BACKGROUND PAPER

THE EUROPEAN INTERNATIONAL MODEL UNITED NATIONS
TEIMUN

# INTERNATIONAL ATOMIC ENERGY AGENCY

## DEVELOPMENT OF NUCLEAR POWER AND TECHNOLOGY AS AN ALTERNATIVE SOLUTION TO THE ENERGY SUPPLY CRISIS AND AS A STRATEGY TO MITIGATE CLIMATE CHANGE

**Welcome Letter**

**Dhifan Kemal Akbar**

Greetings delegates! Hailing from Indonesia, I am currently studying Mechanical Engineering. I was always interested in energy-related issues and I am now focussing my studies on advancing renewable energy technology. I really like joining MUN as it is more than just simulations, caucuses and resolution papers. It will give you an experience that makes you discover your hidden talents, and allow you to meet people who share the same interest as you, giving you the opportunity to pursue projects in the future. It can also lead to achievements you never knew were possible. So, don't hesitate to get involved as it will be my highest pleasure to assist you in this unique endeavour.

**Annika Würfel**

Dear Delegates, my name is Annika Würfel, and I am one of your chairs for the IAEA Council in TEIMUN 2022. I am a political science student from Germany. I am delighted to have the opportunity to chair a conference for the first time. Despite the fact that I live near the border to the Netherlands, I am still excited exploring the Netherlands and of course meeting you all! Our topic is a global issue that will be more and more important in the future. Many stakeholders see radioactive waste as a critical issue due to the potential hazards for human health and the environment. The goal of our debate will be to determine an effective radioactive waste management to ensure the protection of human health and the environment now and in the future

**Jan Willem Leeuwma**

Welcome to you all! I'm proud to be one of your chairs. I'm Jan Willem Leeuwma and I am from The Netherlands. As a History student I love to step in on this subject and have a focus on subjects from the past with the consequences of today. The MUN world is still very new for me as I have just joined in a couple of years ago. But nothing to be scared of as I know to chair and keep you all in line. Come prepared and show the best of yourself. We are all going to make this a MUN we will never forget. Make this debate as radioactive as our topic.

## Introduction

The history of nuclear power goes back to four decades in which much has been done, much has been achieved and many lessons have been learnt. Sceptics of the use of nuclear technology evolved around the world, in some countries more and in others less. Historical disasters such as in Hiroshima and Nagasaki point out the risk and the threat while continuing to use nuclear power as an energy source. Some say these historical disasters are evidence of the technology's incompatibility with the modern world. At the same time there are plans around the world to further expand nuclear power capacity to deal with the ever growing demand of energy.

The direction of the global transition to clean energy was agreed in the Paris Agreement, an international deal between over 180 countries that are part of the United Nations Framework Convention on Climate Change (UNFCCC). The agreement's central aim is to limit the increase in global average temperatures to well below 2°C relative to pre-industrial levels by encouraging the use of low carbon energy sources to reduce greenhouse gas emissions. The near-global agreement that climate change and sustainable development needs to be addressed, includes the overall awareness that countries need to make rapid changes to the means by which they generate energy. And this issue has become a tough needle to thread. Environmental pollution and global warming has induced the energy industry and various levels of government to reduce their dependence on fossil fuels, especially coal and oil. Nuclear power is the second-largest source of low carbon energy used today to produce electricity, following hydropower. Nuclear power plants produce almost no greenhouse gas emissions. According to the IEA, the use of nuclear power has reduced carbon dioxide emissions by more than 60 gigatonnes over the past 50 years, which is almost two years' worth of global energy-related emissions. Many environmentalists have opposed nuclear power, citing its dangers and the difficulty of disposing of its radioactive waste. Therefore in some countries, nuclear power has begun to fade, with plants closing and little new investment made.

However, some argue that nuclear power is safer than most energy sources and is needed if the world hopes to radically decrease its carbon emissions. If we do not curb the effects of climate change, the international consensus seems to be that nuclear technology will take part as an alternative low carbon energy resource. It has the advantage of high production capacity that can be fully utilised, low fuel consumption and low cost relative to the amount of electricity being generated.

At this year's European International Model United Nations conference, the IAEA will discuss the need for a technological revolution when it comes to energy production, and what role nuclear power will play in that future.

## Problem Specification

Concerns about climate change and the urgent need for quick action have grown in

recent years.[1] Simultaneously, interest in nuclear energy has been rising among both countries and researchers. The need for nuclear energy expansion has been driven by the imperative to cut carbon emissions in order to counteract climate change.[2] The advantages of nuclear energy are frequently emphasised, including its low lifecycle greenhouse gas (GHG) emissions and ability to provide base-load power.

Climate change mitigation is a long-term commitment. Considering cumulative global emissions to date, we have almost certainly committed to a global mean surface temperature peak rising of at least 1 degree Celsius above pre-industrial levels.[3] A substantial amount of manmade CO2 remains in the atmosphere for more than a century. If global warming is to be limited to less than 2 degrees Celsius without overshooting and with a probability of at least 66%, greenhouse gas emissions must fall to less than 20 gigatonnes of CO2 equivalent by mid-century, continue to decline thereafter, and eventually stabilise at zero net CO2 emissions.[4] Until now, the majority of studies examining the cost and feasibility of meeting aggressive climate targets have relied exclusively on existing available light water reactor (LWR) technology.[5] Nonetheless, given the long-term commitment, underdeveloped technologies can make a substantial contribution in the second half of the century, and eliminating them depicts a more constrained and inflexible future, in contrast to the abundantly diverse energy demands and available technology. As a result, technologies with a closed nuclear cycle should also be studied. If nuclear energy is to make a significant contribution to climate change mitigation, technologies that permit weapon development are likely to spread.

Apart from potentially reducing climate change, nuclear energy also has the potential to exacerbate energy shortages. The majority of energy crises have been precipitated by regional shortages, wars, and market manipulation. According to some, government measures such as tax increases, nationalisation of energy corporations, and regulation of the energy sector disrupt the economic equilibrium of energy supply and demand.[6] However, such variables did not contribute to the recent historical energy crisis. Market failure is a possibility when monopolists manipulate markets. A crisis might occur as a result of industrial actions such as union-organised strikes or government-imposed sanctions. The cause could be excessive use, old infrastructure, disruption of choke points, or bottlenecks at oil refineries and ports that impede gasoline supply. A crisis might also occur during extremely cold winters as a result of increasing energy usage.

---

[1] World Bank. 2012. “Turn Down the Heat: Why a 4 °C Warmer World Must Be Avoided”. *Washington DC*.
[2] Bauer, N., R. J. Brecha, and G. Luderer. 2012. “Economics of Nuclear Power and Climate Change Mitigation Policies.” *Proceedings of the National Academy of Sciences* 109 (42): 16805–16810.10.1073/pnas.1201264109.
[3] Tanaka, K., and T. Raddatz. 2011. “Correlation between Climate Sensitivity and Aerosol Forcing and its Implication for the ‘Climate Trap’.” *Climatic Change* 109 (3–4): 815–825.10.1007/s10584-011-0323-2.
[4] Rogelj, J., et al. 2011. “Emission Pathways Consistent with a 2 °C Global Temperature Limit.” *Nature Climate Change* 1: 413–418.10.1038/nclimate1258
[5] GEA (Global Energy Assessment). 2012. “Global Energy Assessment – Toward a Sustainable Future”. Cambridge and Laxenburg: *Cambridge University Press and International Institute for Applied Systems Analysis*.
[6] Kazmi K. 2021. "Essay on the Energy Crisis". Smadent.

Pipeline breakdowns and other incidents might result in brief interruptions of energy delivery. A crisis could develop as a result of infrastructure damage caused by extreme weather. Terrorist or militia attacks on critical infrastructure pose a threat to energy customers, with a successful strike on a Middle Eastern plant posing the possibility of global shortages. Political upheavals, such as regime changes, monarchy collapse, military occupation, or coups, can affect oil and gas production and result in shortages. Fuel shortages can also be a result of excessive and inefficient use of fuels.

**QARMAs**

1. What are the next steps to be taken to transition into Nuclear Energy as the alternative solutions to mitigate climate change and the energy crisis?
2. What is the role of nuclear power in the energy system to create a global pathway for a clean energy transition?
3. How can nuclear power be safely implemented into the energy system for the energy transition?

**Explanatory section per QARMA**

**QARMA 1**

1) History/Background of the Problem

The worldwide community ratified the Paris Agreement on climate change in 2015, committing to restrict global average temperature increases to less than 2°C over pre-industrial levels, and if possible, to 1.5°C. This would require bold and immediate actions to cut greenhouse gas (GHG) emissions across all activities and sectors, including a full reform of the energy sector to phase out unabated fossil fuel production and usage, the primary source of carbon dioxide (CO2). This is increasingly acknowledged as requiring the energy sector to become carbon neutral by the middle of the century, with any CO2 emissions offset by CO2 removals — i.e. to attain 'net zero' emissions. While there are numerous paths to achieving this goal, long-term energy and climate scenarios, such as those outlined in the Intergovernmental Panel on Climate Change's (IPCC) Special Report on Global Warming of 1.5°C and the International Energy Agency's (IEA) Net Zero by 2050 Roadmap, highlight two critical elements: widespread electrification of the economy with low carbon electricity (from renewables and nuclear) and deployment of other low carbon electricity.

2) Recent Developments

Nuclear energy is increasingly regarded as a climate-friendly energy alternative in the context of net zero and increased climate ambition, not just as a climate-friendly energy choice, but also as a facilitator of the energy sector's broader transformation. This is due to nuclear energy's unique characteristics, which include the lowest

greenhouse gas emissions of all energy technologies, 24/7 availability, operational flexibility, a small land footprint, and the ability to decarbonize difficult-to-abate activities. While neutral scientific assessments from the IPCC, the IEA, and others recognize nuclear power's significant potential to contribute to climate change mitigation and other global challenges, the extent to which the world will capitalise on this low-emission, reliable, and sustainable source of energy remains uncertain, in part due to limited — albeit growing — public acceptance and policy support.[7] Between 2011 and 2020, global nuclear power generation capacity increased modestly, by 59 gigawatts (GW). While various countries' programs extended the life of existing nuclear power facilities by up to 80 years, 48 GW of capacity was nonetheless retired during the same period due to reactor shutdowns.

Time is fast running out to reduce global emissions and avoid severe climate change consequences (IPCC, n.d). This urgency necessitates the deployment of all low carbon options for decarbonizing the energy system, particularly those that are proven, cost effective, and compatible with broader development and environmental goals. Nuclear power plants operating in 32 countries have already contributed to a 10% reduction in global power sector CO2 emissions, and 19 nations are now building around 50 additional reactors with a combined capacity of approximately 54 GW.[8] Bangladesh and Turkey are currently constructing their first reactors, while Belarus and the United Arab Emirates will begin generating nuclear energy in 2020: many of these newcomer countries recognize nuclear energy's role in combating climate change and long-term economic development, and approximately 30 countries are collaborating with the IAEA to explore the possibility of introducing nuclear energy for the first time. Nonetheless, the current rate of reactor building is significantly slower than what is required to attain net zero emissions. While the nuclear industry is working to contain newbuild costs through streamlined supply chains and modular construction, accelerating the transition to net zero emissions is critical. In most countries, launching new projects will require a more favourable policy environment that fosters investor confidence and lowers financing costs.

3) Relevant Actors/Institutions

Citizen engagement and empowerment have been acknowledged as critical components of both the creation and successful implementation of national policies in regional and local contexts. Large-scale technology projects are considerably more likely to be approved when stakeholders have contributed to their feasibility and developed an interest in or sense of responsibility for them. Diverse stakeholders bring a variety of perspectives, perceptions, attitudes, interests, and values to the table. This complexity must be considered. A critical component is increased regional and local stakeholder involvement. Involving regional and local stakeholders begins with

[7] Tyson, A., Kennedy, B., 2020, "Two-thirds of Americans think the government should do more on climate", *Pew Research*, Washington, DC,
[8] IAEA. 2019. "Nuclear Power in a Clean Energy System".

information dissemination and progresses to include consultation, active engagement, and shared decision authority in varying degrees. Local communities should have a leading role. They should be actively involved in creating and implementing their own solutions, with major aid from regulatory and decommissioning authorities, as well as industry proponents. This comprises planning and implementation following a site selection agreement. The FSC emphasises the importance of early stakeholder interaction (NEA, 2015). It is beneficial to have local liaison groups in close proximity to potential sites to provide public education, information, and consultation (NEA, 2009). Numerous tools and approaches are available to assist citizens in participating and empowering themselves. Guidelines have been created to assist in the selection of appropriate stakeholder discussion strategies for a variety of decision-making situations8 (NEA, 2004a). The technique that is most appropriate for a given circumstance is determined by the stakeholders and the goals and objectives (NEA, 2015).

4) International Approaches that have Already been Undertaken

However, policy and regulatory incentives promoting the deployment of low-carbon technologies and a transition away from coal have had mixed results to date. Coal consumption has dropped in recent years in Europe and North America, having been mostly supplanted by natural gas for economic and environmental reasons. In comparison, the Asia Pacific region has seen a rather rapid increase in coal consumption, whereas Africa has seen just a mild increase. As a result, cumulative worldwide coal consumption has remained relatively steady since 2011, however there are some early indications that consumption may begin to decline in the near future as new coal power projects face more financing hurdles. However, policy and regulatory frameworks will almost certainly need to provide additional incentives to significantly accelerate the transition away from all fossil fuels — not just coal, but also natural gas and oil — and toward low carbon energy sources, including through carbon pricing, which is frequently viewed as the optimal economic instrument for promoting low carbon energy sources. Historically, carbon prices and other incentives have been far too low in many markets to prevent fossil fuel investment, and will need to dramatically increase in order to be effective.

**QARMA 2**

1) History/Background of the problem

Achieving the pace of CO2 emissions reductions in line with the Paris Agreement is already a huge challenge. The growing demand for electricity, energy diversification, and climate change mitigation brings out the need for a new energy system able to provide a reliable and sustainable supply of electricity. Electricity demand is increasing about twice as fast as overall energy use and is likely to rise by more than half to 2040. This motivates the construction of new nuclear reactors. Nuclear

technology is among the energy technologies available today with the lowest GHG emissions, producing only 15 grams CO2-equivalent per kWh. Nuclear power provides about 10% of the world's electricity, and 18% of electricity in OECD countries. Almost all reports on future energy supply from major organisations suggest an increasing role for nuclear power as an environmentally benign way of producing reliable electricity on a large scale.

According to the International Energy Authority, between 1970-2013 the use of low-carbon energy sources meant we avoided 163 Gt of CO2 emissions. Nuclear power contributed 41%, while solar and wind accounted for 6%. Nuclear energy represents one of the lowest sources of GHG.[9]

Nuclear power's high unit capacity and high reliability make it suitable for base-load power in the energy system. Compared to fossil fuels, nuclear has two distinct advantages. First is that it is a low-carbon energy source. Second is that it delivers predictable and relatively low-cost electricity generating technologies.

2) Recent developments

Many countries have committed to increase the share of power from nuclear energy in order to meet the Paris Agreement targets. But the political and economic environment, and the public lack of support, make the prospect of accomplishing these ambitious objectives extremely difficult. The cost of nuclear power is relatively low in comparison to renewable energies. But waste, safety and nuclear proliferation are still roadblocks that should be tackled in order to enable deployment of this technology.

Nuclear power plants are currently operating in fifteen non-OECD countries and provide a firm, zero-emission, and baseload substitute for coal.[10]

It would take far more investment worldwide in nuclear plants than is currently expected for nuclear power to significantly limit climate change, according to the International Atomic Energy Agency. Many countries, especially in the Arab world, are turning to nuclear power to supply growing populations, but many more developed countries, for example Germany, are also in the process of limiting their nuclear supply. Nuclear energy is opposed by a majority of Americans due to the potentially catastrophic effects of accidents.

3) Relevant actors/institutions

There is a lot of interest from venture capitalists, philanthropists, investing in the nuclear energy sector.

Combined efforts from all sectors – government, industry and civil society – are

[9] Losasso, M. 2020. "Nuclear power has a big role to play in the energy transition. Here's why". *World Economic Forum.*
[10] IAEA. 2020. "Nuclear Key to the Clean Energy Transition – Conclusions of the 2020 IAEA Scientific Forum".

needed in order to reach through the expansion of nuclear power a meaningful impact on the clean energy transition.

4) International approaches that have already been undertaken

Nuclear power has an uncertain role in the future energy transition. Some see nuclear power as the best way to produce carbon-free energy in the near term and at the right scale to power entire societies. Others claim that the dangers involved in nuclear fission, as well as the economics involved, will lead to the abandonment of the technology in favour of renewables or natural gas.

Many countries with existing nuclear power programmes either have plans to, or are building, new power reactors. About 30 countries are considering, planning or starting nuclear power programmes.[11]

**QARMA 3**

1) History/Background of the Problem

With a history of problems and the dangers of direct contact with nuclear material, the nuclear power plant still invokes a lot of fear and with that it is difficult to implement into a society of the future. The most recent big disaster that scared the world was the tsunami in Japan in 2011 where the nuclear power plant of Fukushima got partly flooded and 3 people died. This was however not because of the damage of the plant but the flooding of the active reactors. The event itself made the world warry on how nuclear energy can be used in a safe and sound way and enhance the quick change to greener energy sources.

This direct fear is mostly built on the events of 1986 where the nuclear power plant of Chernobyl in current day Ukraine had a meltdown. The then Soviet Union was not well prepared to tackle the issue which caused the biggest shock of what nuclear energy can damage if not handled properly. It caused the death of around 30 people directly, in addition to a couple of thousands of deaths caused by the effects of radiation. The whole village of Pripyat had to be evacuated and until today it is still an exclusion zone with limited access. The Pripyat and the Fukushima events are the most well-known and strike fear into the public. See Germany scaling down their activity of nuclear energy in 2011 because of the Tsunami in Japan.[12]

In the annual report the IAEA has placed a record on the number of events where concerns should be placed.[13] With the growing demand for energy comes the quest to find the pathway to the future. With rising water tides and uncertainty of impact of climate change it is of the utmost importance that people have the energy guarantee

[11] World Nuclear Association. 2022. "Plans For New Reactors Worldwide".
[12] Jordans, M. 2022. "Germany shuts down half of its 6 remaining nuclear plants". *ABCNews*. https://abcnews.go.com/International/wireStory/correction-germany-nuclear-shutdown-story-82051054
[13] IAEA. 2020. "Incident and Emergency Preparedness and Response - IAEA annual report for 2020".

and the safety that comes with it. The event of Chernobyl has shown that an area of 26000 square kilometres can directly be impacted – for instance, there were radioactive parts which got transported through the air. In the safety protocols the IAEA takes a high standard on the safety of the people and the environment.[14] However, even after all this consideration the switch to nuclear power for a green future is still on a thin thread.

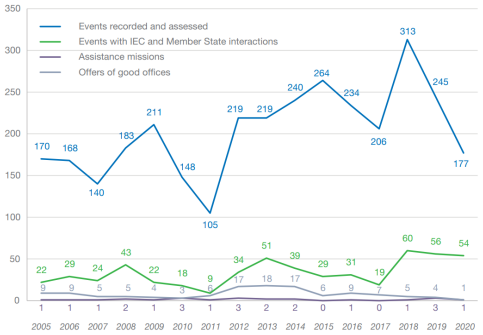


*FIG. 1. Number of radiation events the Agency's Incident and Emergency Centre (IEC) recorded and assessed, and Agency responses, since 2005.*

2) Recent Developments

As Germany is closing all of its nuclear reactors it's one of the big players that has made a huge turnaround when considering the clean solutions for the future. They chose a future where safety is one of the key components. Especially when looking at the last couple of months where Russia or the leader of the country, Vladimir Putin, announced a special military operation to invade Ukraine. Again, the power plant of Chernobyl got in the headlines as the Russians took it in the first place and left after a week. However, a working power plant of Zaporizhzhia in the south of the Ukraine also fell into the hands of the Russians.[15] In handling a nuclear power plant, the high standards of safety play an important role in keeping the people and the environment safe. With an invasion and heavy fire, the safety of such a valuable object could get into trouble. The question of safety and the maintaining of a safe atmosphere is in danger.

The safety of the power assurance got into trouble and the safety of the environment is again questioned when the world wants to get its energy out of such an unstable product.

3) Relevant Actors/Institutions

With the current developments, the safety and safekeeping of nuclear energy should be one of the top priorities. When the world is at peace and the security for the nuclear power plants can be guaranteed it should be completely fine. The relevant actors currently are the countries in conflict areas, as it is difficult to sustain a safe environment for the people working on location when there are wars raging on. However, the safety of power plants can also be a topic of discussion regarding the changing climate. If we get harsher weather and more outbursts like tsunamis, who can guarantee safety then? The big actors are countries that have a direct influence on conflict areas and/or areas that are at risk because of the environment. These countries

[14] IAEA. 2018. "Safety standards"
[15] BBC. 2022. "Ukraine nuclear plant: Russia in control after shelling". *BBC*. https://www.bbc.com/news/world-europe-60613438

are also the ones that have to protect the people from these dangers while at the same time satisfying their energy needs.

Next to those direct actors, the talks on the local level from Euratom can be of huge importance as different countries within the European sphere see the future of nuclear energy differently. With those local parties and the discussions at IAEA the clean and safe future can be discussed.

4) International approaches that have already been undertaken

One of the most important undertakings of safety for the future can be found in that Safety Standards document of the IAEA.[16] Together with all the partners that have a seat at the IAEA they work on the complete work on how to safely transfer nuclear energy to the future. From the use of the material to the design of the buildings it has all been discussed. In that regard, the list of incidents from 1952 is only 28 (of which only 2 have had the category 7 incident). With all the risks being discussed during these talks it is almost impossible for a big disaster to happen again.

[16] IAEA. 2018. "Safety standards"

**Sources for further research**

International Atomic Energy Agency. *Nuclear Energy for a Net Zero World*.

IAEA Bulletin. September 2020. *The IAEA's flagship publication*.

**Bibliography**


Bauer, N., R. J. Brecha, and G. Luderer. 2012. “Economics of Nuclear Power and Climate Change Mitigation Policies.” *Proceedings of the National Academy of Sciences* 109 (42): 16805–16810.10.1073/pnas.1201264109

GEA (Global Energy Assessment). 2012. *Global Energy Assessment – Toward a Sustainable Future*. Cambridge and Laxenburg: Cambridge University Press and International Institute for Applied Systems Analysis.

IAEA. 2020. *Nuclear Key to the Clean Energy Transition – Conclusions of the 2020 IAEA Scientific Forum.* IAEA

IAEA. 2020. *Incident and Emergency Preparedness and Response - IAEA annual report for 2020*. IAEA

IAEA Volume 61-3

IAEA. 2019. *Nuclear Power in a Clean Energy System.* IEA

IAEA. 2018. IAEA Safety Standards

Ichord. R. F. 2021. *Nuclear power and the energy transition in non-OECD countries.* Atlantic Council

Jawerth, N. 2020. *What is the Clean Energy Transition and How Does Nuclear Power Fit In?*

Kumail Kazmi (4 September 2021). "Essay on the Energy Crisis". Smadent. Retrieved 5 September 2021.

Lehtveer, M., & Hedenus, F. (2014). Nuclear power as a climate mitigation strategy – technology and proliferation risk. *Journal Of Risk Research*, *18*(3), 273-290. https://doi.org/10.1080/13669877.2014.889194

Losasso, M. 2020. Nuclear power has a big role to play in the energy transition. Here's why. *World Economic Forum.*

Michalski, M. 2019. Development of nuclear power as an alternative to fossil fuels. *Acta Innovations.*

Rhodes, R., 19 July 2018. *Why Nuclear Power Must Be Part of the Energy Solution*. Yale School of the Environment

Rogelj, J., W. Hare, J. Lowe, D. P. van Vuuren, K. Riahi, B. Matthews, T. Hanaoka, K. Jiang, and M. Meinshausen. 2011. “Emission Pathways Consistent with a 2 °C Global Temperature Limit.” *Nature Climate Change* 1: 413–418.10.1038/nclimate1258

Rogner, H.-H. 2013. “World Outlook for Nuclear Power.” *Energy Strategy Reviews* 1 (4):

291–295.

Tanaka, K., and T. Raddatz. 2011. “Correlation between Climate Sensitivity and Aerosol Forcing and its Implication for the ‘Climate Trap’.” *Climatic Change* 109 (3–4): 815–825.10.1007/s10584-011-0323-2

Tyson, A., Kennedy, B., Two-thirds of Americans think the government should do more on climate, Pew Research, Washington, DC, 2020.

World Bank. 2012. *Turn Down the Heat: Why a 4 °C Warmer World Must Be Avoided*. Washington DC.

World Nuclear Association. 2022. Plans For New Reactors Worldwide