



Energy Review

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Adviser's Note



The demand for electricity will continue to increase in the world. The percentage of electricity in the Total Final Consumption (TFC) of energy is increasing due to the convenience of end-use, and minimum environmental implication at the point of use. Therefore, an increase in electricity demand anywhere is due to two reasons: an increase in energy demand, and an overall increase in the share of electricity in the TFC.

The imperative of climate change tells us to meet this demand from low carbon sources and hydro, nuclear, solar, and wind are the principal low-carbon sources. India has a rising aspirational middle class, is rapidly urbanising, and is going through an intense infrastructure-building phase. However, India is not rich in energy resources, and hydro, solar, and wind cannot meet its growing electricity requirements due to their low potential as compared to demand. It is necessary for India to ramp up generation from nuclear as soon as possible so as to provide much-needed electricity in a reliable manner.

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Nuclear Energy – The Gordian Knot of Climate Change

Prof. Yanko Yanev

Energy is essential to how we can power the economy and manage the environment. Not without consent, energy rests at the core of geopolitics – an issue of both wealth and power, as it can be both a source of conflict and a basis for international cooperation. Energy is the key to development and political stability. Just to mention, currently, there are still almost a billion people worldwide who don't have access to electricity. That is unacceptable both in political, economic and security terms. As we fight with a pandemic virus and limit activity and travel, we are still faced with a global threat of climate change and this will continue.



That the planet's climate is changing much faster than what has been observed for at least the last 100 years is a scientific fact. Why this happens is another question that requires detailed analysis of a huge number of climate parameters. The opinion of the vast majority of climatologists and scientists from various fields of science is unequivocal; our activity and, above all, the huge use of fossil fuels, which return carbon to the atmosphere, are the main cause of climate change. Will there be a climate apocalypse or not is not simple to predict. The changes will depend on how we will treat the transformation of the energy system, transport and a number of other areas that

require high energy consumption. Most important of all is what energy source we will use. Will we continue with fossil fuels, coal, oil, gas or will we transform the energy system into a low-carbon one, using all kinds of renewable sources and nuclear technology?

If we want to get a realistic picture of the future energy system, a return to basics is necessary. An energy system has three fundamental parameters, and they drive its development and implementation. Energy has to be **available**, which means to be proven science and technology with the existing industrial base for its development and application. Second it has to be **accessible** in terms of capability and requirements for its deployment. Lastly but not at the least, it has to be **affordable**. Affordability for some is a matter of policy and a simple business assessment for others.

If we add today's world politics, energy choices are expected also to promote new technologies and efficient use of energy, to reduce pollution, to diversify the global energy supply, to create jobs, and to address the threat of climate change. Can Nuclear Power play a role in achieving each of these objectives? My answer is Yes and No.

Nuclear power is a mature energy source as it has been developed for the last 60 years in the leading industrial countries both as science and industrial technology. It can be well accessed but requires a long-term commitment in meeting well established international requirements for safety and non-proliferation. Nuclear power affordability is well taken in the long-term context of its life expectancy of more than 80 years, thus providing one of the cheapest low-carbon sources of electricity (see recent NEA report). For today's energy entrepreneurs, nuclear power is expensive and unattractive. Current governments, at least in

Europe and North America, try to stay away from financing nuclear power, something they have easily done in the seventies, when the majority of current nuclear reactors were built. Here comes the important question: who can do it? Those who have the know-how and can or those who still don't know but dramatically need energy to develop?

The answer to this question can provide a realistic estimate of the role of nuclear power in the future energy system. The countries which need nuclear technology for maintaining their strategic objectives like USA, Russia, France, UK, China and India are the countries which possess the entire nuclear fuel cycle and currently operate the majority of the nuclear power fleet of the world. Japan and the Republic of Korea are to be added as the two leading non-nuclear weapon countries with high nuclear energy utilization. All new development in science and technology belongs to these countries. If a major development of nuclear power of the scale to make a significant contribution to decarbonization of the energy system (MIT assessment for 1000 reactors) should be done, then it should be done by these countries.

A major deployment of nuclear power (hundreds of reactors) in the developing countries of Africa, Asia and Latin America is more in the area of optimistic plans of governmental officials and nuclear activists. The reason being that none of the above critical parameters of accessibility, availability and affordability can be met, at least, in the next 20 – 30 years in these countries. Further, there is a need to introduce nuclear knowledge and competence at an acceptable level and build the necessary infrastructure for a sustainable and safe nuclear power program there.

Despite the desire to move away from fossil fuels, oil and especially gas will remain dominant

in the global energy mix – the energy world will continue to be consumed by the need to find gas to meet growing global demand. Politics and security will be intimately interwoven in this quest. At the same time, climate and security pressures are real and, over time, technology and policy will enable the world to move away from fossil fuels to more sustainable and clean energy sources. And here comes the politics. Different countries, depending on the available resources or participation in the global energy business, determine their energy policy mostly in their own interest. This hinders a common solution and seems to determine the way in which the problem of decarbonization will develop.

Nuclear energy can play a significant role to support other renewable energy sources but it has to be addressed globally. The need for a global agreement on the use of nuclear energy is becoming obvious. We cannot agree on safety levels defined by national borders. As has been the case throughout the course of history, such a major shift in the global energy mix will come with major political and security changes. The need to change the current international nuclear regime is becoming obvious and it is needed if nuclear energy will be a key supporter of decarbonization. To solve a whole lot of interconnected issues of energy needs, climate protection and politics, the Gordian knot has to be untied. In previous times it was President Eisenhower who showed the way forward. May be now we need a new Alexander the Great?

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Outlook for Nuclear Energy Under the Biden Administration

Prof. Ravi Madhavan

As the Biden-Harris transition team gears up for Inauguration Day on January 20th, there is much that is unclear about the new administration's likely policies and actions. While more pressing issues such as the COVID vaccine rollout, economic recovery and China policy inevitably hog the limelight, one issue relevant to readers of this newsletter is the outlook for nuclear energy. Despite the ambiguous and contradictory political currents, my reading of the tea leaves suggests a cautiously optimistic outlook for nuclear energy under the Biden administration. Going beyond Joe Biden's overall centrism and reputed openness to nuclear energy, my assessment is based on three strands of evidence.



First, the democratic party platform has evolved during the last several months to incorporate positive language toward advanced nuclear energy. The early phases of the Democratic primary process were marked by vociferous opposition to nuclear energy from front-runners such as Bernie Sanders. Subsequently, however, Joe Biden and Bernie Sanders cooperated in drafting a set of unity task force recommendations incorporating explicit support for advanced nuclear energy. During this period, Alexandria Ocasio-Cortez, a key architect of the politically controversial Green New Deal, also went on record

as being open to nuclear. This positive sentiment was built into the Democratic party platform ahead of the election.

Second, nuclear energy could be a rare area of bipartisan agreement. The power balance in the House and Senate between the parties will remain on the knife edge, requiring the Biden administration to look for measures that can attract bipartisan support. Given that green policies tend to be lightning rods in Congress, nuclear energy could potentially be one area of cooperation. Early in December 2020, for instance, a bipartisan bill subsidizing existing reactors and supporting the development of new technologies progressed in the Senate. Although it did not become law before the end of the Senate term, it is expected to be taken up again in the newly seated Senate. Such actions are indicative of potential support from a pragmatic bipartisan coalition.

Three, the time may be right for a re-framing of nuclear energy as part of a climate change solution set. While Republicans have usually supported nuclear energy as part of a conventional energy mix, the Biden administration may well adopt a different lens through which to view it: as part of a climate change action toolkit. In the wake of California's rolling blackouts in 2020, in which the early retirement of functioning reactors played a part, there is greater recognition of the practical limitations of a renewables strategy that rules out nuclear. Thus, a focus on advanced nuclear energy with its safety enhancements may be more acceptable to many constituencies on both sides of the aisle.

Despite the above signposts, no one in the industry is anticipating a wave of new reactor builds. Rather, the best scenario is focused investment to arrest decline (e.g., subsidies to head off the early

retirement of reactors) and accelerate innovation (e.g., moving forward with Small Modular Reactors [SMRs] and microreactors). A related imperative from the industry's viewpoint is to continue shoring up US competitiveness in the global market for nuclear energy, where China and Russia have made substantial inroads at the expense of the US and France.

More broadly, a nuclear-inclusive green investment policy from the Biden administration will be an important signal of a truly system-level climate change agenda rather than one based on separate silos with unaddressed interactions. Of particular urgency is spreading the word about

Energy Systems Integration, encouraging policymakers and opinion leaders to look beyond their own silos and pet technologies. For example, the dream of a hydrogen economy will be more realistic if we factor in the potential role of SMRs as affordable sources of the vast power requirements associated with electrolysis-produced green hydrogen.

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China's Nuclear Energy and Strategic Priorities

Sruthi Kalyani

Energy expert Daniel Yergin, in his recent book *The New Map*, observes that the current geopolitical rivalries and the changing energy trajectories of nations are majorly being determined by the systemic challenges of climate change and the subsequent national responsibilities to cut down carbon emissions. China's rise and its assertive territorial claims based on the maps drawn of its own (the South China Sea, for instance), he notes, have underlying ambitions of protecting its energy security. On the strategic front, given the interlinked relationship between [great power rivalry and energy transition of nations](#), China's position on the global clean energy agenda is significant, especially during the coming years of Joe Biden's expected climate proactiveness. Xi Jinping's promises of achieving carbon neutrality by 2060, in a speech notably commenced during the times of the US elections, show the impending politics of the leadership race in the climate arena. In the light of such a geopolitical landscape where climate and energy play a decisive role in power politics, this article attempts to understand China's nuclear energy developments that are embedded in the nation's climate pledges and political agenda.

On the economic front, a transition towards clean energy systems will not only help meet China's rising energy demands but also will alleviate the gruesome realities of air pollution caused by its dominant coal-based economy. Hence, shifting to low carbon energy sources, particularly towards nuclear energy for the sake of this article, is an

urgent need of the times. For achieving a 1.5°C climate compatible scenario by 2100, the IPCC model pathways suggest a [six-fold increase in global nuclear capabilities](#). However, societal skepticism, as the IPCC report cautions, acts as a major barrier for governments to invest in nuclear energy. Public apprehensions towards nuclear power have played a major role in the decline of nuclear power projects in advanced economies.

After the Fukushima accident in 2011, when nations of the West were rapidly shutting down their nuclear power reactors, China remarkably added 34 new nuclear reactors between 2011 to 2019, raising back from a temporary shutdown that was imposed immediately after the meltdown. China's nuclear resurgence at a time when advanced economies were falling into the no-investment '[nuclear fade case](#)' is interesting to study. Unlike the nuclear priorities of the advanced economies that are predominantly led by open market forces, the Chinese path towards a new '[nuclear renaissance](#)' is directed by state-led nuclear enterprises that allow little voices of participation from the civil society. China's post-Fukushima nuclear plan, thus, entailed not only in establishing nuclear safety laws, but also in state-led authoritarian devices of [consensus-building and public acceptance](#). Hence, the state's control over societal views has in a way facilitated faster progressions in China's nuclear roadmap.

Another important aspect of China's nuclear plan is its advancement in technological innovation. China aspires to achieve '[socialist modernisation](#)' by 2035 through major breakthroughs in technologies. Nuclear aspirations for the same year of 2035 lie in a target of achieving [200GWe nuclear capacity out of the total generating capacity of 2600 GWe](#) electricity. Furthermore, the state-

supported nuclear industry, abiding by Xi Jinping's economic strategy of 'dual circulation', has responded to the goal of self-reliance by developing an indigenous alternative of American technologies, namely the Hualong One third-generation nuclear power technology. This has already been opened up to the international market, exporting the reactor model to countries that are specifically close to China's belt and road ambitions.

Through policies envisioned under the 13th Five Year Plan, the Chinese energy sector is witnessing various structural reforms, R&D in innovation, and investment frameworks that are enabling the nuclear industry to effectively contribute to the net-zero agenda. With the goals of nuclear-powered electricity to be increased ninefold by the year 2040, nuclear energy is expected to play a greater role during the 14th Plan period (2021 - 2025).

As an IEA report on clean energy systems perceives, nuclear power generation when backed

by stringent safety measures, risk communication strategies, and conducive space for innovation can effectively aid nations in achieving energy security and sustainable development goals faster than the current scenario. Learning from China's priorities towards nuclear energy, developing economies should recognize that clean energy transition will be costlier if investments are focused merely on mainstream renewables. The peculiarity of being a hybrid superpower – a country with advanced technological sophistication and resources, and yet dire developmental challenges – has placed China at the center stage of the world energy landscape. Given the ability to influence the parties subject to its overseas investments, China's priorities to nuclear energy may significantly impact the clean energy agendas of developing economies. Thus, the probable shifts in national nuclear stances are the future developments to look out for in the field of energy and world politics.

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We thank Prof. Ravi B Grover for joining as the Guest Adviser for the January 2021 issue of Energy Review. Prof Grover is an eminent nuclear scientist, currently serving as a Member of the Atomic Energy Commission. He was the Vice Chancellor of the Homi Bhabha National Institute, Mumbai, India.

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