WORLD NUCLEAR ASSOCIATION

Submission to the first stage of the Asian Infrastructure Investment Bank Energy Strategy

The World Nuclear Association welcomes the opportunity to contribute to the preparation of the Asian Infrastructure Investment Bank's Energy Strategy. Our submission sets out the case for including nuclear energy among the energy infrastructure projects that are suitable for AIIB financing and investment. We believe that the AIIB has missed an opportunity by not including nuclear projects at this stage but we are heartened by the statement in the Issues Note that the AIIB will revisit its position in the future. There is an increasing appetite for nuclear energy in the region and an array of financing options are needed. In the Asian nuclear sector, China, Japan and South Korea already have large established nuclear fleets and export programmes; India, Iran and Pakistan are also operating and building nuclear power plants while the UAE is currently building its first four reactors. Beyond these, countries including Bangladesh, Indonesia, Jordan, Kazakhstan, Malaysia, the Philippines, Saudi Arabia, Thailand, Turkey and Vietnam are at different stages of setting up nuclear energy programmes.

This document comprises four sections, which support the following conclusions:

1. **Nuclear energy projects can readily comply with the AIIB's standards**. Many international institutions and established practices already work to support high standards in the nuclear industry. We believe that the insistence on high standards as a condition of AIIB funding could further support the quality of such projects in emerging nuclear countries and that AIIB funding would be welcomed by all parties.
2. **Nuclear energy contributes to a sustainable energy mix while nuclear technology helps to meet sustainable development goals**. Nuclear energy's high energy density and small environmental footprint means that it is very well suited to meeting the growing energy needs of industrializing countries while minimizing environmental impacts such as land use. Furthermore, as part of a diverse portfolio of low-carbon energy sources, nuclear energy helps to ensure a secure, reliable electricity supply at a low overall energy system cost. Beyond the production of electricity, nuclear technology has applications in agriculture, water management, medicine, and manufacturing and could help countries achieve Sustainable Development Goals. The establishment of a strong nuclear sector in these countries is a key step in terms of their technical and social advancement.
3. **The Asia region must increase the use of all low-carbon energy sources, including nuclear energy, if the world is to successfully limit climate change.** The global challenge is immense: by 2050, 80% of global electricity will need to be produced with low-carbon technology (compared with about 30% today) in order to contain climate change below 2°C. During the same period, global demand for electricity will double, with higher demand growth to be experienced in much of Asia. Low-carbon electricity is also expected to play a major role in decarbonizing other sectors such as transport and heating. Meeting this challenge requires the use of all low-carbon electricity technologies. We believe that in order to meet these climate and development goals nuclear energy should provide around 25% of electricity globally by 2050 up from about 11% today. The use of nuclear energy must grow significantly in Asia if the world is to have any hope in achieving this.
4. **Financing nuclear energy projects is an opportunity for AIIB to complement the lending activities of other development banks and would increase its relevancy in the Asia region.** Several highly populated Asian countries are planning nuclear energy programmes as part of their future sustainable energy mix and all countries are looking to increase access to other nuclear applications. At the moment other development banks do not finance nuclear projects and this creates a potential barrier to meeting future environment, energy security and economic development goals. There are in fact only modest barriers to the AIIB developing the necessary competency to assess nuclear projects and the World Nuclear Association would be pleased to provide assistance in this matter as a priority.

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1. Nuclear energy projects and AIIB requirements

We believe that nuclear energy, as part of a balanced energy mix, can help meet the objectives given in the proposed AIIB Energy Strategy for delivering sustainable energy, namely ensuring "adequate and reliable supplies of environmentally and socially acceptable forms of energy at competitive prices without compromising the energy needs of future generations." The AIIB's Environmental and Social Framework establishes a set of standards that clients must meet in order to qualify for financing, investment and technical assistance. Whilst every project must be assessed on its merits, we believe that the nuclear industry, its regulators and supporting bodies have developed institutions and practices which more than comply with the standards and the principles enumerated in the Framework. In this section we provide evidence of how nuclear energy projects meet AIIB requirements.

The AIIB Energy Strategy

Nuclear-generated electricity can meet the proposed Guiding Principles stated in section 11 of the AIIB Energy Strategy.

Firstly, nuclear energy is a very secure form of electricity generation given that fuel supply is a small component of total costs and the very high energy density of fuel means that several years' worth of reactor requirements can readily be stockpiled at the plant site. In the more than 60 years of nuclear generating experience, there are no recorded incidences of disruption to supply in the international fuel market leading to a curtailment of nuclear operations. Moreover, by diversifying the low-carbon generating sector inside countries to include nuclear, the security of supply of the generating system is significantly enhanced.

The critical need to reduce carbon emissions in power generation can be addressed by nuclear energy which has very low lifecycle emissions of carbon, similar to those of wind energy. The role nuclear energy must play in helping to mitigate climate change is expanded on in Section 3 of this document.

Nuclear power plants produce very low chemical emissions during the normal course of operation. These are not at levels which have any pollution impact. There is also a risk of radiation accidents involved with operating a nuclear power plant, but with commercial reactor designs available today that risk becomes vanishingly small and impacts easier to mitigate. This tiny tail end risk is preferable to the very real and measurable health impacts which are caused by almost every form of combustion on an ongoing basis.

In terms of attracting private capital we note that given the appropriate market conditions (i.e. where there is an adequate return on long-term investments) such as are commonly found in Asian countries, private investors can be mobilised for nuclear projects. Many Asian energy companies with nuclear interests are now listed on stock exchanges, including CGN and KEPCO. Most of the US nuclear fleet, the world's largest, was financed by private capital.

Nuclear energy can help to promote regional cooperation. Four Asian countries - Japan, South Korea, China and India - have the capability to provide nuclear equipment and services and there is a willingness to share these competences with other countries. For example, South Korea is providing the UAE with its nuclear reactors while Japan is about to sign a nuclear cooperation agreement with India[1]. In 2008 the ASEAN Centre for Energy established a Nuclear Energy Cooperation Sub-Sector Network as the responsible specialised body for ASEAN-wide nuclear energy cooperation and information sharing for those member states wishing to develop the technology. It aims to strengthen regional cooperation and build capacity for forthcoming nuclear development in South-East Asia.

[1] See for example Japan Times 'Japan, India to sign nuclear cooperation pact in mid-November' http://www.japantimes.co.jp/news/2016/10/31/national/politics-diplomacy/japan-india-sign-nuclear-cooperation-pact-mid-november/

AIIB Environmental and Social Framework

There are many existing international organisations, treaties and principles which work to support high standards within the global nuclear industry. These standards should meet the requirements of the AIIB's Environmental and Social Framework.

Standards for working conditions and community health and safety

The nuclear industry globally has one of the lowest rates of occupational health and safety incidents[2]. Its safety culture is a precautionary one which emphasises safety as the primary goal of plant operation. In an organisation with a strong nuclear safety culture, safety objectives are recognized across every division from the management to the worker level. Communication on safety issues flows up and down company structures without fear of recrimination, and training and resources are made available as required. Put simply, a well-implemented nuclear safety culture means that safety is part of everybody's job. The World Association of Nuclear Operators (WANO) counts every nuclear power plant across the globe amongst its members. Its priority is the "assurance of nuclear safety and excellence in operational performance"[3]. WANO members receive notification on operation incidents and near misses and exchange information on good practice and are bound by similar requirements.

Moreover, nuclear plant safety is regulated comprehensively by independent national authorities in line with guidance issued by the International Atomic Energy Agency (IAEA). The licensing of nuclear power plants by the safety regulators provides assurance that the plant will be designed, constructed and operated in accordance with stringent safety and environmental standards and best practice. Furthermore, the operators, developers and builders of nuclear power plants are required under their licensing terms to meet criteria on safety, quality, environmental stewardship and corporate social responsibility. The standards to which they work can be expected to comply with the World Bank Group's Environmental, Health, and Safety Guidelines for good international industry practice in environmental management (including hazardous materials management), occupational health and safety, community health and safety, and construction and decommissioning. All countries operating nuclear power plants today are signatories to the Convention on Nuclear Safety, the aim of which is to legally commit participating states operating land-based nuclear power plants to maintain a high level of safety by setting international benchmarks to which IAEA member states comply[4].

The radiation exposure of personnel at nuclear facilities, uranium mines and those involved in nuclear materials transport is managed in line with recommendations set by an internationally accepted system of radiological protection coordinated through the International Commission on Radiological Protection (ICRP). Nuclear industry workers are required to wear dosimeters and radiation exposure is monitored. It is clear that in the vast majority of cases the doses received are of the same order of magnitude as many non-nuclear professions[5], for example, civil aviation flight crews and many mine workers.

Nuclear plant licence conditions require operators to be prepared for a severe accident and plants routinely conduct drills, sometime even involving members of the local community. Plants come equipped with systems which can minimise and prevent the release of radioactive materials in the case of a fuel melt event, while there are procedures which enable the reactor to be returned to a stable state. International guidelines on severe accident management are provided through the IAEA[6]. If a significant radioactive release takes place governments and regulators may enact public protection measures including the issuing of iodine pills[7], short term sheltering guidance, evacuation and restrictions on the consumptions of certain food products. While the Fukushima Daiichi nuclear accident garnered much media attention, two important points should be noted.

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[2] See WANO, 2013, Performance Indicators (Industrial Safety Accident Rate) http://www.wano.info/en-gb/library/performanceindicators/Documents/PI%20Trifold%202013%20-%20individual%20A4%20size.pdf
[3] See WANO website, Our Principles (accessed 9 November) http://www.wano.info/en-gb/aboutus/ourmission
[4] See IAEA background https://www.iaea.org/publications/documents/treaties/convention-nuclear-safety and treaty full text https://www.iaea.org/sites/default/files/infcirc449.pdf
[5] See UNSCEAR 2008, Sources and Effects of Ionising Radiation http://www.unscear.org/docs/reports/2008/09-86753_Report_2008_Annex_B.pdf
[6] See IAEA, The Severe Accident Management Guideline Development Toolkit https://www.iaea.org/NuclearPower/SAMG-D/index.html
[7] Certain countries and regions are now requiring these to be pre-issued, see for example *All Belgians to be given iodine pills for nuclear safety http://www.bbc.co.uk/news/world-europe-36157806*

Firstly, that according to the United Nations Scientific Committee on the Effects of Atomic Radiation: "Radiation exposure following the nuclear accident at Fukushima-Daiichi did not cause any immediate health effects. It is unlikely to be able to attribute any health effects in the future among the general public and the vast majority of workers"[8]. The health effects of nuclear accidents are often thought to be far greater than evidence attests. Secondly, that following the accident every single nuclear power plant in Europe[9] conducted an evaluation of plant safety in light of learning from the accident and its causes. In other countries the regulator conducted the assessment and ordered upgrades.[10] When a nuclear accident happens the entire global industry responds.

Nuclear plants are robust, secure facilities which rank among the best-protected industrial facilities in the world. All plants have many levels of security, including physical barriers and well-trained guards, which are very effective at preventing attacks. The security of nuclear facilities is principally a national responsibility. The UN Security Council acting in its legislative capacity created a binding obligation on all states to provide adequate physical protection, border controls and law enforcement over nuclear and radiological materials in 2004[11]. The Convention on the Physical Protection of Nuclear Materials imposes similar requirements on signatory states[12]. The global nuclear industry is committed to implementing effective security arrangements within national regulatory frameworks, taking into account IAEA guidelines and best practice[13].

Nuclear energy is subject to an international regime to protect its materials and technology from misuse. Chief among these is the Non-Proliferation Treaty[14], and it is backed up by IAEA safeguards and multilateral and bilateral agreements.

Environmental standards

We consider that the nuclear industry is well able to manage environmental risks and impacts throughout the life of a nuclear power plant project in a systematic manner. Given the low and tightly regulated emissions across the full nuclear lifecycle, the low resource and land-use requirements of a nuclear power plant, the industry's expertise in managing hazardous materials (including waste products and used nuclear fuel), and the capability of its highly trained personnel, we believe that a nuclear energy project will prove environmentally sound.

The nuclear industry is risk-adverse by its nature and its culture, and many of its safety and environmental practises align innately with the precautionary principle. The constructors, operators and regulators of nuclear facilities take a highly precautionary approach to actions that might impact the environment. Safety is governed according to either a probabilistic risk approach[15] or defence in depth[16] or a combination of both. The ICRP system to control exposure to radioactive sources is founded upon the precautionary principle since it sets conservative dose levels despite the absence of any measurable health impacts at these doses.

Nuclear projects generally go to considerable lengths to protect the natural environment and avoid biodiversity impacts[17]. In most if not all countries, nuclear energy facilities will be subjected to an environmental impact assessment (EIA) before approval can be given for construction or any major change of status such as an operating licence extension, upgrade or decommissioning. Such regulatory consideration will usually mandate an extensive public consultation process and a rigorous assessment would no doubt be required as part of the

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[8] United Nations, 2013, *No Immediate Health Risks from Fukushima Nuclear Accident Says UN Expert Science Panel,* http://www.unis.unvienna.org/unis/en/pressrels/2013/unisinf475.html

[9] The so-called European stress tests were a multi-lateral exercise involving 140 reactors with the results subjected to peer review- see http://www.ensreg.eu/sites/default/files/EU%20Stress%20Test%20Peer%20Review%20Final%20Report_0.pdf

[10] See US Nuclear Regulator Commission, Japan Lessons Learned, http://www.nrc.gov/reactors/operating/ops-experience/japan-dashboard.html

[11] United Nations Security Council Resolution 1540 of 2004.

[12] IAEA, background on Convention on the Physical Protection of Nuclear material https://www.iaea.org/publications/documents/conventions/convention-physical-protection-nuclear-material

[13] Nuclear Industry Summit Joint Statement issued on 30 March 2016 at http://nis2016.org/agenda/documents/documents-nuclear-industry-summit-2016-joint-statement/

[14] See IAEA, *Treaty on the non-proliferation of nuclear weapons* https://www.iaea.org/publications/documents/treaties/npt

[15] A probabilistic risk assessment establishes the likelihood of accident pathways and their impacts. It therefore is used to determine how much any given action increases the risk of an accident occurring and if any mitigating action is needed.

[16] Defence in depth refers to the use of multiple systems to achieve safety. These systems will have built in redundancies so that if one (or sometimes more) components fail the safety function of the system is still available.

[17] Barry W Brook and Corey J A Bradshaw, 2014, Key role for nuclear energy in global biodiversity conservation, *Conservation Biology*, 29 (3), June: pp. 702-712, http://onlinelibrary.wiley.com/doi/10.1111/cobi.12433/full (accessed online Feb 2015)

condition for AIIB funding of such a project. Many nuclear plants engage in active environmental stewardship programmes which provide and protect habitats for local species.[18]

The impacts of nuclear plants on local aquatic environment are probably the most important environmental concern of routine operation. These are similar in nature to other thermal energy projects and relate primarily to cooling requirements. Aquatic impacts are local and largely determined by plant siting and therefore factored in to the EIA. They are also subject to ongoing regulatory monitoring and assessment.[19]

Nuclear plants help keep the air clean by preventing the emission of airborne pollution from fossil and biomass sources which can lead to adverse health effects. It has been calculated that nuclear energy has up to now averted 1.84 million premature air-pollution related deaths[20].

Nuclear facilities are generally resource efficient[21] and require little land[22]. This is a result of the extraordinary energy density of nuclear fuel: one uranium pellet the size of an adult's fingertip produces as much energy as one tonne of coal. In terms of operational characteristics, a nuclear power plant most resembles a coal power plant but with innately superior environmental performance.

In contrast with other forms of energy production (such as biomass and fossil fuel), the low level of material emissions from nuclear facilities do not contribute to pollution. The small volumes of hazardous and non-hazardous wastes produced from nuclear plants are all responsibly managed. The high-level radioactive wastes remain contained inside the fuel, rather than being released to the atmosphere or environment. Transport and disposition of this waste is thus a manageable logistical task. The volume of used fuel is such that it can be easily stored onsite at most nuclear plants, or in an intermediate storage facility. Civil nuclear wastes have been managed without a significant environmental release for over six decades.

Over the long-term there is international scientific consensus on deep geological disposal of high-level radioactive wastes and the global industry is committed to the setting up of such repositories. No other energy technology goes to anywhere near such lengths in dealing with its waste streams. Recycling of nuclear fuel can lead to even greater resource availability and much smaller volumes of long-lived radioactive waste.

Nuclear is one of a handful of low carbon energy options, all of which must be increased if climate change is to be contained. This is expanded upon in detail in Section 3 of this document.

Social standards

Nuclear power plants generally make a substantial contribution to local and regional economic development. Most nuclear operating costs are people costs. A nuclear plant will typically require 400-800 employees, most of whom will be well-paid and therefore able to create significant levels of induced local employment via their own spending and taxation. A range of local services and supplier companies will gain opportunities to develop further business. Local employment creation by nuclear plants is substantially higher than for competing technologies. In many countries, nuclear enjoys broad public support as part of the energy mix. It is of interest that those living in the vicinity of nuclear plants are more supportive than the population as a whole[23]. Apart from being more familiar with the risk, these neighbours also enjoy significant benefits from such a facility.

Regulatory processes in most countries provide significant opportunities for stakeholder engagement and influence over operations – arguably more than for other any other electricity generating technology. In addition, the public's sensitivity to nuclear issues means that facilities are typically subjected to a high-level of scrutiny by the media and environmental groups. It is certainly in a nuclear operator's best long-term interests to undertake

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[18] See for example, Eskom, The Koeberg Plant nature reserve http://www.eskom.co.za/Whatweredoing/ElectricityGeneration/KoebergNuclearPowerStation/Pages/Nature_Reserves.aspx

[19] For further information on water the water impacts of nuclear facilities please refer to IAEA, 2012, *Efficient Water Management in Water Cooled Reactors* http://www-pub.iaea.org/books/IAEABooks/8883/Efficient-Water-Management-in-Water-Cooled-Reactors

[20] PA Kharechi and J E Hansen, 2013, Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power, *Environmental Science & Technology*, 47 (9): pp. 4889-4895, doi:10.1021/es3051197 http://pubs.giss.nasa.gov/abs/kh05000e.html

[21] See http://www.scientificamerican.com/article/renewable-energys-hidden-costs/

[22] See note from Entergy http://www.entergy-arkansas.com/content/news/docs/AR_Nuclear_One_Land_Use.pdf

[23] See US Nuclear Energy Institute web resource on public opinion - http://www.nei.org/Knowledge-Center/Public-Opinion

ongoing and pro-active engagement. A ‘social licence’ is generally considered to be a condition of operation and the loss of public support has caused some nuclear power plants to curtail operations and even close prematurely.

Nuclear facilities are often relatively remote from large centres of population. Land acquisition is undertaken in compliance with national law, and restrictions on land use are kept to the minimum necessary for the safety and security of the plant and its neighbours.

Nuclear energy projects should therefore be classified as Category B under the AIIB framework: they have a limited number of potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the Project area; and can be successfully managed using good practice in an operational setting (Environmental and Social Framework, Requirements, p. 10).

2. Nuclear technology and sustainable development

The AIIB aims to spur the development of infrastructure and other productive sectors in Asia, including energy and power, transportation and telecommunications, rural infrastructure and agriculture development, water supply and sanitation, environmental protection, urban development and logistics. Through these investments in infrastructure the bank will foster sustainable development and promote interconnectivity and Asian economic integration (Articles of Agreement, Article 1 Purpose). The AIIB supports 'green economic growth' and promotes the conservation of energy, water and other resources; supports sustainable land use management; and encourages making best use of low-carbon technologies, renewable energy, cleaner production, sustainable transport systems and sustainable urban development (Environmental and Social Framework, Vision, p. 5).

The goal of the AIIB's proposed Energy Strategy is suggested to be energy sustainability: that is, to provide access to adequate and reliable supplies of environmentally and socially acceptable forms of energy at competitive prices without compromising the energy needs of future generations. It will contribute to the achievement of Sustainable Development Goal #7: access to affordable, reliable, sustainable and modern energy for all. The proposed exclusion of nuclear energy by the bank is therefore a missed opportunity, as it meets all these criteria and contributes significantly to energy sustainability.

Nuclear energy is competitive in Asia and especially when compared to other low-carbon options

Current nuclear plants produce low-cost power, with low and predictable operating and maintenance costs. While the capital costs of a large nuclear power plant are substantial, the operating costs are generally low and where the costs of financing are low, it is among the cheapest forms of electricity generation on a levelized cost basis[24]. Nuclear power plants are valuable long-lived assets, capable of being refurbished for a 60 to 80 year life. Costs of generation cover the whole lifecycle – from construction to decommissioning, and from mining to waste disposal.

[24] See IEA/NEA, 2015, *Projected Costs of Generating Electricity*, Paris: Organization for Economic Cooperation and Development: Tables 3.9 to 3.11: pp. 48-49.

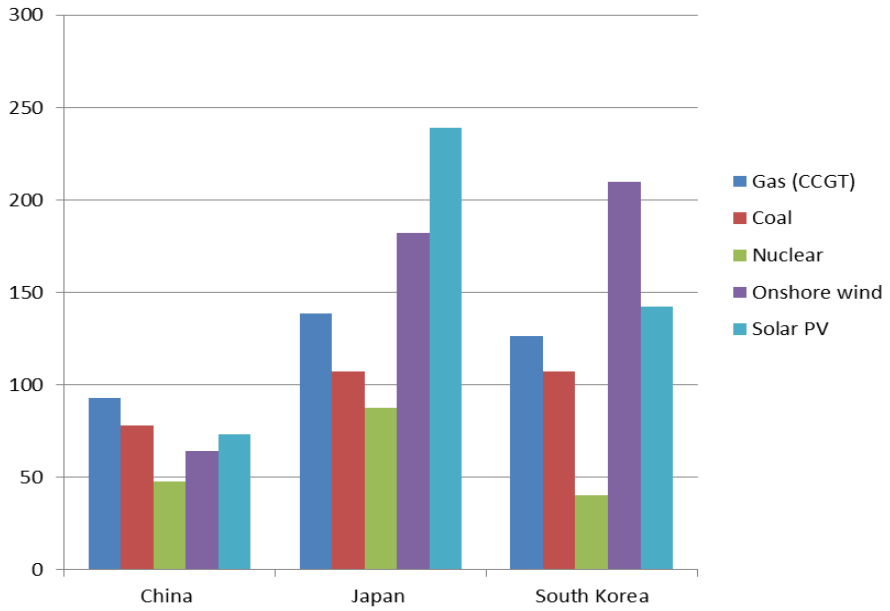

Figure 1: The Levelized Cost of Generating Electricity in Three Asian Countries[25] US$/MWh projected to 2020. Source: Projected Costs of Generating Electricity 2015 Edition, International Energy Agency and OECD Nuclear Energy Agency

Nuclear energy is particularly competitive with other generation technologies in Asia. Data provided by the International Energy Agency and OECD Nuclear Energy Agency[26] shows that the capital cost of nuclear is low in China, South Korea and Japan with the result that the levelized costs of generation are fully competitive in most cases. Moreover, there is a high level of confidence that these costs will remain stable over the life of the plant, given the low share of fuel costs in the total cost structure. The cost competitiveness of nuclear is further enhanced by the modest level of systems costs (adequacy, balancing and transmission and distribution costs) especially when compared with intermittent renewables, whose system costs inevitably increase as the penetration of these renewables increases[27]. The chart below shows estimates for these costs in South Korea assuming a 30% renewable share in generation. Where the Issue Note states that "Renewable Energy investments are essential to limit CO2 emissions", we would say that nuclear energy is similarly essential given the impossibility of completely de-carbonising the electricity supply system with solar, wind power and run-of-the-river hydro, or the as yet inchoate technology of carbon capture and storage, at a reasonable cost.

[25] ibid
[26] Projected Costs of Generating Electricity 2015 Edition, IEA & OECD-NEA.
[27] Nuclear Energy and Renewables, OECD-NEA, 2012

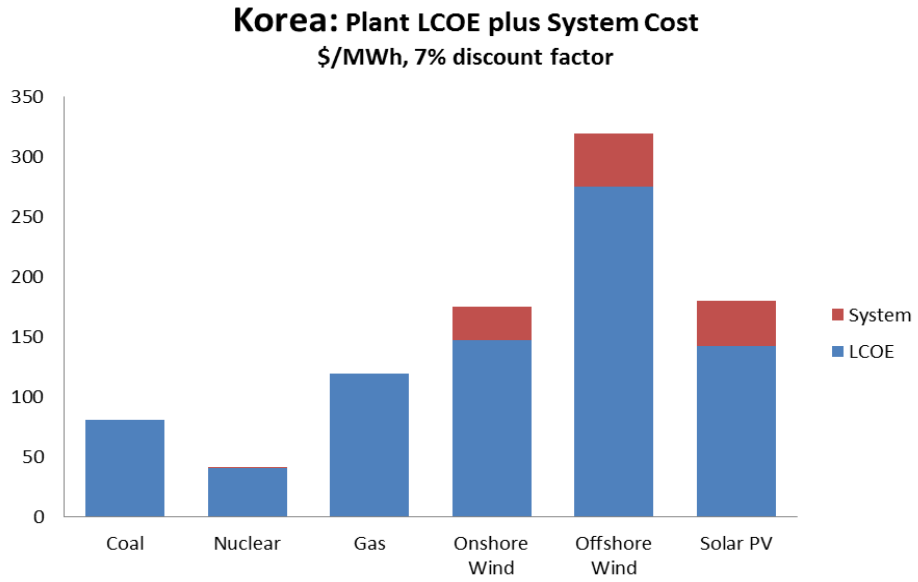

Figure 2: Source: Projected Costs of Generating Electricity 2015, Nuclear Energy and Renewables, OECD NEA 2012

Nuclear energy facilities are valuable long-term assets

Nuclear power plants are economic growth engines for the regions and countries in which they are constructed, injecting significant funds into local economies.[28] They provide opportunities for a large number of workers across a diverse range of fields.[29] The US Nuclear Energy Institute has quantified the nuclear economic contribution in a number of states. For example, in the state of Illinois the 11.4GW of nuclear capacity earned $8.9bn in 2013, of which $6bn accrued within the state. The 5900 jobs created are typically highly skilled and paid salaries twice the state average. Moreover, it was estimated that 21,700 jobs were created by suppliers to the plants as well as spending by employees. $1.4bn of taxes were paid.[30]

Nuclear energy boosts grid system stability and energy security

Nuclear energy is dispatchable and performs optimally at a steady output, but nuclear power plants can also load follow if required. Grid stability, and especially frequency response, is enhanced with a segment of dispatchable electricity that nuclear generation can provide and complements the variability of intermittent renewable energy sources. Nuclear power plants are generally highly reliable and capacity factors in excess of 80% are normal.

Nuclear energy as part of a diverse and balanced generating mix boosts security of supply. Nuclear fuel is a minor element in reactor operating costs and this contributes to long term energy price stability in an electricity generating system.

Using nuclear energy today does not significantly compromise the needs of future generations

The uranium-based fuel used by nuclear power plants is available commercially from a range of suppliers. Uranium is an abundant element and at current rates of extraction known recoverable resources will last for about 100 years. However over the years this number has grown as new deposits have been identified and

[28] For new build see http://www.thecmlink.com/wordpress/wp-content/uploads/2013/10/2012-June-Benifits-from-Infrastructure-Investment-A-Case-Study-in-Nuclear-Energy.pdf. For operating plants see http://www.nei.org/CorporateSite/media/filefolder/Policy/Papers/ExelonIllinoisEconomicBenefitsOctober2014.pdf?ext=.pdf

[29] During operation the number of full-time staff will be around about 500 for a typical reactor but many other contractors will be periodically required. For a list of nuclear careers see NEI website (accessed Feb 2015), *What are Employers Looking* For http://www.nei.org/Careers-Education/Careers-in-the-Nuclear-Industry/What-Are-Employers-Looking-For

[30] http://www.nei.org/Why-Nuclear-Energy/Economic-Growth-Job-Creation

extraction technology has improved[31]. With proven reprocessing technology and advanced generation reactors, stockpiles of depleted uranium and used nuclear fuel can be recycled and the energy potential from uranium resources is extended for centuries or even thousands of years more. As other technology improves we will be able to exploit seawater uranium resources and other unconventional supplies, extending the question of availability beyond meaningful analysis. Nor does nuclear energy damage the planet's atmosphere as is the case with combustible thermal technologies using fossil fuels.

Modern nuclear reactor designs are well suited to the needs of modern society

Nuclear energy is well suited to meeting the energy intensive needs of a modern industrial and urban society because reactors provide lots of reliable electricity at low production costs. A reliable electricity supply is an important requirement for modern industrial development, which to date has been the only sustainable route to social and economic development and poverty reduction. Many industrial processes need constant and stable power supplies and severe costs are caused by any disruption. The same is also true of many other users of electricity in business and infrastructure, and especially social services such as hospitals and public transport.

While currently available reactor offerings tend to be large, in the gigawatt range, a new generation of small modular reactors should be available within 10 years will be even more flexible in terms of siting, financing and their ability to nimbly load follow[32]. Nuclear energy is already well suited to integrating with decentralised and renewable forms of generation and will even more so in the future.

Nuclear technology and a strong nuclear sector helps society to advance

Nuclear technology does more than just provide energy. It also has a significant role to play in the achievement of many of the Sustainable Development Goals[33] and especially in the areas of medicine, agriculture and water management. It is only natural that countries in Asia will want to make greater use of these technologies as they seek to improve the quality of life of their citizens and surely they should be encouraged to develop the competencies and infrastructure to do so.

Establishing a nuclear sector in a country builds up skilled high-tech and long term jobs. It also requires a commitment to science, education and good governance practises which make it a key step in any country's development pathway.

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[31] For details consult the World Nuclear Association Fuel Market report http://www.world-nuclear.org/our-association/publications/publications-for-sale/nuclear-fuel-report.aspx

[32] See World Nuclear Association, Small Nuclear Power Reactors, http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/small-nuclear-power-reactors.aspx

[33] For a list of relevant technologies see https://www.iaea.org/newscenter/news/new-video-series-nuclear-science-for-sustainable-development

3. Nuclear energy's role in mitigating climate change

At least 80% of the world's electricity must be low-carbon by 2050 to keep the world within 2°C of warming, according to the IPCC[34]. This is a massive global challenge that requires the use of all available low-carbon energy technologies. Nuclear energy is recognized by the Intergovernmental Panel on Climate Change (IPCC) as "an effective greenhouse gas mitigation option" with life cycle emissions "comparable to most renewables"[35]. According to the International Energy Agency the use of nuclear energy needs to "more than double" by 2050 if the world is to stay within 2°C of warming[36]. Nuclear energy is essential if we are to improve energy access and successfully tackle climate change. It should be expected to play a greater role in developing countries and emerging economies.

The climate challenge is immense

By 2050, 80% of electricity will need to be low-carbon[37]. That is in stark contrast to today's global electricity portfolio, 70% of which is comprised of technology that burns fossil fuels. Electricity production is the primary source of CO_2 emissions. Today's low-carbon energy accounts for only 30% of the electricity mix – primarily from hydro (approximately one-half) and nuclear energy (approximately one-third).

To reduce the dominant use of fossil fuels, significant efforts will be needed, especially given that the use of fossil fuels for electricity production is not currently declining. Since 2010, the growth of coal was actually higher than that of all non-fossil energy sources combined.[38]

Since 1990 (the reference year for the Kyoto Protocol), CO_2 emissions, far from decreasing, have actually increased by 60%[39]. If the electricity mix continues to be dominated by fossil fuels, the average global rise in temperature could be 6°C[40], well beyond the objective of 2°C.

Global electricity demand should double to meet the basic needs of humanity in terms of population growth and development goals.

By 2050, the world's population will be around 9.6 billion[41]. Progress in the field of energy efficiency, no matter how significant, will not be sufficient to meet rising electricity demand (which is growing faster than energy demand). International Energy Agency (IEA) scenarios, although ambitious in terms of energy efficiency, predict between an 80 to 130% increase in electricity demand by 2050, mainly driven by emerging economies[42].

The fight against climate change should not jeopardize the development of countries

Today, approximately 1.2 billion people - the equivalent of the population of India or Africa - do not have access to electricity nor to the development benefits that it brings[43]. In addition, 1 billion more have access only to unreliable electricity networks. The IEA expect that even in 2030 some 334 million people in Asia will still lack access to electricity[44].

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[34] See IPCC Summary Report for Policymakers http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_SPMcorr2.pdf
[35] See IPCC working group III report on mitigation http://www.ipcc.ch/ipccreports/tar/wg3/index.php?idp=128
[36] See overview to the IEA's Nuclear Energy Technology Roadmap http://www.iea.org/publications/freepublications/publication/technology-roadmap-nuclear-energy-1.html
[37] Fifth Assessment Report, IPCC (2013-2015) http://ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_full.pdf
[38] Energy Technology Perspectives 2014, IEA http://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives_ES.pdf
[39] Global Carbon Project http://www.globalcarbonproject.org/carbonbudget/14/hl-compact.htm
[40] Energy Technology Perspectives 2014, IEA http://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives_ES.pdf
[41] United Nations (2015) http://esa.un.org/wpp/documentation/pdf/wpp2012_press_release.pdf
[42] Technology Roadmap 2014, IEA http://www.iea.org/publications/freepublications/publication/technology-roadmap-nuclear-energy-
[43] World Bank (2013) http://documents.banquemondiale.org/curated/fr/2013/01/17747859/global-tracking-framework-vol-1-3-resumegeneral
[44] IEA, 2012, World Energy Outlook, Paris: OECD/IEA: p. 535.

Low-carbon electricity is expected to play a major role in decarbonizing other sectors[45]

Electricity can replace fossil fuels in many sectors (e.g., domestic heating and transport), thereby reducing CO_2 emissions if it is low-carbon. For instance, in the transportation sector, deployment of rail transport and development of electric vehicles using low-carbon electricity significantly reduces the consumption of oil and coal[46].

The world must increase the use of all low-carbon energy sources, including nuclear energy, if it is to limit climate change while still meeting development goals

Currently, nuclear energy is the only available technology that can provide electricity that is both reliable and low-carbon at a reasonable cost in all situations. Recognizing this has led the global nuclear industry to set a vision of nuclear energy providing 25% of electricity by 2050 - this would (depending on electricity demand) require about 1000GWe of new nuclear plants to be constructed. Government, industry and the civil sector will need to work together in order to realize this goal.

To remove any doubt, nuclear is a low-carbon energy source. Throughout its life cycle (construction, operation, decommissioning) its emissions are comparable to those of renewable energy sources. Nuclear energy emits an average of 15g CO_2/kWh. This is 30 times less than gas (491g/kWh), 65 times less than coal (1024g/kWh), three times less than photovoltaic (45g/kWh) and about the same level as wind power[47].

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[45] Energy Technology Perspectives 2014, IEA
http://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives_ES.pdf

[46] 2DS Scenario of the IEA

47 Climate Change and Nuclear Power Report – AIEA (2014) Median value https://www.iaea.org/newscenter/news/iaea-issues-2014-editionclimate-change-and-nuclear-power

4. The nuclear opportunity facing the AIIB

The AIIB has an excellent opportunity to revive the financing of an essential zero-carbon generating technology by development banks. Other development banks have chosen not to support nuclear and to focus their financing of generating capacity on renewables, despite the fact that nuclear generated a third of all zero-carbon electricity in 2013. As currently conceived in the Issue Note, the AIIB could find itself largely duplicating the efforts of other development banks in their financing of wind and solar capacity rather than complementing these efforts as stated as an objective on page one. Meanwhile, because of the high upfront financial requirement for a nuclear power plant, there is often a paucity of financing options for nuclear energy in developing countries, which are often budget-constrained. The bank could play a useful role in enabling more diversified sources of funds for nuclear energy and help support a more diversified low-carbon sector while, at the same time, ensuring that nuclear projects complied with the highest social and environmental standards.

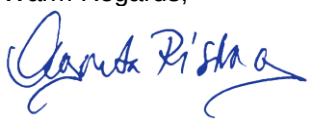
The bank could be well placed to make a significant contribution to the development of nuclear in Asia, given that the Asian region is particularly suitable for nuclear energy, featuring:

- numerous governments that are interested in or actively supportive of nuclear energy,
- large population centres requiring sizable and concentrated sources of power,
- regulated electricity markets, which allow investment in a portfolio of generating technologies and aim for lowest long term costs,
- rapidly industrializing economies requiring reliable and secure sources of electricity,
- very often a relative paucity of fossil fuel opportunities,
- a ready supply of high-educated and qualified people to work in the nuclear sector,
- several experienced nuclear companies able to deploy proven technology and
- large numbers of companies with the potential to contribute to the nuclear supply chain.

In view of the close match between the characteristics of nuclear energy and the objectives of the bank in the energy sector, the World Nuclear Association would like to engage more closely with the AIIB to understand the specific objections that underlie the decision in the Issue Note not to consider currently the financing of nuclear as part of its portfolio. We agree that nuclear competence would need to be accumulated in the bank's project assessment team although, as stated in the Issue Note, this is true for all areas of expected lending activity and, in the case of nuclear technical skills, are readily available. The World Nuclear Association is ready to assist the AIIB and its clients in developing the capacity to ensure that nuclear power plant projects meet the required environmental and social standards.

We believe that through dialogue the AIIB might be better able to appreciate the role nuclear energy and technology could play in meeting the bank's objectives.

Warm Regards,



Agneta Rising
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