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ENERGY RENAISSANCE IN EAST ASIA: NUCLEAR OR RENEWABLES?

As East Asia rapidly develops, greater demands are being placed on governments to efficiently supply energy to sustain economic growth. Simultaneously, public awareness of environmental issues has placed new imperatives on energy planning. To meet these challenges, the concept of sustainable development must be incorporated into energy security strategies in order to balance the three priorities of energy security, economic growth and environmental protection. Alternative energy forms a cornerstone of such a strategy. From a brief examination of the contemporary developments in alternative energy sources in East Asia, this Alert shows that the use of 'nuclear renaissance' for describing the energy future of the region is still premature, given that progress in this field has not been uniform and has largely stagnated. Instead, renewable energy developments show better progress and hold greater promise for East Asia. Instead of a 'nuclear renaissance', a 'renewables renaissance' may be taking hold in the region.

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Lurking Uncertainties

Continuing debates on energy security have been affected by two important global developments. First, the December 2009 Copenhagen Summit failed to reach a global consensus on a concrete plan to curb carbon emissions. As such, socioeconomically driven national self interests have led many states to focus on national-level carbon emissions reduction and energy efficiency strategies.

Second, as the world economy has begun to recover, it may lead to increasing energy demand. Since this increase follows patterns of population growth and development in Asia, many energy economists point to the long-term upward trend in energy prices. Michael Quah from Singapore's Energy Studies Institute has forecast that rising energy prices will continue despite erratic hydrocarbon prices and an uneven economic recovery.

East Asia at the '3Es' Crossroads

For rapidly-growing East Asia in particular, given the increasing energy demand and continued price volatility of fossil fuels, continual reliance on just hydrocarbons is no longer sustainable for economic development. Moreover, the need to mitigate climate change means that energy has to be harnessed in an environmentally sustainable manner. These interrelated dynamics constitute an energy-economic-environment (also known as the '3Es') nexus which can only be fruitfully resolved through sustainable development, in which energy diversification could play a pivotal role in satisfying rising demands, circumvent supply volatility and mitigate climate change through the employment of cleaner, alternative energy sources.

Setting the Scene

Nuclear energy carries considerable appeal in East Asia. However, whether the much touted 'nuclear renaissance' has taken place in the region remains debatable. Problems regarding waste disposal and nuclear proliferation among a range of nuclear concerns continue to be salient. This thus points to an indispensable need to explore possible alternatives. To date, gradual economic recovery has spurred revival of interest in renewable energy (RE) sources.

To explore how far either technology has progressed in terms of acceptance and implementation in East Asia, a comparison between recent developments in nuclear energy and progress in implementing RE projects will be outlined.

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Nuclear Renaissance in East Asia?

Since the late 1990s to early 2000s, it has been widely claimed by some scholars and industrial leaders that East Asia is on the throes of experiencing a 'nuclear renaissance'. With the race to develop alternative energy now in momentum, prospects for nuclear energy appear bright, as Mr Kenji Uenishi, President of GE Energy Asia Pacific, remarked in mid-February 2010 about the 'massive potential for nuclear energy in this region'.

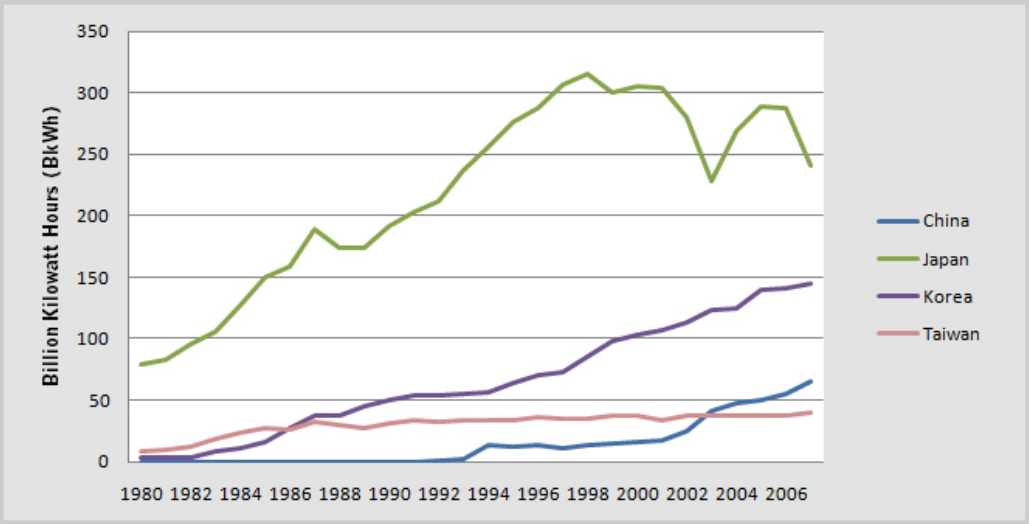
According to the World Nuclear Association (WNA), 'nuclear renaissance' implies a revival of the nuclear power industry that has been lying dormant or in decline for some time. Various factors are thought to drive this 'nuclear renaissance', such as increasing energy demand, climate change, economic considerations and the security of supply. However, a point to note is that, according to WNA, 'no revival of nuclear power is possible without the acceptance of communities living next to facilities and the public at large, as well as the politicians they elect'. The problem of public acceptance has appeared to be the stumbling block for 'nuclear renaissance' in some East Asian nuclear energy aspirants.

To determine whether these conditions still hamper nuclear energy development in East Asia, some countries in the region are selected for deeper analysis.

Northeast Asia: The existing club members

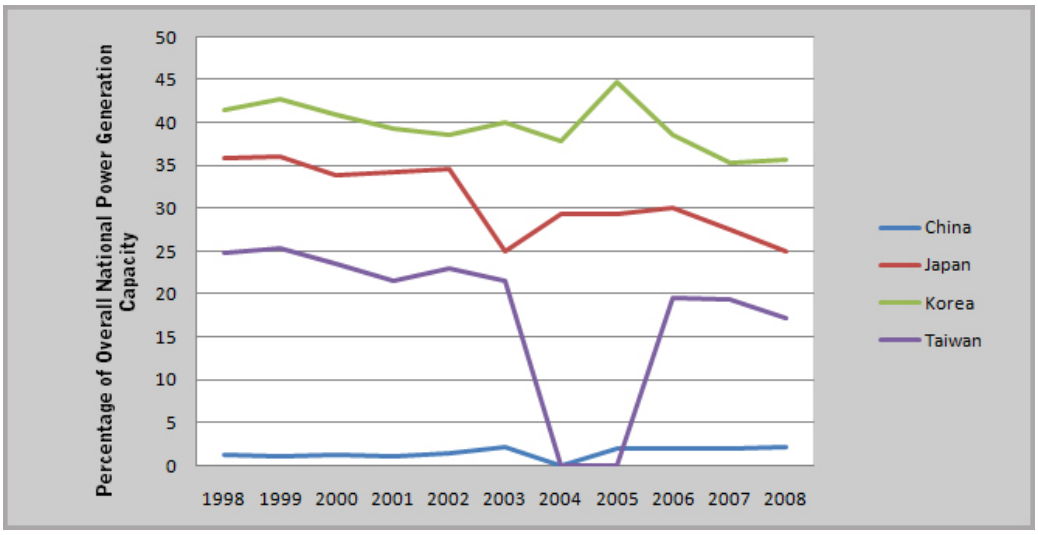
The bulk of nuclear development activities taking place in East Asia are dominated by existing primary users – China, Japan, South Korea and Taiwan. However, the share of nuclear energy in each of their overall power generation capacities saw little change. In fact, there is even a slight decline in the nuclear share registered for all except China.

Figure 1: Nuclear Power Generation in East Asia 1980-2007



Source: Data compiled from: World Net Nuclear Electric Power Generation 1980-2007, Energy Information Administration, Department of Energy, United States of America (http://www.eia.doe.gov/pub/international/iealf/table27.xls) and World Nuclear Generation and Capacity (2008), Nuclear Energy Institute (http://www.nei.org/resourcesandstats/documentlibrary/reliableandaffordableenergy/graphicsandcharts/worldnucleargenerationandcapacity/)

Figure 2: Nuclear Share in Overall Power Generation Capacity in East Asia, 1998-2008



Source: Nuclear Share Figures, 1998-2008, World Nuclear Association, May 2009 (http://www.world-nuclear.org/info/nshare.html)

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China's phenomenal economic growth means that its steadily increasing power consumption needs would soon outpace its energy supplies, which are mostly made up of fossil fuels. To ensure energy security whilst addressing climate change, China has decided to raise the use of non-hydrocarbon energy to 15 per cent of the overall energy mix by 2020. In this effort, nuclear energy is expected to play a crucial role, given the nascent state of development of RE sources. Hence, China appears determined to accelerate its nuclear power development, as indicated by the remarks from Wu Yin, Deputy Director of the Chinese National Energy Administration in February 2010. In all, Beijing envisages the installation of 40 gigawatts (GW) operational and another 18GW under construction by 2020.

While it might not have a colossal nuclear power plant (NPP) construction programme like China does, Japan appears keen to dramatically hike nuclear usage such that it constitutes the bulk of its national power generation capacity.

South Korea, while in the midst of expanding domestic nuclear usage, is also keen on expanding its nuclear horizons abroad, as shown in its recent nuclear deal with the United Arab Emirates. Seoul has devoted national effort into driving its nuclear research and development, viewing the industry as its new-generation growth engine. According to the Korean Ministry of Knowledge Economy, South Korea is reportedly aiming to export up to 80 nuclear reactors by 2030.

Southeast Asia: Aspirations mostly in the pipeline

Once believed to be the hotspot for 'nuclear renaissance', Southeast Asia has produced fairly mixed results over the past years. Notwithstanding the huge amount of optimism about a 'nuclear renaissance' in Southeast Asia, nuclear planning has effectively stalled in the regional nuclear aspirant countries, with the exception of Vietnam. So far, the country has planned to increase the share of nuclear

power in its total electricity generation capacity to 11 per cent by 2025. In November 2009, Hanoi signed a deal with Russia for the construction of its first 2GW NPP, due to come on line in 2020.

Jakarta remains undecided on nuclear power, and lacks concrete measures for implementing a nuclear programme, as indicated in the exclusion of nuclear power in its Power Distribution General Plan 2009-2018, which in turn is based on the National Power Master Plan 2008-2025. However, the National Atomic Energy Agency has planned to connect the first NPP to the Java-Bali grid by 2016. Non-governmental organisations such as the World Wide Fund and even Muslim clerics have opposed the plan due to concerns about geologic stability, waste disposal, as well as the possible need for the state to subsidise its operation. As a result, the Yudhoyono Administration has indefinitely postponed the bidding for the construction of its first NPP despite having gained endorsement from the International Atomic Energy Agency to proceed.

In the Philippines, the reactivation of the Bataan NPP (BNPP) has been stalled by public debate over a range of issues. A broad spectrum of actors, including geologists such as Kevin Rodolfo of the University of Illinois-Chicago, civil society organisations such as the Freedom from Debt Coalition, and the officials of the Philippine Catholic Church have expressed concerns about the geologic safety of BNPP as well as the potential debt burden that would be incurred by its rehabilitation cost, estimated by the Korea Electric Power Corporation in January 2010 to be US$1 billion.

Canals channelling water to mini hydroelectric plant

Source: Dominic Sansoni, The World Bank, 2002.

Philippine Congressman Mark Cojuangco, a strong proponent of nuclear power, also proposed that the local government of Pangasinan province bid for the purchase of two 1GW reactors, costing USD$5 billion a piece, from the Korean Peninsula Energy Development Organization. He warned of a serious power shortfall, as supply shortages have already occurred in parts of the Visayas and Mindanao regions. The El Niño phenomenon has been blamed by analysts, cited in reports by Remo and Alcuin in February 2010, for the declining water levels in several major dams, reducing hydroelectric generation capacity.

Previously believed to be the next rising nuclear aspirant in Southeast Asia, Thailand has also seen its nuclear plan bogged down by public opposition. While it still harbours long-term plans for at least two NPPs, subject to the approval of the Cabinet, Bangkok has lately altered its strategy to emphasise dissemination of nuclear knowledge in an attempt to 'sweeten' public perceptions. Meanwhile, the location of the first NPP would be proposed in May 2010, with the feasibility study to be submitted in March next year.

As far as Malaysia and Singapore are concerned, nuclear power remains deliberated in policy statements but no concrete plans exist yet. The Malaysian Minister of Energy, Green Technology and Water, Datuk Peter Chin was reported to have said during an interview with the Oxford Business Group in late January 2010 that Malaysia's implementation of nuclear energy is inevitable. Even more recently, a proposal by the Singapore Government to embark upon a nuclear power feasibility study could be seen as the clearest indication that the country is now seriously considering its use.

From an examination of East Asia, it is premature to conclude that a 'nuclear renaissance' is occurring, as nuclear expansion has been taking place in countries that already utilise nuclear power. With the exception of Vietnam, virtually all the rest of the nuclear aspirants in Southeast Asia have largely seen their nuclear developments progress no further beyond rhetoric or feasibility studies due to domestic opposition based on cost and environmental safety.

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Renewable Energy Developments in East Asia: A Regional Overview

Since a nuclear renaissance in the region remains debatable, it may be more useful to examine the growth of other energy sectors. This section outlines some of the RE developments in East Asia to date.

Hydropower

One of the most abundant RE resources in East Asia, hydropower has long been in use by several countries. For some countries, such as China and Vietnam, hydropower is not considered an alternative energy but a conventional power source. Indeed, China is a substantial hydropower user, with its major Three Gorges Project taking centre-stage in national hydropower efforts. In all, 26 generators that make up the initial plan of this project were already in place, with current plans to increase that to 32 generators to provide a total capacity of 22.4GW.

Vietnam is another country where hydropower is tipped for an increased share of the national power capacity. Like Thailand, Hanoi also faces environmental resistance to large-scale hydropower projects and has turned to small-scale ones that could contribute to rural electrification. One notable example has been a new program to build 37 small-scale hydropower plants in the northern provinces bordering China.

Hydropower projects are among the key RE initiatives in Malaysia; In March 2009 it was announced that 12 new hydropower plants would be constructed as part of the much touted Sarawak Corridor of Renewable Energy. The key challenge to confront Malaysia would be the implementation of such large-scale projects in an environmentally sustainable way.

Taiwan also has huge hydropower potential which has been under-used. Nonetheless, several of Taiwan's new and ongoing hydropower plants are expected to be operational in the next few years, with a potential for constituting up to 3.5 per cent of total generating capacity.

The Philippines envisages an increase in hydropower capacity from 3.2 to almost 4GW by 2014 through the development of all viable small and mini-hydro plants. Philippine National Oil Company Renewables is reportedly engaged in negotiations with local and foreign investors on the construction of 11 hydropower projects with a total installed capacity of 270 megawatts (MW).

Large-scale hydropower projects in Indonesia have been hampered by the need for substantial upfront capital investments – a disincentive for Indonesia's state and private firms to devote their limited resources to. Nonetheless, Jakarta still has plans to construct up to 570 mini hydropower plants with a total of 45.6MW capacity, ostensibly geared towards rural, community-level electrification.

However, hydropower has relatively limited potential in other East Asian countries such as Japan, and virtually no such potential in Singapore. Hydropower project has a limited scope in South Korea too, where major effort has been devoted towards solely expanding existing works such as the 79.6MW Cheongpyeong hydroelectric project, targeted to reach a total of 139.6MW by June 2011.

Wind power

A previously unharnessed RE source, wind power is now in vogue in East Asia. The China Meteorological Administration estimates that the country has the potential to develop 2.5 billion kilowatts (kW) of onshore and offshore wind energy. China appears determined to become the world leader in this field. This is indicated by its efforts in doubling national wind power capacity from 12 to 25GW in one year's time, and increasing that to 150GW by 2020, according to the Global Wind Energy Council in February 2010. Furthermore, the China National Offshore Oil Corporation has announced plans to construct the world's largest offshore wind farm outside Shandong Province in a decade's time. Simultaneously, in February 2010, Beijing issued regulations for the development of offshore wind power projects to mitigate possible environmental consequences.

High costs of investment might also potentially deter some East Asian countries, though aid programmes may alleviate costs. For example, Vietnam in early February 2010 announced it would utilise official development aid provided by the Danish Government to fund a wind power project in the Ninh Thuan province. Hanoi is intent on developing its considerable wind energy potential (some 100GW waiting to be tapped) as indicated by the National Renewable Energy Centre's recent move to devise incentives for wind power development projects.

A joint study undertaken by the World Wildlife Fund and the University of the Philippines Solar Laboratory has estimated that the Philippines has wind power resources of over 7,404MW. The first large wind farm in the country and in Southeast Asia was constructed in 2005 in Ilocos Norte province, generating over 24.75MW of power at a cost of US$44 million. In September last year, a Filipino corporation, Trans-Asia Oil and Energy Development Corporation, announced plans to invest at least US$1 billion for a 400MW portfolio of wind power projects.

Since wind power requires large areas to be efficiently harnessed, massive construction may be ruled out for smaller countries in East Asia. Nonetheless, Singapore does not foreclose the possibility of utilising 'micro-turbines' installed on top of buildings, despite limited generation capacity.

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Solar power

Solar power is another increasingly popular form of RE. Like wind power, solar power has also become a focal point of industrial competition among some East Asian countries. In December 2009, Taiwan unveiled what was dubbed Asia's largest solar power plant, probably a precursor to major efforts by Taipei to raise the share of solar power in its national mix.

China appears to be hot on Taiwan's heels in solar power developments, with a project to complete an even larger 2GW solar power plant in Ordos City, Inner Mongolia, by 2019. In upping the ante, China is also developing the use of solar thermal power, a technology that concentrates sunlight at water to generate steam for turbines. However, the ability of China to effectively harness this technology has been cast in doubt due to its geographic constraints.

Solar panel used for lighting village houses

Source: Dominic Sansoni, The World Bank, 2002.

In Southeast Asia, Malaysia too is keen to develop its solar power industry. In late January 2010, the Minister for International Trade and Industry Datuk Seri Mustapa Mohamed stated the country's intention to develop 'solar valleys' to enable small- and medium-sized enterprises especially to support the solar industry. So far, Malaysia has attracted major solar energy industrial players such as First Solar from the US and Q-Cells from Germany to compete in its solar energy industry. Kuala Lumpur was reportedly interested in taking the lead in becoming the solar hub in Southeast Asia.

Thailand too has stated its intention to become a solar power innovator, developing a plan to build one of the world's largest solar farms, capable of generating over 70MW, at Lop Buri by 2011.

The Philippines also has a nascent solar photovoltaic (PV) panel fabrication industry. SunPower and Solaria, two major PV manufacturers based in the US, have established local manufacturing sites and research and development centres to improve PV efficiency and to improve manufacturing processes. The companies already export PV panels to the United States (US).

Solar power projects are decidedly of smaller scale in countries such as Indonesia, which is planning to spend US$84 million on rural solar power projects, including a program to supply solar power panels to 192,000 rural households.

It is interesting to note that despite its space constraints, solar power constitutes the primary RE program for Singapore, which envisages the installation of 50,000 square metres of solar thermal systems by 2012.

Strangely, despite its vast solar power potential, Vietnam has not yet embarked on any significant programs to increase its usage, in particular at the rural, community-level scale.

Geothermal power

In this area, Indonesia and the Philippines are spearheading efforts. Manila in particular has an ambition of becoming a leading producer of geothermal energy as part of its strategy of doubling the amount of power generated from renewable sources from over 4.5 to 9GW, with a target of installing an additional 1.2GW to the existing 1.93GW by 2013. At present, it is the second largest producer of geothermal power in the world, after the US. While geothermal power accounted for an estimated 13 per cent of its power generating capacity, the Philippines has experienced a series of power shortages that have been attributed to rapidly growing energy demand as well as reduced hydroelectric generation capacity due to the El Niño phenomenon. A programme of maintenance and servicing for several large fossil-fuel power plants, in preparation for the country's May 2010 national elections, has also reduced the total generation capacity of the country.

In December 2009, the Philippine Department of Energy announced its plans to approve 19 geothermal exploration and development projects, to be implemented in the next nine months. Worth about USD2.5 billion in all, these projects are envisaged to produce about 620MW additional capacity for the country.

Indonesia is the fourth largest geothermal energy producer in the world, and possesses up to 28GW generating capacity, which is untapped still. However, major geothermal projects conceived back in the 1990s were scrapped during the Asian Financial Crisis in 1997–1998.

Geothermal power development originally saw hopes of revival in recent times, but latest news indicated that Jakarta had downsized its geothermal power projects by 18 per cent – trimming from an envisioned 4733MW to 3900MW capacity by 2025. This move is probably due to a lack of funding.

Other forms of renewables

Compared to hydropower, wind and solar power especially, other forms of RE sources have received less attention. More often than not, this is attributed to cost and resource availability. Biomass is a prime example in this respect. In the case of Thailand, initial goals of utilising biomass, such as harnessing electricity from rice husks, have been stifled by limitation of available resources.

For Vietnam, biomass utilisation is largely hampered by high initial investment costs involved, as well as because of a lack of a policy framework. In contrast, Singapore signed a deal in February 2010 with Japanese trading giant Marubeni Corp. to build one of the world's largest biomass and clean coal co-generation plants for US$250 million. According to a Marubeni official, the plant, which is to be partly fuelled by woodchips and palm kernel shells imported from neighbouring countries, would be the largest of its kind in Southeast Asia.

While biofuels production has encountered barriers such as technological bottlenecks and food security concerns, second-generation biofuels (namely cellulosic fuel ethanol) has developed apace. The second-generation biofuels industry holds great promise in China in particular. Malaysia has also been developing the use of biomass waste for power generation, according to its Minister of Plantation Industries and Commodities Bernard Dompok in early February 2010. In mid-February, it was reported that four companies were shortlisted for the construction of a 10MW biomass power plant in Pahang, Malaysia.

Manila has also tapped biomass power to satisfy its energy needs. It was reported in January 2010 that a huge program, envisaging 24 biomass power projects, is to be implemented in the Philippines within the next decade. A Britain-based company, Global Green Power PLC Corp., is investing US$120 million to construct three 15MW biomass power plants in the islands of Luzon, Panay and Negros.

A previously untapped resource is tidal or ocean power, which utilises kinetic energy of marine wave movement to power turbines (in contrast, conventional hydropower relies on the potential energy of water stored in a reservoir). While tidal energy technology harnesses an unlimited resource, its deployment has been limited by high costs for initial capital investment. Nonetheless, cost issues have not deterred some countries like South Korea from attempting to utilise it. Only recently, Seoul unveiled its first tidal power plant in Jindo, on the country's south-western coast. According to the Korean Ministry of Land, Transport and Maritime Affairs, this US$9.9 million plant would provide a 90MW generating capacity by 2013, sufficient for about 46,000 households. Even more ambitiously, South Korea is tipped to build what is acclaimed to be the world's largest tidal power plant in Incheon Bay on its west coast, starting in 2011 and due to be completed in 2017. It has run into opposition however, as local civic groups have been campaigning against the massive project claiming that it could damage the marine ecosystem of the area.

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'Renewables Renaissance' in East Asia?

Alternative energy has indeed emerged as one of the cornerstones of East Asian strategy towards sustainable development, and serves as a primary solution to the problem of '3Es'. From the survey of alternative energy developments, split along two prongs of analysis – nuclear and RE sources – one can conclude the following:

First, saying that a 'nuclear renaissance is occurring in Asia' may be exaggerated, due to the lack of uniformity in nuclear development across the region. More progress has been met in Northeast Asia, though countries in that sub-region are merely expanding their already substantial nuclear energy industry.

Southeast Asia, a focal point of the 'nuclear renaissance' debate, has had limited progress. With the exception of Vietnam, on the whole Southeast Asia's nuclear energy future remains clouded in uncertainty, due to the prevailing domestic political wrangling over the environment, costs and safety grounds, as well as lack of concrete policy blueprints that set out clear directions for nuclear power development in the remaining Southeast Asian nuclear aspirants. As such, any generalisation of progress in nuclear power advancement in the region is untenable.

Second, it could be argued that RE prospects appear to be promising, given the magnitude of investments for this sector. This might not come as a surprise, as most, if not all, RE sources are considered less risky, environmentally and politically, than nuclear power. The key mitigating factors remain technological and financial challenges. Nonetheless, it would seem that East Asian countries are determined to overcome these barriers. As such, a 'renewables renaissance' appears to be more applicable to East Asia.

That being said, however, overcoming technical and financial hurdles do not guarantee the success or mainstreaming of RE technologies.

Well-conceived policy frameworks are essential for integrating RE technologies in a country's energy security strategy. Policymakers must optimise existing technologies at their disposal to the most suitable applications.

Going further, Part Two of this month's NTS Alert will examine policy frameworks adopted by five selected East Asian countries in the field of alternative energy developments. By doing so, the NTS Alert hopes to examine how policymakers intend to harness the technologies and resources at their disposal in the context of a debated 'nuclear renaissance' in East Asia.

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About the Centre:

The Centre for NTS Studies, based in the S. Rajaratnam School of International Studies, was inaugurated by the Association of Southeast Asian Nations (ASEAN) Secretary-General Dr Surin Pitsuwan in May 2008. The Centre maintains research in the fields of Climate Change, Energy Security, Health Security, as well as Internal and Cross Border Conflict. It produces policy-relevant analyses aimed at furthering awareness and building capacity to address NTS issues and challenges in the Asia Pacific region and beyond. The Centre also provides a platform for scholars and policymakers within and outside Asia to discuss and analyse NTS issues in the region.

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