In the Age of Climate Change, the Low-Carbon Nature of Nuclear Power Trumps Its Downsides

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Abstract

In the climate impacted world, it is clear that nuclear energy is seen a powerful alternative for the fossil fuels in terms of electricity generation. Nuclear power is seen as a source to reduce carbon emissions beside hydro, wind, bioenergy, and solar energy.

On the other hand, after Fukushima Daiichi accident in 2011, the importance of continuing efforts not to deny the risks of nuclear power occurred. The incidents at Chernobyl and Fukushima underlined the necessity of taking precautions in terms of nuclear plants and the safety. This work presents that how terms of decarbonization policies, a level playing field that allows all low-carbon generation technologies to compete on their merits can be created. It also shows how scientific researches and recent disasters invite the international community to think about whether nuclear power could solve the problems in the warming world.

Key Words: climate change, low-carbon, nuclear energy, global warming

1) Introduction

For many policy makers, nuclear power has long been seen as an important factor to meeting electricity needs and succeeding to reduce greenhouse gas (GHG) emission. According to OECD International Nuclear Agency World Energy Outlook (2018), there is an ambitious ‘Sustainable Development Scenario’. In this decarbonisation scenario, it is declared that “electricity generation from nuclear increases by almost 90% by 2040 to 4960 TWh, and capacity grows to 678 GWe. The main nuclear electricity producing countries, i.e. the USA, Japan and France, had already extended or were planning to extend the licenses and operating lives of most existing power plants prior to the Fukushima accident.” In addition to that countries, Finland and France have been constructing their new power plants, and “planned in Japan, the UK, the USA, Russia, India, South Korea, Taiwan, Egypt, Israel, Saudi Arabia, or Turkey. China, in particular, had announced to increase its share of nuclear power generation by 2020 from 1% to 6%.” (Joskow and Parsons, 2012)

According to UN’s Sustainable Development Goals (SDGs), nuclear power production has “low land requirements”, and gives “a relatively small burden on ecosystems and health”. In addition, it is well suitable for creating “electricity for urban populations” rapidly exceeding “one billion by 2030”, contributing directly to “ensuring universal access to affordable, reliable and modern energy services [by 2030]” (SDG7 Target 7.1).

Report published by World Nuclear Association (WNA 2018) has included that strong progress is being made in terms of meeting the electricity necessity, with planting on more than 25 reactors scheduled to be completed in 2018 and 2019. The report also underline the supply numbers that “new reactor projects are needed to maintain and accelerate global nuclear build so that nuclear generation can meet the Harmony goal of supplying 25% of the world’s global electricity by 2050.”

On the other hand, after Fukushima Daiichi accident in 2011, the importance of continuing efforts not to deny the risks of nuclear power occurred. The incidents at Chernobyl and Fukushima (IAEA, 2015) underlined the necessity of taking precautions in terms of nuclear plants and the safety. As Joskow and Pearson (2012) remarked that it should not be guaranteed that there will be another chance if there is another serious nuclear accident anywhere in the world. In that context, the total effect of Fukushima is an ongoing pressure for the nuclear energy regarding its safety. As it can be seen on the well-researched study (Kim et al. 2013) on “the public acceptance of nuclear energy,” the effect of Fukushima disaster on some countries is at the high level. It found 52.7 percent of the people backed the use of nuclear energy before the incident, this percentage declined to 45.4 after the disaster. Therefore, as an urgent steps to this Fukushima effect, some countries, including India, Pakistan, Russia, Spain, the USA and the EU, decided to change their policies on nuclear energy. Japan, which is the leading builder of power plants, dramatically changed its nuclear strategy in 2012 and 50 existing reactors had been closed by May 2012 and announced to phasing out of nuclear energy by 2040. “Countries like Indonesia, Malaysia and the Philippines, which had planned to build nuclear reactors for

the first time, are delaying or revising deployment. But other countries like Belarus, France, Indonesia, and Turkey have

not altered plans to build new power stations.” (e.g. IEA 2012b, pp. 69; Schneider et al. 2011).

In sum, nuclear energy provides low-carbon emission and decarbonise electricity and would help to decrease the effect of climate change and the electricity produced by nuclear power tends to be much cheaper than other forms of production. However, it has the potential for catastrophic accidents and widespread environmental damage. The challenges to realising the potential of nuclear power, such as financing high capital costs, addressing public concerns and managing safety, waste disposal and proliferation, are not insignificant. (IAEA, 2016a) The aim of this study is to explain the polarized debate between pro and anti nuclear power in the age of climate change and how the policy makers are in doubt between the low carbon nature of nuclear power and its potential danger for the environment and humanbeing.

2) Current Status of Nuclear Power Generation and Region Profiles

According to World Nuclear Performance Report (2018), to present profound challenges for nuclear power in some markets are combined by some external and internal factors.

Today, even though there are many criticism after Fukushima disaster, several countries are giving priority to the nuclear energy in terms of creating electricity as the cost of electricity produced is usually cheap. In addition to that, it is well known that nuclear energy is a high quality and for decades, it has been known “as an essential part of the low carbon electricity generation in the world”. (Falkner, 2016) Therefore, for industrialized countries wishing to

become a polluter in the lowest level, such as China and USA, the nuclear energy is essential topic.

In a work shared by IPCC WGIII (2014) says: “Nuclear energy is a mature low-GHG emission source of base load power, but its share of global electricity has been declining since 1993. Nuclear energy could make an increasing contribution to low-carbon energy supply, but a variety of barriers and risks exist”.

As a current information, “the world’s 394 GW” of connected nuclear supply accounted for 11 % of electricity generation produced by around 440 nuclear power plants situated in 35 countries. This number has shrunk gradually since 1996, when it reached almost 18 percent, as the rate of new nuclear additions (and generation) has been surpassed by the expansion of other technologies. “After hydropower, nuclear is the world’s second-largest source of low-carbon electricity generation.” (IEA 2014)

Currently, 35 percent of electricity production (13 % of primary energy) is obtained from 132 nuclear power plants in the Europe. 60 new reactors are under construction, mainly in “Asia (China, South Korea, India), and also in Russia, Slovakia, France and Finland. Many other new reactors are in the planning stage, including for example, 12 in the UK.” (IEA 2017)

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In Asia, first nuclear power system is started to be built in Bangladesh. In 2018, with the fifth reactor, nuclear generation was boosted in Japan. In South Korea, construction of Shin-Kori 5 was voted by the public. At the beginning of 2018, China had 38 active nuclear reactors. This number is representing about 9 percent of the world's nuclear capacity. In 2018, 18 of 59 reactors of the world were under construction in China. During 2017, reactors were connected to the grid at Yangjiang, Fuqing and Tianwan, adding 3 GWe of capacity. South Korea started to improve its export with the APR1400 design gained reputation and approval in Europe, in October 2017.

In April 2017, Russia built second unit of India's Kudankulam power plant. In addition to that, Russia's ASE Group got the responsibility for another plantation and second construction was started. Also, Russia gives importance to its bilateral relations in terms of energy. It signed agreement with India in June on Kudankulan power plant project. (IAEA, 2017)

In the Middle East, UAE has the region's biggest power plant named as Barakah. In Turkey, new construction program was started on the site of Akkuyu in December 2017 and first

reactor was activated in April 2018. (IAEA, 2017a) Saudi Arabia built "its first nuclear power plant in 2018 and has solicited data from five vendors from China, France, Russia, South Korea, and the USA."

In Europe, nuclear power is seen as crucial source of low carbon electricity. According to Nikolett Deutsch (2017), EU states changed their policies after Fukushima incident. "Most of the scenarios released after the Japanese accident indicate a higher rate of reduction in nuclear capacities in the EU by 2030 or 2050 and a smaller share of nuclear power in electricity generation than the studies published before 2011, while low-carbon scenarios still presume that nuclear power will play a substantial role in the decarbonisation the European electricity sector as manifested in a larger share of nuclear power in electricity generation in the EU" (Deutsch, 2017) In EU, Germany is the main country in terms of planting. Seven nuclear reactors are operating to produce 10 percent of country's electricity. According to World Nuclear Power Performance Report, "Some frequently operate in load- following mode, accommodating the country's push for variable renewable sources and coping with the negative pricing that often results. Germany's greenhouse gas emissions rose in 2016 – although they fell slightly in 2017 – and in January 2018, discussions between German parties involved in forming a coalition government suggested the country's greenhouse gas emissions goal for 2020 would be missed." (IAEA, 2018)

In Canada, small modular reactor system (SMR) has been developed by the help of its existing Candu reactors. The United States is constructing two VC Summer reactors at Vogtle.

Between 2016-2017, it is seen that "nuclear generation rose in Asia and East Europe & Russia and declined in West & Central Europe. These changes continued the trends of last 5 years." Generation fell immensely in North America, too. Also, IEA says "generation also declined in South America and Africa, although output in those regions is determined by a relatively small number of reactors and has remained little changed over the past ten years." (IEA, 2018).

Current status of nuclear power generation shows that governments are planning to invest this type of energy more and it will be more in the near future. They are renewing their recognition of the importance of nuclear power in protecting the earth from emissions. In Nice Future Report it is stated that “the launch of the Nuclear Innovation: Clean Energy Future initiative at the Clean Energy Ministerial in May 2018 put nuclear energy back on an even footing with other low-carbon solutions already discussed within the Clean Energy

Ministerial process. The NICE Future initiative will play a crucial role in multilateral dialogue and engagement of policymakers on the role of nuclear energy as part of a low - carbon mix contributing to sustainable development.” (Nice Future Report , 2018)

3) Current status of global climate regime

The steps for a global fighting “on climate change were planted in the late 1970s and the scientists strictly underlined that “climate change is a serious threat to mankind” (Vellinga, 2015, p. 350).

In 1992, the policy makers agreed on the United Nations Framework Convention on Climate Change (UNFCCC), the science of climate change was under development, global greenhouse gas (GHG) emissions were by and large produced by developed countries, and the concentrations of CO in the atmosphere had just surpassed 350 ppm. The first treaty signed under UNFCCC was the Kyoto Protocol. Under the Kyoto Protocol, “developed countries and countries in transition, had individual emission reduction targets ranging from –8% to +10%.” (Yamin & Depledge, 2004, p. 25). To be successful on this targets, a market based approach was applied to implement UNFCCC’s goal. Under the Kyoto Protocol, the Doha Amendment was adopted in 2012. It shows that some countries like Russia, Japan and New Zealand refrained from reaffirming their commitment.

25 years later, climate change is scientifically approved, China became the world’s biggest emitter and overtook the US , and the level of emissions are measured “above 400 ppm in 2017”. (IEA, 2017) Contrary to that situation, states have successfully signed a new global agreement under the UNFCCC named as the 2015 Paris Agreement. Before the Paris Agreement, the climate regime was on allocating emission reduction commitments among some countries. "However, the Paris Accord has changed the meaning of climate regime by defining a term based on “Nationally Determined Contributions” (NDCs). By declaring this

approach, the agreements aims that “states decide their ambition levels independently instead of engaging in negotiations about “who does what.” (Widerberg, 2018) Widerberg also says that “this is a more flexible system that for the first time” in the world history all countries will have responsibility to decrease the emissions to keep temperature increase below 2°C compared to pre-industrial levels. Beside that the international climate regime has transformed into “a regime complex, denoting the broad activities of smaller groups of states as well as non-party

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actors, such as cities, regions, companies, and non-governmental organizations along with United Nations agencies.”

Climate change represents both overwhelming challenges and advantages. To fight with the worst climate effects, the governments and the law makers aims to end growth in GHG emissions and as agreed Paris Agreement, they want to reduce emissions to gain the level of net zero by midcentury. The 2020: The Climate Turning Point report declared stock of “what it would take to peak global GHG emissions by 2020, including transforming policy, technology, behavior, and investment.” (Revill and Harris 2017).

Decreasing the level of from fossil fuels improves health conditions, reduces healthcare costs and ruins of climate change, contributes to emissions reduction goals, and increase the number of jobs than fossil fuels, among many other benefits (NCE 2018). In a report of the International Renewable Energy Agency (IRENA 2018a) it is estimated that benefits from a long-term energy transition would yield cost savings of \$6 trillion annually by 2050 just from reduced air pollution, better health, and reduced environmental damage.

In summary, the UNFCCC and its related formal institutions are understood as climate change regime. Beside that, the international NGOs, organizations also governed climate change regime. “Reducing emissions from deforestation and forest degradation to loss and damage, technology transfer, and adaptation” (Falkner, 2016) are the top issues to show the climate change and global warming. A wider web of global climate governance embedded to the UNFCCC. These observations may be seen as a success by the International community. Nonetheless, the current efforts are not enough to meet the requirements in addressing the problem of reducing GHG emissions and coping with global warming.

4) The Economics of nuclear power

The horrific incident at the Fukushima - Daiichi nuclear site caused to think more about safety issues. This type of energy is seen as the alternative for climate change mitigation

along with the problems and “risks of treating waste, proliferation, economic performance and resource availability”. (Bauer, 2015)

There is no doubt that the most important benefit of nuclear power deployment is getting low emissions which is not environmentally harmful. Nonetheless, it comes with the biggest environmental and financial costs.

In 1954, Lewis Strauss, first chairman of the Atomic Energy Commission, said “nuclear power would be someday very cheap to meter.” After 50 years of that speech, it is seen that nuclear power, instead, too expensive to finance. In particular, many international agencies research the financial implications of energy demand and its balance with the population. The agencies such as International Institute for Applied Systems Analysis, the World Energy Conference, the

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European Economic Community, OECD's Nuclear Agency and International Energy Agency have been actively operating for many years.

According to the World Nuclear Association, the economics of new nuclear plants are mostly effected by their capital cost which is at least 60 percent of the levelised budget of electricity. "To build a nuclear power plant is expensive but relatively cheap to run." In terms of electricity generation, nuclear energy is competitive with fossil fuels as a means of electricity generation.

5) Post Fukushima age : Japan and Germany comparison

In 2011, Japan had triple disaster of earthquake, tsunami, and nuclear meltdown totally changed the countries nuclear- based energy vision. Long-term discussions of Fukushima is still not clear but political and economic costs and benefits of this risky technology is long overdue. "Concerns about the future role of nuclear power are part of debates about energy security and climate change. Germany is frequently seen as leading the way toward a clean- energy future with its nuclear exit and renewables expansion, but both Japan and Germany have managed to maintain a secure energy supply with dramatically reduced nuclear power since 2011" (Feldhoff, 2014) It shows that both country take lesson from Fukushima disaster after 2011. A research by Institute for Sustainable Energy Policies shows that in Japan 50 municipalities and in Germany 55 municipalities shifted to renewable energy to protect their future generations from same disaster scenarios. The decreasing level of nuclear energy in both country and the fundamental shift also leads to create a big Energie-wende transition in Germany. Both country has many thing to learn from each other's experiences. Fighting

with climate change scenarios and phasing out nuclear power would help wean themselves from dangerous future.

6) Energie-Wende - Germany's energy innovation against nuclear

Nuclear power is the main supplier of Germany's nearly 20 percent energy demand. Despite some disputes, nuclear energy programme started in West Germany in 1950s. "In the 1970s and 80s, a fierce anti-nuclear protest movement blocked development at potential reactor sites resulting in the cancellation of several planned nuclear plants." (Wettengel,2017)

In last 50 years, Germany energy policy changed from strong eager for both coal and nuclear energy to deep reluctance. The most dramatic accidents leaded to the government's policies and these incidents became very influencing trajectory. After many nuclear incidents such as Fukushima Daiichi, Chernobyl, Germany decided to halt nuclear energy usage for the electricity generation and shut down its nuclear plants within 10 years in 2017. Therefore, it can be understood that one of the biggest energy transition project in the world history, Energiewende, did not come from the sky and is not coincidence. Dr. Manfred Fischedick (2013) says the preparations for this kind of energy transition had already started in 1980s and "there are a lot of scientific background and very successful steps for the government to make that kind of decision in very short period."

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The goal of this energy transition project, which is called as “Herculean task” by German Chancellor, is to phase out Germany’s nuclear power plants until 2022. It also aims to change the energy systems into a reliant on green energy resources, to decrease the level of emissions by 80-95 percent by 2050 and to enhance energy security.

There is no doubt that German see renewable energies as a cornerstone of future energy supply and the only factor to defeat the nuclear power uncertainty in terms of security. But, on the other hand, from Oxford Energy Institute, Buchan argues that Germany has to reach high progress to reach its main targets. Buchan (2012) says that Germany may access its targets only in terms of making “third renewable share of electricity by 2020” and to decrease energy consumption will not be easy. Therefore, it should be remembered that it will be very difficult to reducing emissions.

Conclusion

In the climate impacted world, it is clear that nuclear energy is seen a powerful alternative for the fossil fuels in terms of electricity generation. Nuclear power is seen as a source to reduce carbon emissions beside hydro, wind, bioenergy, and solar energy. Additionally, in terms of decarbonization policies, a level playing field that allows all low-carbon generation technologies to compete on their merits should be created. Yet, scientific researches and recent disasters invite the international community to think about whether nuclear power could solve the problems in the warming world.

The risk of nuclear accidents are increased by some natural incidents such as rising sea levels, warming water, etc. According to the author of “Manual for Survival: A Chernobyl Guide to the Future (2019)”, Kate Brown, there are huge concerns on natural incidents. “Records show that there have been fires in the Chernobyl zone that raised the radiation levels by seven to 10 times since 1990,” Brown says. Also, melting glaciers contain “radioactive fallout from global nuclear testing and nuclear accidents at levels 10 times higher than elsewhere”. In addition to that, there is also one paper which underlines that “Mere absence of greenhouse gas emissions is not sufficient to assess nuclear power as a mitigation for climate change.” (Perkins, 2011)

In sum, the devastating nuclear crisis in 2011 has created fears over the safety of nuclear power and potential risk for human being’s health. Most of the authorities shows that we don’t need nuclear for energy production. Renewables can take the place of nuclear power in a safely way or the energy industry should produce more effective and safe nuclear power technologies and regulations.

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References

Falkner, R. (Ed.). (2016). The handbook of global climate and environment policy. Oxford: Wiley-Blackwell.

Fischedick, Manfred. 2013. "Interview with German Climatologist: Goodbye nuclear power: Germany's renewable energy revolution". Accessible: <https://www.theguardian.com/sustainable-business/nuclear-power-germany-renewable-energy>

Feldhoff, Thomas. 2014. "Post Fukushima energy paths: Japan and Germany compared". Bulletin of the Atomic Scientists 2014, Vol. 70(6) 87–96

IAEA , 2011. IAEA Action Plan on Nuclear Safety, International Atomic Energy Agency, Vienna, Austria.

IAEA, 2015. The Fukushima Daiichi Accident, Report by the Director General, International Atomic Energy Agency, Vienna, Austria.

IAEA, 2016a. Nuclear Power and Sustainable Development, International Atomic Energy Agency, Vienna, Austria.

IAEA, 2016b. Climate Change and Nuclear Power, International Atomic Energy Agency, Vienna, Austria.

IAEA, 2017a. Energy, Electricity and Nuclear Power Estimates for the Period up to 2050, Reference Data Series No. 1, International Atomic Energy Agency, Vienna, Austria, ISSN 1011-2642.

IAEA, 2017b. Nuclear Power Reactors in the World, Reference Data Series No. 2, International Atomic Energy Agency, Vienna, Austria, ISSN 1011-2642.

IAEA, WHO, UNDP, FAO, UNEP, UN-OCHA, UNSCEAR, World Bank, Governments of Belarus, the Russian Federation and Ukraine, 2006. Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine, The Chernobyl Forum: 2003–2005, 2nd revised version, International Atomic Energy Agency, Vienna, Austria.

Joskow, P.L., Parsons, J.E., 2012. The Future of Nuclear Power After Fukushima. Economics of Energy & Environmental Policy 1 (2), 99-113.

Pattberg, Philipp & Widerberg, Oscar. 2018. The Climate Change Regime. 10.1093/acrefore/9780190228620.013.46.

Perkins, John, Kopytko, Natalie (2011). "Climate change, nuclear power, and the adaptation–mitigation dilemma", Energy Policy, Volume 39, Issue 1, January 2011, 318-333

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Rotterdam, Netherlands

Ross, Beveridge, Kern, Kristine . 2013. The 'Energiewende' in Germany: Background, Development and Future Challenges, Renewable Energy Law and Policy Review, 4(1):3-12.

NEA/IAEA, 2014. Uranium 2014: Resources, Production and Demand, A Joint Report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency, NEA No. 7209, Nuclear Energy Agency, Organisation for Economic Co-operation and Development.

Wettengel, J. (2017) A (very) brief timeline of Germany's Energiewende. Clean Energy Wire, April 2017. Available: <https://www.cleanenergywire.org/factsheets/very-brief-timeline-germanys-energiewende>

WNA (World Nuclear Association), 2019. World Nuclear Performance Report.