simple and proven designs;
- working in close cooperation with the regulator;
- having sensible, risk informed contracting models;
- employing proven contractors with experienced teams;
- profiting from lessons learned from other projects; and
- proactively addressing project and risk management.

Nevertheless, many nuclear new build projects have suffered from the following issues over past decades:

- cost overruns and delays;
- lack of access to financing to address the long-term construction and the high up-front capital costs required;
- unsuitable risk allocation and project management;
- deregulated power market models creating challenges for NPPs that require long-term stable and predictable revenues; and
- changing nuclear safety regulations.

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SMRs and advanced reactors

Emerging new small modular reactor (SMR) and advanced reactor (AR) designs and technologies offer promising solutions that may help to mitigate many of the financing and risk challenges listed above. SMRs are generally defined as nuclear reactors of generally 300 MW equivalent or less, designed with modular technology using module factory fabrication, pursuing economies of series production and short construction times.

Generally, SMRs, are expected to have greater simplicity of design, economy of production (largely in factories), short construction times, and reduced siting costs. Most are also designed for a high level of passive or inherent safety reducing the need for additional safety structures and large emergency protection zones.

Furthermore, SMRs can be suitable for areas and applications that are poorly suited to large nuclear power plants such as small islands and areas with limited access to cooling water, countries with small grids, or for other energy-intensive applications such as mining.

Conclusion

Nuclear energy may be considered controversial in some countries for many reasons, including safety, security, proliferation, waste disposal as well as affordability.

Nevertheless, nuclear also offers one of the lowest life-cycle carbon emissions generation technologies, and has been proven to provide affordable, reliable, scalable and safe. At this point, nuclear power, along with hydroelectric and geothermal are the only proven low-carbon technologies, which can provide safe and affordable non-intermittent electricity.

Today's existing nuclear technologies offer proven, affordable and safe low-carbon generation solutions which are compatible with both existing electricity grids and are also complementary to scaled-up renewable energy technologies. These existing and proven nuclear technologies can be rapidly scaled-up on a global basis, complementing global growth in renewables, in order to meet *any* foreseeable 2050 energy demand scenario.

In addition to today's existing and proven nuclear technologies, there are currently many new emerging nuclear reactor technologies, including ARs and SMRs, which may offer further improvements and enhancements relative to today's nuclear generation technologies.

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