IS SOUTHEAST ASIA READY FOR NUCLEAR POWER?

AN RSIS ROUNDTABLE AT THE SINGAPORE INTERNATIONAL ENERGY WEEK 2015

Event Report

29 October 2015

RSiS
Nanyang Technological University
S. RAJARATNAM SCHOOL OF INTERNATIONAL STUDIES

Event Report

IS SOUTHEAST ASIA READY FOR NUCLEAR POWER?

AN RSIS ROUNDTABLE AT THE SINGAPORE INTERNATIONAL ENERGY WEEK 2015

Organised by
The RSIS Centre for Non-Traditional Security Studies (NTS Centre)
S. Rajaratnam School of International Studies (RSIS)
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EXECUTIVE SUMMARY

The S Rajaratnam School of International Studies, in collaboration with the Energy Market Authority of Singapore, organised a roundtable panel discussion at the 2015 Singapore International Energy Week (SIEW) with the theme "Is Southeast Asia Ready for Nuclear Power?"

(From left) Ambassador Ong Keng Yong, Dr Tran Chi Thanh, Assoc Prof Mely Anthony, Mr Egor Simonov, Dr Taswanda Taryo, Dr Ronald McCoy, Dr Andrew Wee Thye Shen, Mr Kwa Chong Guan, and Dr Olli Heinonen. Source: www.siew.sg/newsroom/media-gallery/photos/siew-2015-day-4

The two-panel roundtable featured diverse perspectives on whether Southeast Asia should or should not pursue nuclear power and facilitated constructive debate among experts on this issue. Roundtable panelists included Dr Olli Heinonen, Senior Fellow at Belfer Centre for Science and International Affairs, Harvard University and former Deputy Director-General of the International Atomic Energy Agency (IAEA); Dr Taswanda Taryo, Deputy Chairman of National Nuclear Energy Agency (BATAN) of Indonesia; Dr Tran Chi Thanh, President of Vietnam Atomic Energy Institute (VINATOM); Mr Egor Simonov, Director of ROSATOM Asia; Dr Ronald McCoy, Founding President of the Malaysian Physicians for Social Responsibility; and Dr Andrew Wee Thye Shen, President of Singapore National Academy of Science and Provost's Chair Professor of Physics, National University of Singapore.

Panelists discussed the current status of nuclear energy programmes in Southeast Asia, particularly in Vietnam and Indonesia. Vietnam is set to commission its first nuclear power plant (NPP) by 2025 while Indonesia has long been preparing for nuclear power. However, there are still significant regional concerns over nuclear safety and security in Southeast Asia. The lack of nuclear engineers and shortcomings in their safety regulatory bodies pose serious challenges to safe nuclear power development in both countries. There is still a tremendous need to educate young people and enhance the skills of older professionals in the nuclear field, particularly in nuclear safety and security.

Given the growing need to further enhance Indonesia's human resource development programme and expertise in operating a nuclear reactor, BATAN plans to construct the Indonesia Experimental Power Reactor (I-EPR) to prepare

for the possible future utilisation of nuclear power. BATAN also regularly cooperates with the local regulatory body BAPETEN and with the IAEA to boost nuclear safety measures in the country's research reactors. In Vietnam, various programmes have been adopted to address the lack of nuclear professionals in the country. The Nuclear Energy Specialist Training (NEST) programme was introduced in 2014 to train young leaders for Vietnam's nuclear power programme. In view of the challenges to nuclear power development plans, ASEAN states interested in using nuclear energy should assure their neighbours that they can safely operate their NPPs in the future.

To nuclear energy companies and vendors, Southeast Asia is ready to pursue nuclear energy and should do so. Nuclear energy can help Southeast Asian nations achieve the twin goals of strengthening energy security and reducing greenhouse gas emissions. The nuclear industry is confident and optimistic that countries in the region can safely use nuclear power given the significant improvements made in nuclear safety since the Fukushima accident. The lessons learned from the accident have helped nuclear companies intensify the safety and security features of nuclear reactors. To develop a permanent solution to the problem of accumulating high-level radioactive waste, a deep geological nuclear waste disposal facility is currently being developed in Finland and France.

On the other hand, to anti-nuclear NGOs, Southeast Asia needs to be ready for a nuclear catastrophe if countries in the region build NPPs. Contrary to the claims by nuclear companies, anti-nuclear NGOs deem nuclear power an unclean source of energy as it generates radioactive waste. It is also extremely dangerous as a single accident in one NPP can affect the wider region. They also cite interminable radioactive nuclear waste as the primary reason why ASEAN states should reject nuclear power. Nuclear waste remains radioactive for thousands of years, making nuclear power inherently and irredeemably hazardous.

In the ongoing debate on whether Southeast Asia should or should not use nuclear power, the academic and scientific communities should be able to contribute to public discussion and help governments make informed decisions. There are large sections of the public with no firm views for or against nuclear energy; the attitudes of this middle ground will be critical. The scientific community can help the public and governments understand the latest developments on nuclear power and its implications for the region. With the ground shifting towards nuclear energy playing a role in Southeast Asia's energy mix, it is important for both academic and scientific communities to contribute to the public debate and raise awareness of recent developments in nuclear energy that will affect policy choices in the region.

SESSION 1
NUCLEAR POWER DEVELOPMENT PLANS IN SOUTHEAST ASIA

This session explored government initiatives to uphold nuclear safety, security and safeguards in Southeast Asia. Panelists discussed the major challenges that relevant states in the region face as they prepare for the possible use of nuclear power and the policy responses that they need to adopt.

(From left) Dr Olli Heninonen, Dr Taswanda Taryo, Dr Tran Chi Thanh and Assoc Prof Mely Anthony. Source: www.siew.sg/newsroom/media-gallery/photos/siew-2015-day-4

Asia going nuclear

There is now a significant shift from Europe to Asia in nuclear power production. While the Fukushima accident in 2011 tempered what could have been an unprecedented nuclear energy growth in the region, the global nuclear industry is now pinning its hopes on Asian economies. Currently, the United States is still considered the biggest nuclear operating country with 95 nuclear reactors but no new reactors are being constructed. In Europe, there have been no new nuclear power projects except a few in the United Kingdom and in eastern Europe such as Romania, Bulgaria and Slovakia. In western Europe, countries such as France, Belgium, and Spain have decided to reduce their reliance on nuclear power. Even Germany, for instance, has already adopted a nuclear phase-out policy.

In contrast, Asia is now the main region in the world where electricity generating capacity and specifically nuclear power is growing significantly. One major reason for the pursuit of nuclear power by several Asian states is to diversify energy sources in order to reduce overreliance on carbon-intensive fossil fuels such as oil, gas, and coal. Nuclear and renewable energy may serve as clean alternative sources. However, nuclear experts claim that power supply from renewables remain intermittent while nuclear energy is a reliable energy source, providing on-demand base-load electricity.

China plans to increase the proportion of nuclear power within its national energy mix and intends to build 133 new nuclear reactors by 2030. It is projected to overtake the United States in terms of the number of nuclear reactors in operation. There are also several nuclear newcomers in Asia. Bangladesh is scheduled to complete the first of two Russian-backed, 1,000-megawatt reactors by June

2017. Russia's state nuclear energy firm ROSATOM will build, operate and provide fuel for the plant and process its spent fuel in Russia. In Southeast Asia, ROSATOM will also be building Vietnam's first nuclear power reactor which is scheduled to be completed by 2025. Meanwhile, Indonesia has long been preparing for nuclear energy although no political decision has been made yet on the launch of a nuclear power plant.

Nuclear energy plans in ASEAN

Vietnam currently has the most advanced nuclear power development programme in Southeast Asia. Using nuclear power has been part of the country's long-term development plans since 1976. The country's nuclear experts have studied how nuclear energy can be used in various fields, particularly in electricity generation. In tapping nuclear energy, Vietnam aims to diversify its energy sources as its hydropower potential has already been exhausted and it does not consider renewable energy as a stable source of power. Vietnam also wants to reduce its dependence on coal-based power plants to address environmental concerns over burning carbon-intensive fossil fuels. Vietnam sees nuclear power as a clean source of energy that can galvanise its growing economy.

Russia's ROSATOM is tentatively set to start constructing Vietnam's first nuclear reactor, the 1200-megawatt Ninh Thuan 1, by 2019 in southern Vietnam, 300 kilometres from Ho Chi Minh City. Ninh Thuan 1 will use Russian nuclear technology and may be commissioned by 2026. State utility Electricity of Vietnam (EVN) will be the operator of Vietnam's NPPs. Vietnam also plans to build a second nuclear reactor, Ninh Thuan 2, but technology selection is still under consideration. Vietnam has yet to decide whether to tap Japanese or American nuclear technology for its second reactor.

In preparation for the operation of its first reactor, the Vietnamese government has identified key relevant tasks that it needs to accomplish in the next five to ten years. These tasks include the selection of nuclear design for Ninh Thuan 2; enhancement of the current safety regulatory framework; improvement of research and development infrastructure and capability; examination and review of basic designs of selected technologies such as pressurized water reactor (PWR), boiling water reactor (BWR) and water-water energetic reactor (VVER); providing necessary support to NPP construction; and introduction of the needed education and training programmes.

Like Vietnam, Indonesia has long been preparing for the possible utilisation of nuclear energy with the establishment of three nuclear research reactors: Reactor Triga 2000 in Bandung, established in 1965; Reactor Kartini 250 Kilowatt in Yogyakarta (1979) and RSG-GAS 30 Megawatt in Serpong, established (1987). In 2006, the IAEA declared that Indonesia was ready to make knowledgeable commitment to nuclear power program, although no government decision has yet been made as to whether Indonesia will proceed to build the NPPs.

The Ministry of Energy and Mineral Resources issued "The White Paper of Indonesia NPPs 5000 MWe in Bangka Belitung 2014-2024" which calls for the introduction of nuclear power in order to address Indonesia's rapidly growing energy consumption. Indonesia's electricity demand is projected to increase to 150 GW by 2025. The contribution of this new energy source is seen as a major energy alternative that can boost the country's power supply. The National Nuclear Energy Agency of Indonesia (BATAN) has recommended that a nuclear power plant be established by 2027. BATAN conducted feasibility studies for possible NPP sites in Bangka-Belitung Island; West Kalimantan; Muria in Java; and Banten, also located in Java. Bangka-Belitung Island, near Sumatra, has been identified as the site of the country's first NPP since the island is not within the country's earthquake and volcanic zones. While no official decision has been made on the use of nuclear power, a nationwide public survey commissioned by BATAN in 2014 reported that 72 per cent of Indonesians agree that NPPs should be setup in the country.

Challenges to nuclear power development

Southeast Asia has significant regional concerns over nuclear safety and security, There is still a tremendous need to educate young people and enhance the skills of older professionals in the nuclear field, particularly in nuclear safety and security. It was emphasised that as some ASEAN countries plan to pursue nuclear power, they need to create and maintain a pool of local nuclear professionals with actual relevant experience in the nuclear industry. Furthermore, well-trained and experienced nuclear professionals are also crucial in institutionalising competent and independent regulatory bodies. The region currently does not have enough human resources that can safely operate its future NPPs.

In Vietnam, the largest challenge for now is human resource development particularly in terms of specialists and experts in nuclear engineering. The Electricity of Vietnam, which is tasked to operate the country's future NPPs, does not have sufficient experience in operating a nuclear power station. Vietnam's education system is not yet fully ready to produce young nuclear professionals. Nuclear engineering is just a new course in selected Vietnamese universities; Vietnam National University (VNU Hanoi), Polytechnic University (Hanoi), University of Science –VNU (Ho Chi Minh City), Dalat University, and Electric Power University, Hanoi. However these universities do not have experienced professors in the field of nuclear engineering. The education system has focused mainly on nuclear physics, nuclear technique and radiation technology rather than the much needed nuclear engineering. The Vietnamese government has sent 315 students overseas to pursue nuclear training and education but the results have so far been very limited. Overseas training programmes on nuclear power are mainly short courses being offered by IAEA, Japan, Russia, South Korea, and other nuclear-powered countries.

Vietnam's research and development is not yet fully developed. Although Vietnam has had many years of nuclear research, it has not been properly focused or organised. There are no local leaders in nuclear research and application as Vietnam lacks leading nuclear scientists and engineers. R&D infrastructure is also insufficient to facilitate nuclear energy research.

Vietnam's regulatory body, the Vietnam Agency for Radiation and Nuclear Safety (VARANS), is not fully independent from the Ministry of Science and Technology which promotes nuclear power. The Vietnamese government is not keen to make VARANS a fully independent regulatory body as it believes that inter-agency cooperation is far more important at this stage to make the first NPP project successful.

Meanwhile, although the Indonesian government has not yet decided whether it is going through with plans to build an NPP, it has to address important issues concerning its nuclear power development programme. Like Vietnam, Indonesia too needs to deal with human resource development issues. The country does not have enough young graduates in the field of nuclear engineering. The HR development programme of the National Nuclear Regulatory Agency (BAPETEN) still needs to be improved in order to have competent nuclear regulators and be able to religiously fulfill their mandate.

Nuclear power development strategies

Several initiatives have been implemented by the Indonesian government in order to strengthen Indonesia's nuclear power development programme. In the early 2000s, the National Agency for Education and Training of the Ministry of Energy and Mineral Resources and other related Ministries and Agencies already identified the country's need for nuclear engineers as well as technicians to operate the country's future NPPs.

Due to the growing need to further enhance the country's HR development programme and expertise in operating a nuclear reactor, BATAN plans to construct the Indonesia Experimental Power Reactor (I-EPR), which is scheduled to be operational by 2021/2022. The primary objectives of this project are to demonstrate the safe operation of small-scale NPP; to improve the ability of Indonesia's nuclear professionals to master the nuclear power application and technology in preparation for the commissioning of NPPs in the future; to develop R&D for the future NPP and its supporting facilities as well as for human resources development; and to enhance public acceptance of NPP operation. BATAN also organises site visits to experimental reactors for community leaders as well as public discussions with communities to reassure them that NPPs are safe.

BATAN also regularly cooperates with the local regulatory body BAPETEN and with the IAEA to enhance nuclear safety measures in the country's research reactors. It coordinates with the army and police to conduct nuclear security exercises in the research reactor so as to strengthen the security of nuclear facilities from internal and external threats. They also conduct scenario-based exercises to test out the country's nuclear emergency preparedness and response measures. BATAN has also done joint seismic studies with Indonesian scientists to determine potential sites for NPPs that are not prone to earthquakes and volcanic eruptions.

In Vietnam, various programmes have been adopted in order to address the lack of nuclear professionals in the country. The Vietnamese government views human resource development (HRD) as key to the success of its nuclear power programme. International cooperation will play an essential role in HRD until Vietnam fully develops its local nuclear expertise. Russia assisted Vietnam in establishing the Centre for Nuclear Energy Science and Technology in 2011. The Nuclear

Energy Specialist Training (NEST) programme has been recently introduced to train young leaders for Vietnam's nuclear power program. It aims to train 40 top specialists/experts. Strategic areas for training include NPP design and construction; NPP operation and finance; reactor safety; nuclear economics; and nuclear fuel cycles, among others. Trainees will undergo nine months of training in Vietnam by taking up nuclear-related courses. They will then receive rigorous training overseas, particularly in the US, European countries, Japan and South Korea. After their overseas training, they will be back to Vietnam to work at nuclear-related agencies such as the Vietnam Institute for Atomic Energy (VINATOM), Centre for Nuclear Energy Science and Technology, Electricity of Vietnam, and VARANS. In preparation for the commissioning of the first NPP, 300 students are currently being trained in Russia while 15 are studying in Japan, all of whom are expected to work at the Electricity of Vietnam which is tasked to operate the country's NPPs.

Discussion

Both Indonesia and Vietnam face a problem of attracting students to pursue nuclear-related courses particularly nuclear engineering. The two countries need to produce nuclear professionals that have actual first-hand experience in the nuclear industry and are not just university-trained. Both the Vietnamese and Indonesian governments have introduced scholarship and fellowship programmes to entice the youth to study nuclear engineering. Through the introduction of competitive salary packages, both governments are also determined to create a good working environment at home for young nuclear professionals currently studying overseas.

It was also highlighted that there are still challenges in the project management of the nuclear power programmes in Indonesian and Vietnam. In Indonesia, inter-agency cooperation to further advance the NPP programme remains weak. While it would be highly recommended to ensure that the regulatory body is completely independent from any agency promoting nuclear power, BAPETEN still needs to have robust cooperation with BATAN to fully develop its regulatory capability.

In the case of Vietnam, a national steering committee was set up by the government to oversee the project management of its NPP programme. The committee comprises the Ministry of Trade and Industry with Electricity of Vietnam as the attached agency; the Ministry of Science and Technology with VARANS, VINATOM and Vietnam Atomic Energy Agency as attached agencies; and the Ministry of Education and Training. The management of the committee itself is not efficient and members do not meet regularly as the Deputy Prime Minister, who is assigned to chair it, has been extremely busy with other tasks. Nonetheless, VINATOM maintains that Vietnam is deeply committed to nuclear safety and continues to upgrade its capability to operate NPPs prior to the commissioning of the Ninh Thuan 1 NPP. It was emphasised that ASEAN states interested in using nuclear energy should assure their neighbours that they can safely operate their NPPs in the foreseeable future.

SESSION 2
SHOULD SOUTHEAST ASIA USE NUCLEAR POWER?

This session tackled multi-stakeholder perspectives on the readiness of Southeast Asia to pursue nuclear power. The Session featured alternative voices from the private sector, civil society and academe and facilitated constructive debate among experts. They shared their insights on why Southeast Asia should or should not use nuclear power.

(From left) Mr Egor Simonov, Dr Ronald McCoy, Dr Andrew Wee Thye Shen, and Mr Kwa Chong Guan. Source: www.siew.sg/newsroom/media-gallery/photos/siew-2015-day-4

Why Southeast Asia should use nuclear energy

To nuclear energy companies and vendors, Southeast Asia should and is ready to pursue nuclear energy. A number of reasons were cited by the nuclear industry as to why nuclear energy can be tapped as a reliable source of electricity. Nuclear can generate affordable baseload electricity, strengthening a country's energy security. Nuclear energy is also advertised as clean energy since it does not emit carbon dioxide, helping to significantly reduce greenhouse gas emissions. It can help a country reach a new level of socio-economic development as it is expected to lead industrial development and immediately generate 60,000 jobs. With much technological advancements since the Fukushima accident in 2011, Southeast Asia's nuclear newcomer countries can benefit from nuclear energy technology much more than the old nuclear users in Europe. Newcomer countries are expected to stand to benefit from technological, scientific and educational progress brought about by associated national nuclear research and training programmes.

However, there are five key challenges newcomer Southeast Asian countries may face when developing national nuclear energy programs: (1) safety concerns; (2) financing of NPP construction project; (3) electricity cost; (4) nuclear infrastructure; and (5) public acceptance. From the perspective of nuclear vendors, governments should still play the key role in developing the nuclear power programme, educating the public, and promoting the commercial attractiveness of NPP projects. Nonetheless, the role of a responsible vendor today is to take on these challenges together with a client country.

To address nuclear safety concerns, vendors have introduced time-tested NPP designs that can meet

modern post-Fukushima standards. Most new nuclear power plants of Generation 3+ already have design features that fully take into account the main lessons learned from the Fukushima disaster. For instance, ROSATOM has offered its VVER-1200 safety systems to selected Southeast Asian states, particularly Vietnam. These are designed to have the capability of stable operations under adverse conditions such as earthquakes, floods, storm winds, hurricanes, snowfalls, tornadoes, fire, low and high extremes of temperature, and even aircraft crash.

On the issue of high capital expenditure for NPP construction, vendors usually offer flexible financing options to governments such as state loans, increased debt financing, and public-private partnership through build-own-operate and build-own-operate-transfer schemes. For instance, since ROSATOM will be constructing Vietnam's first NPP, Russia will provide loans to Vietnam to finance the project.

It is also a misconception that nuclear energy heightens the cost of electricity. According to nuclear vendors, the cost of electricity per kilowatt hour (KWh) generated from NPPs is the lowest compared to other sources of electricity such as oil, gas, coal and renewables.

Another challenge is nuclear infrastructure issues that need to be addressed by any state interested in tapping nuclear power.[1] Nuclear infrastructure is a key condition to a sustainable national nuclear energy program. In this regard, the role of the vendor is to support newcomer countries in the development of nuclear infrastructure. For instance, ROSATOM cooperates with Vietnam in nuclear infrastructure development to provide training, consultancy and other related services.

To nuclear vendors, public acceptance remains an important factor affecting the development of the nuclear industry around the world. Negative public perception is based mainly on the lack of knowledge and myths;[2] nuclear weapons testing; severe accidents at Three-Mile Island NPP (1979), Chernobyl NPP (1986), and Fukushima NPP (2011); and activities of various anti-nuclear movements. Vendors assist concerned governments in educating the public regarding the safe and peaceful use of civilian nuclear energy. For instance, ROSATOM built the Information Centre of Nuclear Energy in Hanoi which is a multi-functional communication facility set up by ROSATOM to educate the public about the use of nuclear energy. ROSATOM's nuclear industry information centers are also located in 17 cities in Russia, Minsk (Belarus), Istanbul and Mersin (Turkey), and Dakka (Bangladesh). According to surveys conducted by ROSATOM, more than 81 per cent of visitors changed their attitude to nuclear energy after visiting the information centres.

The nuclear industry is confident and optimistic that the region can safely use nuclear power given the significant improvements that have been made in nuclear safety since the Fukushima accident. The lessons learned from the accident helped nuclear companies to enhance safety and security features of nuclear reactors. Nuclear companies believe that through public education and information campaigns to debunk myths about nuclear energy, public acceptance will significantly improve.

Why the region should reject nuclear energy

On the contrary, to anti-nuclear NGOs, Southeast Asia should be ready for a nuclear catastrophe if countries in the region build NPPs. According to anti-

1 The 19 nuclear infrastructure are: National position; Nuclear safety management; Funding and financing; Legislative framework; Safeguards; Regulatory framework; Radiation protection; Electrical grid; Human resources development; Stakeholder involvement; Site and supporting facilities; Environmental protection; Emergency planning; Security and physical protection; Nuclear fuel cycle; Radioactive waste; Industrial involvement; and Procurement.

2 Some of the major myths, according to the nuclear industry, include the following: Nuclear energy leads to the proliferation of nuclear weapons; Nuclear power is not safe (nuclear physicists emphasise that nuclear is currently being safely used in many non-power applications such as in medicine, agriculture, educational research, and industry etc.); the nuclear industry still has no solution to the 'waste problem'; and there is a potential terrorist threat to the large volumes of radioactive wastes currently being stored and the risk that this waste could leak or be dispersed as a result of terrorist action. World Nuclear Association. 2012. Radioactive Waste Myths and Realities. http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Nuclear-Wastes/Radioactive-Wastes---Myths-and-Realities/ (Accessed 28 January 2016).

nuclear NGOs, the global nuclear industry wrongly cites the need to mitigate climate change to justify the construction of more NPPs, which is part of a wider misinformation campaign by the nuclear industry. Anti-nuclear NGOs counter the claims of the nuclear companies, arguing that nuclear power is 'dirty' energy, extremely dangerous, and will not help countries reduce their greenhouse gas emissions. Moreover, any single accident in one NPP can cause a nuclear catastrophe in the region and even beyond.

Anti-nuclear energy NGOs further counter the nuclear industry by highlighting the inherent health, security and environmental risks of nuclear energy. The anti-nuclear NGOs argue that nuclear energy is not reliable, affordable, viable, socially acceptable or environmentally sound. The global consensus is that nuclear energy has failed the 'market test' and that accidents are inevitable in nuclear power plants. There were 99 minor nuclear accidents worldwide between 1952 and 2009, each with the potential to develop into a major disaster. Major nuclear reactor accidents are not common, but when they do occur they can be catastrophic, as in Chernobyl and Fukushima. The meltdown of three nuclear reactors in Fukushima in March 2011 brought Japan to its knees, reinforced worldwide fears of nuclear accidents, and highlighted the nuclear industry's failure to prevent accidents and 'near misses'.

Since the Fukushima disaster, radiation readings inside buildings continue to make direct human intervention almost impossible. Massive amounts of water, about 360 tons per day, are still being pumped into the destroyed reactors to cool fuel rods. This constantly increasing volume of contaminated radioactive water is stored in tanks which have started to leak. Experts argue that the Japanese government will soon be left with no choice but to release the radioactive water into the ocean. More than 130,000 people in Fukushima have been evacuated and another 137,000 people have been living in temporary housing. The number of deaths attributed to stress, fatigue and the hardship of living as evacuees is estimated to be around 1,700 so far as of March 2015.

To the anti-nuclear NGOs, this is a wake-up call for all thirty countries operating nuclear power plants and for governments still planning to build nuclear reactors, including some countries in the ASEAN region.

These anti-nuclear NGOs also cite interminable radioactive nuclear waste as the primary reason why ASEAN states should reject nuclear power. Nuclear waste remains radioactive for thousands of years, making nuclear power inherently and irredeemably hazardous. They believe that there is still absolutely no way to safely and permanently dispose of the waste. The nuclear industry's so-called solutions to radioactive waste include the theoretical Generation IV Integral Fast Reactor for reprocessing spent nuclear fuel or alternatively the burying of nuclear waste in deep geological repositories. None of these so-called 'solutions' can be considered safe and permanent. Nuclear power plants continue to temporarily store their radioactive waste under water in pools located alongside reactors posing serious public health risks to communities.

Instead of relying on nuclear power to reduce carbon emissions and strengthen energy security, many NGOs strongly encourage countries to invest in the development of renewable energy. Renewable energy has emerged as a safe, flexible, and easily deployed energy source, with a lower carbon footprint than nuclear power. Many governments have recognised this and have started to develop and rely on renewable energy, citing several European countries which have produced more electricity from renewables than from nuclear power. NGOs assert that most governments in the world are phasing out nuclear energy and investing in renewable energy, energy efficiency technologies and energy conservation and argue that Southeast Asia should therefore follow this trend and reject nuclear energy.

Discussion

Nuclear vendor representatives insisted that there is a need for massive public education to debunk the nuclear energy myths being propagated by anti-nuclear NGOs. Pro-nuclear panelists emphasised that there have been no recorded harmful health effects on residents living in the vicinity of the crippled Fukushima plant.

The nuclear industry claims that safety and security features of nuclear reactors as well as emergency protocols in NPPs have already been strengthened since the Fukushima nuclear disaster. Pro-nuclear voices contend that the issue of nuclear waste should no longer be used in anti-nuclear campaigns as there is now a permanent disposal technology that has been developed in Finland and France. The deep geological disposal sites being constructed will be able to demonstrate that high-level radioactive waste can be safely and permanently buried and will not pose an environmental contamination and public

health risk. The fact that a solution has already been found has to be included in any public education campaign on nuclear energy. ROSATOM, for instance, has been conducting public consultations involving mostly anti-nuclear journalists.

The representatives of anti-nuclear NGOs insisted that nuclear energy should be completely phased out and that nuclear waste buried in the deep geological sites would remain radioactive and dangerous for thousands of years. Anti-nuclear groups urged nations to instead invest in sustainable living, including the massive utilization of renewables to mitigate global climate change. If people adopted sustainable lifestyles and energy efficiency measures, this would meet 20 per cent of global energy demand, making nuclear energy irrelevant.

However, phasing out nuclear power has proven to be too expensive. For instance, Germany's plan to transform its energy system to one reliant on renewable power as it phases out nuclear energy could cost up to €1 trillion. Renewables and nuclear energy should not be viewed as competing energy sources. They can co-exist and complement national energy mixes. For industry players, nuclear energy allows nations to buy time while waiting for renewable technologies to be fully developed.

In the ongoing debate on whether Southeast Asia should or should not use nuclear power, academic and scientific communities should also be able to contribute to public discussion and help governments make informed decisions. The public gains most of its information on nuclear energy from the media, and scientists are the most trusted group while national governments in general are less trusted.

There are large sections of the public with no firm views for or against nuclear energy; the attitudes of this middle ground will be critical. The scientific community can help the public and even governments understand the latest developments on nuclear power. When the climate change benefits of nuclear energy are explained, the support for nuclear energy may increase significantly and if the radioactive waste disposal issue is satisfactorily resolved, public support could again significantly increase.

The scientific community has an important role in shaping nuclear energy policies in Southeast Asia. Scientists need to engage in active research in nuclear energy policy in order to gather solid evidence that will form part of government decisions. They have to publish policy papers, briefs, statements; be involved in public education and discourse; and build trust with governments. They also have to engage local and international nuclear experts to study nuclear energy issues in their own national context. Finally, they should organize regular dialogues with other national academies in the region to develop a collective voice to their respective governments and ASEAN.

ABOUT THE SPEAKERS

Dr Olli Heinonen is a Senior Fellow at the Harvard Kennedy School of Government's Belfer Center for Science and International Affairs. His research and teachings include: nuclear non-proliferation and disarmament, verification of treaty compliance, enhancement of the verification work of international organizations, and transfer and control of peaceful uses of nuclear energy.

Before joining the Belfer Center in September 2010, Olli Heinonen served for 27 years at the International Atomic Energy Agency in Vienna. Heinonen was the Deputy Director General of the IAEA, and head of its Department of Safeguards. Prior to that, he was Director at the Agency's various Operational Divisions, and as inspector including at the IAEA's overseas office in Tokyo, Japan.

Olli Heinonen studied radiochemistry and completed his PhD dissertation in nuclear material analysis at the University of Helsinki.

Dr Ronald McCoy is a past president of the Malaysian Medical Association, Malaysian Physicians for Social Responsibility and International Physicians for the Prevention of Nuclear War, which received the Nobel Peace Prize in 1985.

In 1995, he was a member of the Malaysian government's delegation to the International Court of Justice on the legal status of nuclear weapons, as well as a member of the Canberra Commission on the Elimination of Nuclear Weapons, appointed by the Australian government.

Dr McCoy is a retired obstetrician and gynaecologist who believes that all the babies he has delivered over forty years of practice deserve to live in a peaceful world, free of nuclear weapons and nuclear power plants.

Mr Egor Simonov graduated with honours from the National Research Nuclear University (Moscow Engineering Physics Institute). He also holds diplomas from the World Nuclear University (World Nuclear Association) and the NAC International (Nuclear Fuel Cycle Management).

He worked as the Project Manager at the ROSATOM Center for Environmental Safety, a Market Analyst for nuclear fuel cycle products and services at TENEX (ROSATOM), as well as the Marketing and Sales Manager at TENEX-Korea based in Seoul.

Dr Taswanda Taryo is currently the Deputy Chairman for Nuclear Energy Technology, of Indonesia's National Nuclear Energy Agency (BATAN). Prior to his current post, Dr Taryo was the Secretary –General of BATAN from 2011 to 2014 and Deputy Chairman for the promotion of Nuclear Science and Technology (NST) from 2008 to 2011. He has been working at BATAN since 1982. Dr Taryo obtained his Doctoral degree in Nuclear Engineering from the University of Gadjah Mada, (UGM) in 2003; his M.Sc. In Engineering, from the University of New Brunscwick, Canada in 1991; and he has a Bachelor of Science from the Bandung Institute of Technology (ITB) in 1981.

Dr Tran Chi Thanh is currently the President of the Vietnam Atomic Energy Institute (VINATOM) (2012-present). Prior to assuming this post, he worked at the Nuclear Power Safety Division, Department of Physics, Royal Institute of Technology in Stockholm, Sweden from 2005 to 2009. He was the Deputy Director of the Nuclear Power Plants Department, Institute of Energy, Ministry of Industry and Trade in Hanoi, Vietnam from 2009 to 2012. Dr Tran received his MSc in Engineering from the Moscow Power Energy Institute in 1994 and his PhD from the Royal Institute of Technology in Stockholm, Sweden in 2009.

Professor Andrew Wee is Vice President (University and Global Relations) at the National University of Singapore (NUS). He was previously Dean of the NUS Faculty of Science from 2007-2014. He is a Provost's Chair of Physics and Director of the Surface Science Laboratory.

Prof Wee's research interests include nuclear energy education and surface and nanoscale science. He was involved in the 2015 NUS public education and outreach seminar on nuclear issues and studies in Singapore. He is a Fellow of the Institute of Physics UK, the Institute of Physics Singapore, and the Singapore National Academy of Science where he is currently serves as President. He is an Associate Editor of the journal ACS Nano, and serves on several journal editorial boards.

Prof Wee was a Rhodes Scholar (1987) at the University of Oxford, where he received his DPhil. He holds a BA and MA in Physics from the University of Cambridge.

CONFERENCE PROGRAMME

Marina Bay Sands Expo and Convention Centre, Level 3 Cassia Junior
Thursday, 29 October 2015

08.45–09.00 Arrival of Participants and Registration

09.00–09.05 Welcome Remarks
Ambassador Ong Keng Yong
Executive Deputy Chairman, RSIS

09.05–09.35 **Session 1: Nuclear Power Development Plans in Southeast Asia**
The Session explored national and regional initiatives to uphold nuclear 3S in Southeast Asia. Panellists discussed the major challenges that relevant states in the region face as they prepare for the possible use of nuclear power and the policy responses that they need to adopt.

Speakers
Dr Olli Heinonen
RSIS Distinguished Visitor, Former Deputy Director-General of the International Atomic Energy Agency (IAEA), and Senior Fellow at the Harvard Kennedy School of Government's Belfer Center for Science and International Affairs
Dr Taswanda Taryo
Deputy Chairman, National Nuclear Energy Agency (BATAN), Indonesia
Dr Tran Chi Thanh
President of Vietnam Atomic Energy Institute

Moderator
Associate Professor Mely Caballero-Anthony
Head, Centre for Non-Traditional Security (NTS) Studies, RSIS, NTU

09.35–10.15 Discussion

10.15–10.45 Tea Break

10.45–11.15 **Session 2: Should Southeast Asia Use Nuclear Power?**
This session discussed the multi-stakeholder perspectives on the readiness of Southeast Asia to pursue nuclear power. The Session featured alternative voices from the private sector, civil society and the academe. They shared their insights on why Southeast Asia should or should not use nuclear power. The Session explored relevant lessons for Southeast Asia from other regions and nuclear-powered states on nuclear safety and security.

Speakers
Mr Egor Simonov
Director of ROSATOM Asia, Vice-President of ROSATOM International Network
Dr Ronald McCoy
Founding President, Malaysian Physicians for Social Responsibility, a member of Malaysian Coalition Against Nuclear (MyCAN)
Professor Andrew Wee Thye Shen
Provost's Chair Professor of Physics, National University of Singapore, and President, Singapore National Academy of Science

Moderator
Mr Kwa Chong Guan
Senior Fellow, RSIS, NTU

11.15–12.00 Discussion

ABOUT THE RSIS CENTRE FOR NON-TRADITIONAL SECURITY (NTS) STUDIES, NTU

The RSIS Centre for Non-Traditional Security (NTS) Studies conducts research and produces policy-relevant analyses aimed at furthering awareness and building capacity to address NTS issues and challenges in the Asia-Pacific region and beyond.

To fulfil this mission, the Centre aims to:

- Advance the understanding of NTS issues and challenges in the Asia-Pacific by highlighting gaps in knowledge and policy, and identifying best practices among state and non-state actors in responding to these challenges.
- Provide a platform for scholars and policymakers within and outside Asia to discuss and analyse NTS issues in the region.
- Network with institutions and organisations worldwide to exchange information, insights and experiences in the area of NTS.
- Engage policymakers on the importance of NTS in guiding political responses to NTS emergencies and develop strategies to mitigate the risks to state and human security.
- Contribute to building the institutional capacity of governments, and regional and international organisations to respond to NTS challenges.

Our Research

The key programmes at the RSIS Centre for NTS Studies include:

1. Humanitarian Assistance and Disaster Relief (HADR)
2. Energy Security
3. Food Security
4. Health Security
5. Climate Change, Environmental Resilience and Sustainable Development
6. Peace, Human Security and Development
7. Women, Peace, and Security

Our Output

Policy Relevant Publications

The RSIS Centre for NTS Studies produces a range of output such as research reports, books, monographs, policy briefs and conference proceedings.

Training

Based in RSIS, which has an excellent record of post-graduate teaching, an international faculty, and an extensive network of policy institutes worldwide, the Centre is well-placed to develop robust research capabilities, conduct training courses and facilitate advanced education on NTS. These are aimed at, but not limited to, academics, analysts, policymakers and non-governmental organisations (NGOs).

Networking and Outreach

The Centre serves as a networking hub for researchers, policy analysts, policymakers, NGOs and media from across Asia and farther afield interested in NTS issues and challenges.

The Centre is the Coordinator of the ASEAN-Canada Research Partnership (2012–2015) supported by the International Development Research Centre (IDRC), Canada. It also serves as the Secretariat of the initiative.

In 2009, the Centre was chosen by the MacArthur Foundation as a lead institution for its three-year Asia Security Initiative (2009–2012), to develop policy research capacity and recommend policies on the critical security challenges facing the Asia-Pacific.

It is also a founding member and the Secretariat for the Consortium of Non-Traditional Security (NTS) Studies in Asia (NTS-Asia).

More information on our Centre is available at http://www.rsis.edu.sg/research/nts-centre/

ABOUT THE S. RAJARATNAM SCHOOL OF INTERNATIONAL STUDIES

The S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University, was inaugurated on 1 January 2007 as an autonomous School within Nanyang Technological University (NTU), upgraded from its previous incarnation as the Institute of Defence and Strategic Studies (IDSS), which was established in 1996.

The School exists to develop a community of scholars and policy analysts at the forefront of Asia-Pacific security studies and international affairs. Its three core functions are research, graduate teaching and networking activities in the Asia-Pacific region. It produces cutting-edge security related research in Asia-Pacific Security, Conflict and Non-Traditional Security, International Political Economy, and Country and Area Studies.

The School's activities are aimed at assisting policymakers to develop comprehensive approaches to strategic thinking on issues related to security and stability in the Asia-Pacific and their implications for Singapore.

For more information about RSIS, please visit www.rsis.edu.sg.

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