

Nomura Expert Series: Global uranium outlook

In this special section by Gene Clark, principal and CEO of TradeTech (a US firm providing market information and consulting services to the nuclear fuel industry), Dr Clark gives an overview of the current state of the uranium industry, followed by an analysis of the historic and future price outlook of the metal. Following is his conclusion.

Exploration continues at a slower pace

The acquisition and exploration of uranium properties continued at a slower pace in 2009, following the economic crisis that affected the commodities market in the latter half of 2008. While the global financial crisis has challenged the industry, many mining companies have continued exploration programmes and licensing activities for new projects. However, the market was sensitive to any disruptions reported by the production sector over the past year.

Junior mining companies with properties in the US and Canada remained optimistic about future uranium production in North America, but acknowledged the timeline for advancing exploration and production could remain slow as the global economy struggles to recover, which could affect project financing and contribute to market price volatility.

Price outlook

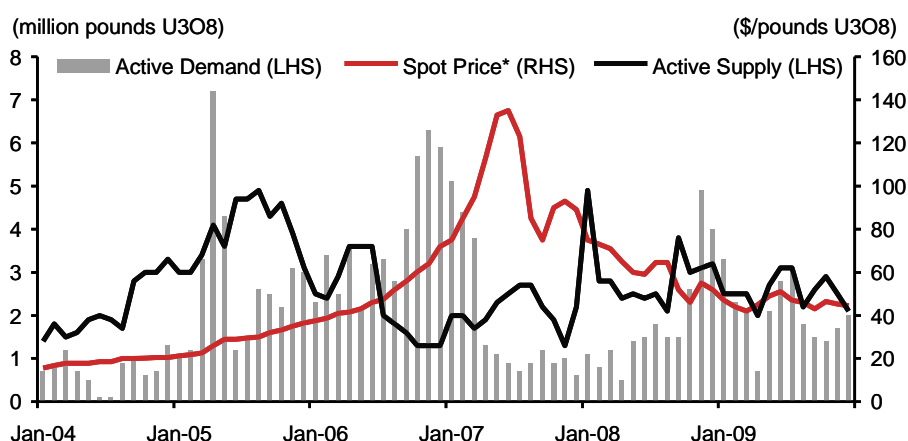
The uranium market, for most of its history, has been well-insulated from external market influences. Given the small size of the market, its level of regulation and, importantly, that the limited players able to participate must hold delivery accounts at uranium converters, this has meant that it has essentially only been uranium market fundamentals that affect prices.

This being the case, the balance between the demands of end-users (nuclear power companies) and the supply from mined production and excess inventory should dictate price. Although described by many market observers as irrational, the spot uranium market price has historically been clearly responsive to overall levels and month-to-month changes in active supply (supply being offered for sale at a given point in time) and in active demand (amounts of uranium being actively sought for purchase at a given point in time), as shown in the Exhibit below.

Economic crisis affected the commodities market

Uranium market, for most of its history, has been insulated from external market influences

Exhibit 29. Spot price supply/demand correlation



* TradeTech's NUEXCO Exchange Value

Source: TradeTech

For example, the prolonged increase in active demand over the mid-2005 to early-2007 period, during a similarly prolonged drop in active supply, was accompanied by a run-up in price to its highest level on record in mid-2007.

A recent development, and arguably one that may have far-reaching implications for the modus operandi of the market, is the involvement of financial institutions.

Several uranium broker/trader organisations have exploited a lucrative opportunity to open up the uranium market to outside interest. In the past, financial institutions, with their inability to take delivery of uranium, have been prevented from participating in the market. In response, uranium brokers have established companies with the sole purpose of holding uranium. These companies, in turn, are listed on various stock exchanges, enabling financial institutions to take positions in them and, hence, gain exposure to the uranium market.

Financial institutions, however, are driven by a different set of parameters than nuclear power operators and principally seek a monetary gain over the shortest possible time frame. When parties of this nature enter a small illiquid market, where pricing remains inefficient, the effect can be significant.

As excess secondary supply finally approached equilibrium in 2004, the introduction of secondary demand from financial institutions helped push prices up dramatically to an all-time high of US\$136 per pound U3O8. Purchases in the spot market by investors rose from a minuscule amount in 2004 to becoming the dominant factor in 2007, as other buyers backed away in the face of record-high prices.

Their interest in market exposure quickly reversed with the credit crisis, and secondary demand morphed into secondary supply. For 2008, the investor community as a whole were net sellers —the first time in the market's history — which helped cause the price to fall to the current level of US\$45 per pound U3O8.

This demonstrates that not only has the landscape of the uranium market changed so that it is no longer insulated from external market influence, but given its continued illiquidity and inefficiency, it is arguably far more exposed to external influence (and volatility) than many other highly traded commodities.

As for the near term future of the spot uranium market, TradeTech expects a return to the market by the more traditional buyers in spring 2010. Although active supply remains considerable, the buying activity results in upward pressure on the price, with a resulting price rise to a peak value of about US\$55 per pound U3O8, followed by a drop back to the high US\$40s for the rest of 2010.

Well into 2011, TradeTech sees buying activity picking up for yet another major round, another price rise occurs, with a peak of slightly over US\$60 per pound U3O8. Although these results are for only one scenario, a fairly robust finding is that the spot price is projected to generally remain in the range of US\$45-60 per pound U3O8 over the next 24 months.

Regional analysis: China

China is undergoing its largest nuclear power development programme in history. Though nuclear power accounts for only 1.1% of total installed power capacity in China in 2008 and 2% of total power generation, the government has plans to grow nuclear's share of China's total generating capacity to 5% by 2020F. This is based on recent reports by state media which indicated that central authorities plan to revise their 2020F nuclear power capacity target from 40GW to 70-86GW. (China currently has 11 reactors in operation, with 8.6GW of generating capacity.) These plans are also supported by the head of China National Energy Administration Zhang Guobao, who has a preference for nuclear power among various alternative energy sources given the scalability, reliability and low generation cost of nuclear power.

The government's potential capacity target of 70GW by 2020F is achievable, in our view. According to WNA, there are 57 nuclear power plants planned or under construction in China, which would increase nuclear power capacity by 61GW to 70GW by the end of 2020, exceeding the NDRC's target of 40GW. If we include the 20 nuclear power projects under planning or application stage, then the cumulative

A recent development is the involvement of financial institutions

Financial institutions are driven by a different set of parameters

Spot prices seen to peak at about US\$55 per pound U3O8 in 2010F

Largest nuclear power development programme in history

nuclear power capacity could surpass 100GW by 2020, more than double the government's target. If all the announced projects materialise, we expect that average annual new installation of nuclear capacity would be 7.5GW over the next 12 years, implying a 12-year capacity CAGR of 22% through 2020.

Chinese power equipment makers stand to be major beneficiaries of the increased penetration of nuclear power in China. Based on our China power equipment team's estimates and a target of 70GW nuclear capacity by 2020F, we estimate that China's nuclear power equipment market will reach about RMB350bn over the next decade. If we apply a localisation rate of 70% for nuclear island equipment, 80% for conventional island equipment, 90% for BOP equipment, 100% for other equipment, plus an overall discount factor of 85%, cumulative revenue from now to 2020F attributable to local equipment suppliers will likely reach RMB250bn — twice the Big 3 power equipment players' (Dongfang Electric [1072 HK, DFE], Shanghai Electric [2727 HK, SEG], and Harbin Power [1133 HK, HPE]) combined FY08 revenue.

Among the Big-3 Chinese power equipment vendors, our Power Equipment research team believes DFE and SEG stand to be the biggest beneficiaries of China's nuclear drive, given their sizeable nuclear power backlogs. Although HPE, like SEG, is one of the key Chinese vendors in the government's 3G nuclear technology transfer and localisation scheme, it has not won substantial nuclear orders. While we are encouraged by the positive revenue impact of forthcoming nuclear revenue for these leading Chinese power equipment players, our concerns over nuclear profit margins and the companies' overwhelming exposure to the declining thermal power market keep us on the sidelines. We retain our REDUCE ratings on DFE and HPE, and our NEUTRAL call on SEG, and keep our price targets unchanged.

China's search for uranium

With the government's proven track record in executing nuclear power constructions on schedule, we believe one of the largest obstacles that could potentially impede its growth in nuclear power development is the procurement of uranium. Hence, we believe a focus for China's nuclear power sector in the coming years is the acquisition of overseas uranium assets.

This is evidenced by CNNC's and CGNPC's recent foray into the international markets. Through a backdoor listing in November 2008, CNNC has established Hong Kong-listed CNNC International (2302 HK) with a main goal to procure uranium assets overseas. In June 2009, CNNC International bought 69.5% of a Canadian company called Western Prospector, which has a uranium mine in Mongolia with 8,000 tonnes of reserves. Estimated annual production is 1,000-2,000 tonnes per year.

Similarly, in November 2009, CGNPC invested HK\$728 mn for a 16.67% stake in HK-listed Silver Grant (171 HK). Silver Grant will use the proceeds for "investment projects or acquisition opportunities relating to natural resources, energy and nuclear related matters", according to the company statement. While CGNPC management has declined to comment on this investment, we believe this is a way for CGNPC to indirectly make investments in overseas uranium assets through a listed vehicle. As mentioned earlier, CGNPC has already started making these acquisitions through its subsidiary, China Uranium Development Co., with its investment in Energy Metals Ltd.

Such investments will continue in order for the two nuclear power operators to secure enough fuel supply in the long run, in our view. We believe they will continue to look for investments in Kazakhstan, Australia, Canada and countries in Africa.

China relies on imports for about half of its uranium needs, with supplies coming from Russia, Namibia, Australia and Kazakhstan. According to the WNA's estimates, China produced 769 tonnes of uranium in 2008. CNNC, which is the dominant domestic uranium producer by output, said it aims to raise its domestic uranium production to 2,000 tonnes a year by 2020.

In our view, power equipment makers stand to be major beneficiaries

Dongfang Electric and Shanghai Electric stand out

Procurement of uranium is key

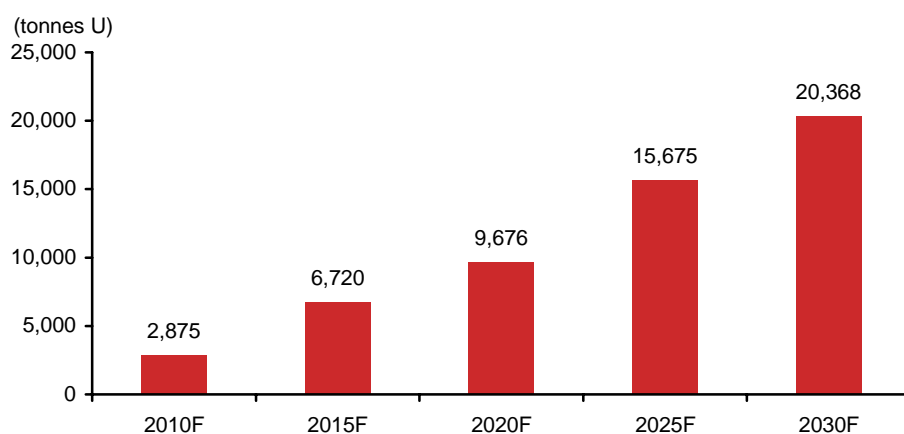
Both CNNC and CGNPC are investing in uranium overseas

According to WNA's estimates, China produced 769 tonnes of uranium in 2008

This is still far below the projected amount of uranium required by China. According to the head of CGNPC's uranium supply unit (Guangdong Nuclear Uranium Resources Co.), Zhou Zhenxing, the company alone will need more than 100,000 metric tonnes of uranium between 2009 and 2020. This is a five times increase from 2,000 tonnes in 2009 to 10,000 tonnes a year in 2020.

Based on the WNA's Reference Scenario projections — which make a conservative assumption that nuclear power capacity will grow only to 50GW by 2020F — China's uranium requirement will grow by more than three times to 9,676 tonnes in 2020F from 2,875 tonnes in 2010F. If China increases its cumulative nuclear power capacity to 70GW by 2020F, as we are projecting, the requirement for uranium would be even larger.

Exhibit 30. China's uranium requirement as projected by WNA's Reference Scenario



Source: WNA

Beneficiaries of China's nuclear boom

We identify major players within the China nuclear industry. These include upstream advanced technology and equipment suppliers like Areva, Westinghouse, and Toshiba; local equipment suppliers like Dongfang Electric, Shanghai Electric, Harbin Power and Hollsys; and nuclear power operators such as China National Nuclear Corporation (CNNC), China Guangdong Nuclear Power Holding (CGNPC), China Power Investment Corporation (CPI), and other coal-fired IPPs. Only CNNC, CGNPC and CPI have the necessary licence to hold dominant stakes in nuclear projects in China, while the other Chinese IPPs and foreign investors can only hold minority interests.

We note that despite the prosperous outlook for nuclear power in China, it is difficult for investors to find an investment target that has high exposure to this sector. Nonetheless, our checks reveal that some of the nuclear power operators might have listing plans over the next few years, and these might prove interesting.

Regional analysis: Japan

Nuclear power likely to be promoted as part of policies to reduce carbon emissions

The Democratic Party of Japan (DPJ) administration says it aims to cut Japan's CO2 emissions from 1990 levels by 25% by 2020 (equivalent to a 30% cut from 2005 levels), and by over 60% by 2050. These are more ambitious targets than the Aso administration's plan, which called for an 8% reduction (15% vs 2005 levels). The DPJ's plans for achieving its goals include benefits from the introduction of an emissions trading system and apparently assume that China and other countries will, post-Kyoto, be required to reduce emissions.

Only CNNC, CGNPC and CPI have the necessary licence to hold dominant stakes in nuclear projects

DPJ aims to cut CO2 emissions from 1990 levels by 25%

We think nuclear power will need to be promoted to achieve the DPJ's targets for reducing CO2 emissions, given that renewable energy is more expensive than nuclear power. We calculate that a 1pp capacity factor improvement at all existing nuclear power plants (aggregate capacity of around 48mn kW) would help cut CO2 emissions by 1.91–3.18mn t/y (1.91mn tonnes in the case of averaging per-unit CO2 emissions across all power sources, and 3.18mn tonnes in the case of averaging for thermal power).

Electric power companies account for about one-third of Japan's CO2 emissions. Reducing those emissions will be important to achieving targets for reducing the country's CO2 emissions. Although efforts could be made to limit demand for electric power by imposing taxes on electricity rates, that would be politically difficult, in our view. Promoting nuclear power is probably the best option from a cost perspective.

Promoting nuclear power would also be positive for enhancing Japan's energy security. Increased use of nuclear power would reduce the impact of any sharp rise in the cost of crude oil and other fuels. Although Japan does depend on imports for nuclear fuel, fuel costs account for a much smaller proportion of nuclear power generating costs than is the case with thermoelectric power, so even if uranium prices were to rise, the cost of nuclear power generation would probably not rise that much, we believe. The government also intends to promote pluthermal generation using domestically reprocessed used nuclear fuel.

Nuclear power plant construction plans

No nuclear power plants were completed in FY09 (March year-end). In FY10, however, total new nuclear power output of 0.91mn kW is due to come online, followed by zero in FY11, 1.37mn kW in FY12, zero in FY13 and FY14, 1.38mn kW in FY15, 4.29mn kW in FY16, and 4.30mn kW in FY17. Although there are large annual swings, the FY16 and FY17 projected new capacity exceeds the most recent peak of FY06 (2.46mn kW), FY98 (2.54mn kW) and FY94 (3.96mn kW).

The ratio of electric power generating capacity at Japan's 10 electric power companies accounted for by nuclear power is projected to increase from 20% at end-FY08 to 23% at end-FY18F. With the construction of new facilities together with the resumption of normal use at power plants that have been taken off-line, we project that the ratio of total power output accounted for by nuclear power will rise from 26% to 40% over that period.

Maintenance co's and heavy machinery makers likely to benefit

We think the planned expansion of capex at electric power companies in FY10 is likely to benefit shipbuilding/heavy machinery companies engaged in the construction of thermal and nuclear power plants and other capital goods companies as well as electric power-related plant maintenance companies. We think valve makers and plant maintenance companies with high sales exposure to electric power companies are likely to see the largest earnings impact.

We believe beneficiaries from the nuclear power industry in Japan are: Tokyo Electric Power (whose profits are highly exposed to nuclear power), Toshiba Plant System & Services (whose nuclear power systems will likely continue to drive mid-term profit growth), Japan Steel Works (which seems highly competitive in nuclear power plant parts and materials) and Mitsubishi Heavy Industries (major provider of pressurised water reactor plants).

We think nuclear power will need to be promoted

Electric power companies account for about one-third of Japan's CO2 emissions

Regional analysis: Korea

Nuclear power a growth sector domestically and overseas

Installed nuclear power capacity will likely account for 33% of total installed capacity in Korea by 2022F, versus 25% in 2008, overtaking coal and LNG-fired capacity, which currently account for the highest share of generating capacity (33% and 25%, respectively). In terms of generating volume, we estimate the nuclear portion will grow from 34% in 2008 to 48% in 2022F, while the coal portion shrinks from 39% to 36% over the same period. The MKE expects electricity demand to grow at an average 2.1% pa to some 500.1bn kilowatt hours in 2022F. Twelve new nuclear power stations are scheduled for construction by 2022. Through 2016, new nuclear capacity will likely account for 85% of Kepco's new generating capacity. According to the Fourth Power Supply Plan announced by the Ministry of Knowledge and Economy (MKE), Korea will invest W37tn (about US\$28.5bn) in increasing generation capacity over the period to 2022.

A Kepco-led Korean consortium won a contract in December to set up four nuclear reactors for the oil-rich United Arab Emirates (UAE). The UAE deal will authorise a consortium led by Kepco to design, build and run the reactors that will produce 5,600 megawatts of electricity. While the contract to build the four reactors is worth about US\$20bn, the consortium expects to earn another US\$20bn by jointly operating the plants for 60 years, according to the Gulf's Al Jazeera News. The reactors — the first nuclear plants in the Gulf Arab region — are scheduled to start supplying electric power to the UAE grid in 2017. The Korean bid in the UAE beat bids from France, the US and Japan, and heralds Korea's first big step in a sizeable global market for new nuclear plants. The MKE expects 430 new nuclear power plants to be built worldwide by 2030 at a cost of over US\$1tn.

Hyundai E&C (HDEC) and Samsung C&T (SSCT) have 55% and 45%, respectively, of W7tn in UAE nuclear plant-building contracts. HDEC and SSCT should see an 8-10% uplift to sales from the UAE project. Korea Plant Service & Engineering (KPS) holds a virtual monopoly on service/maintenance of Kepco's nuclear plants and should enjoy a similar position in the UAE project, we expect. The UAE deal could add 11-12% to KPS' annual revenue, we estimate. Korea Power Engineering (052690 KS, not rated) could see a 30-35% annual sales impact from the UAE deal, according to market estimates, perhaps a reason for the high consensus P/E valuation after its December KRX listing. Kepco may ironically gain the least due to its larger domestic power business. Doosan Heavy (034020 KS, not rated) will provide equipment to the consortium, but relies on US and Japanese suppliers for crucial reactor equipment such as RCP (Reactor Coolant Pump) and MMIS (Man Machine Interface System).

Regional analysis: India

India faces shortage of power

India needs to sustain its economic growth at 8-10% for the next 25 years to become a developed economy. Access to quality power is essential. However, insufficient domestic manufacturing capacity of power equipment, poor transmission and distribution infrastructure, sluggish execution of projects, red tape and long gestation periods for power projects have been major impediments to growth in the power capacity and the country continues to suffer from inadequate power. The government estimates that India will need to grow its installed power capacity by 5-6 times, from 152GW currently to 770-960GW by 2031-32.

Korea expanding power capacity mostly in nuclear power

Korean government expects US\$1tn-plus market for new nuclear plants worldwide by 2030

Korean consortium wins the much coveted UAE nuclear project

Major beneficiaries in power plant services and construction

India probably needs to sustain its economic growth at 8-10% for the next 25 years

India lacks energy resources

Over the years, India's dependence on imports to meet its energy needs has been increasing. India imports all three of its major sources of energy: oil, gas, and coal. Although India has significant coal reserves, the supply has lagged behind the demand due to lack of investment and modern infrastructure. With thermal-fuel contributing more than 80% of the country's power generation, India's overdependence on coal looks unhealthy. Moreover, India's power plants use outdated technology and hence need more coal to generate the same amount of power. In addition, Indian coal is of poor quality and is a major cause of pollution leading to climate change.

Nuclear energy can solve India's energy woes

India will need power generation capacity of 1,300-1,500 GW by 2052F to meet its electricity needs, as per the Department of Atomic Energy's (DAE) projections. More importantly, even if India is able to use all its energy resources, India will still fall short of meeting this target. India plans to overcome this problem by using its vast Thorium reserves, which are one of the largest and of the best quality in the world. As per the DAE's projection, Thorium can meet India's electricity requirements for nearly 1,950 years at the current rate of electricity requirement and for 170 years at 2050F electricity requirements. With 17 nuclear power plants (NPP) totalling 4,120MW of installed capacity, nuclear energy contributes around 3% of the total installed capacity in the country. Nuclear energy in India is cost competitive with coal and is a lot cleaner. To utilise the country's modest uranium resources and vast thorium resources in the best possible manner, India has a planned a three-stage nuclear power programme.

India's three-stage nuclear power programme

The first-stage of the programme focuses on setting-up Pressurised Heavy Water Reactors (PHWRs), while second stage involves setting up Fast Breeder Reactors (FBRs), supported by reprocessing plants and plutonium-based fuel fabrication plants. This is necessary to increase India's nuclear power capacity and then to launch the use of thorium on a large scale in the third stage of the programme. In the third stage, India expects to use its vast thorium resources.

Indo-US nuclear deal: the game changer

The NSG waiver paved the way for the historic Indo-US nuclear deal, ushering a new chapter in India's nuclear era. India can now access the global nuclear market to meet the uranium requirement of its plants and also import nuclear power plants having superior technology. Simultaneously, India will continue to work on its indigenous technology to successfully realise its three-stage nuclear power plan. India has set itself a target to increase its nuclear power capacity with the help of imports to 20,000MW by 2020F and 63,000MW by 2032F from the current 4,200MW.

Nuclear sector provides a huge opportunity to private sector in India

The government realises that to achieve the long-term nuclear energy targets, private sector participation is a must as nuclear energy requires a huge amount of financial capital and skilled manpower. According to government estimates, in the next decade alone, investment opportunities in India's nuclear sector are expected to be around US\$150bn. However, current government policies do not allow for participation of private-sector companies in nuclear power generation, hence we believe that to attract capital and expand the role of domestic and international private players, the policy will need to be amended. Equipment manufacturers, utilities players, and steel companies are some of the businesses expected to benefit with the opening of the nuclear sector, in our view. Strong political will, the right policies, access to fuel and technology, and participation of the private sector will be crucial to India achieving its nuclear ambitions.

India will likely need power generation capacity of 1,300-1,500 GW by 2052F

The NSG waiver paved the way for the historic Indo-US nuclear deal

We believe that Larsen and Toubro, Hindustan Construction Company, National Thermal Power Corporation, Bharat Heavy Electrical Ltd and Reliance Infrastructure Ltd are some of the companies that are expected to benefit from the opening up of India's nuclear sector to private players. However, India's political process is quite slow and it may take a few years before rules and policies are amended and the private sector is allowed to participate in the nuclear sector. Currently, most private sector players are preparing themselves by taking the partnership route with NPCIL (monopoly in nuclear power generation in India) and with international nuclear sector players to set up joint ventures (JVs) to make sure that they hit the ground running when the policies are changed to allow private sector participation in the Indian nuclear sector.

L&T, HCC, NTPC and BHEL seen to benefit

Regional analysis: Southeast Asia

While there is a growing awareness of, and urgency surrounding, the need to diversify the energy mix away from traditional hydrocarbons fuel sources such as natural gas and coal, the potential of nuclear energy will unlikely become a reality over the medium term given strong public opposition to the notion of nuclear energy and, in the case of Thailand and Malaysia, significant surplus power generation capacity.

The potential of nuclear energy will unlikely become a reality over the medium term in SEA

Thailand: According to Thailand's 15-year Power Development Plan (PDP), energy policy makers are targeting the completion of two 1,000MW nuclear power plants by 2022, as urgency mounts to diversify the country's fuel mix away from its heavy dependence on natural gas. According to data from Energy Policy and Planning Office (EPPO), in 2008 natural gas accounted for circa 70% of the aggregate power generation mix, and the electricity industry was responsible for more than 70% of overall natural gas consumption in Thailand in 2008. By 2022, nuclear energy is expected to account for 5.4% of the primary energy mix, and the contribution of natural gas is expected to decline 59%.

However, policy makers face serious opposition from environmental activists and NGOs who favour demand side energy saving programmes and the aggressive promotion of alternative and renewable energy through the country's SPP and VSPP programme over coal and nuclear-fired power plants.

Malaysia: Malaysia's new long-term energy policy is currently in the final stages of being drafted and, according to local press (*Business Times*, 8 September, 2009), energy policymakers could decide in early 2010 whether or not to proceed with nuclear energy. According to the *Business Times*, while visiting South Korea, Malaysia's PM Datuk Seri Najib Razak said that Malaysia is considering developing small nuclear reactors for industrial and daily use and that a small-scale nuclear reactor, generating between 200,000kW and 300,000kW of power, would be safe and could be set up near a municipality.

New long-term energy policy is in the final stages of being drafted

Malaysia's government wants to increase the use of renewable energy (RE) to reduce the country's reliance on key fuel sources of coal and gas. According to data from Malaysia's national utility Tenaga, in 2008 natural gas accounted for roughly 64% of Peninsular Malaysia's total generating mix, followed by coal (29%), hydro (7%) and oil-based generation. According to Energy, Green Technology and Water Minister Datuk Peter Chin Fah Kui, RE is targeted to account for 6%, or 1,000MW, of the total fuel mix by 2015, up from a meagre 0.91%, or 40.5MW, of current total electricity generation.

Malaysia's government wants to increase the use of renewable energy

The Philippines: Nuclear energy is somewhat of an exposed nerve in the Philippines after the country's first attempt at building a nuclear power plant remains as the biggest white elephant in the country's history and is seen, by many, as symbol of corruption and crony capitalism in the Philippines. Recently, in late 2008, faced with a looming power shortage and high fuel prices the debate to revive the Bataan Nuclear Power Plant once again resurfaced, after Korea's Kepco was reportedly interested in operating the plant — although there is little clarity over whether this is feasible.

Nuclear energy is somewhat of an exposed nerve in the Philippines

Indonesia: The basis for renewable energy development in Indonesia is Presidential Regulation No. 5/2006 on National Energy Policy (Kebijakan Energi Nasional). It sets national targets for an optimal energy mix in 2025, namely: 1) less than 20% from oil; 2) more than 30% from gas; 3) more than 33% from coal; 4) more than 5% from biofuel; 5) more than 5% from geothermal; 6) more than 5% from other renewables, especially biomass, nuclear, micro-hydro, solar and wind, and; 7) more than 2% from liquefied coal.

According to the country's National Energy Management Blueprint (2006) issued by the Department of Energy and Mineral Resources, Indonesia plans to construct four nuclear power plants each with an installed capacity of c.1.05GW for commercial operation in 2016, 2017, 2023 and 2024 at an estimated total investment cost of US\$6.6bn, or roughly US\$1.6mn/MW.

Given that there are no operational nuclear plants in the SEA markets that we cover, we believe local governments will likely look to North Asian nuclear players like Kepco and CLP to further their nuclear aspirations. For instance, according to local Philippine press (Philstar), the Philippine DOE has approached Kepco to establish the feasibility of — and potential costs associated with — reviving the Bataan Nuclear Power Plant, while Thailand has signed a MOU with CLP and China Guangdong Nuclear Power Group on nuclear energy development, according to Bloomberg (16 November, 2009) reports.

Indonesia plans to construct four nuclear power plants

SEA governments likely to look to North Asian nuclear players to further their nuclear aspirations

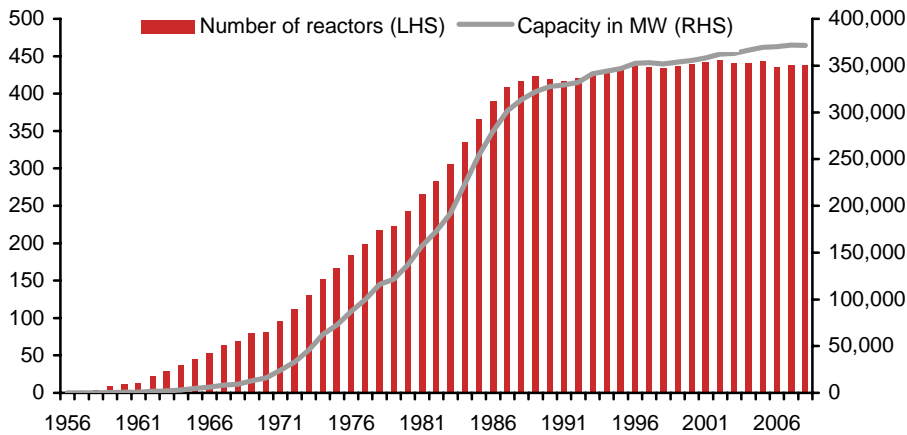
Global view on nuclear power

Background on nuclear power development

Nuclear power was first put to commercial use in the 1950s, and power capacity rose dramatically in the 1960s and 1970s. The CAGR of nuclear power capacity during the 1960s was 34.5% and 23.7% during 1970s. There are 435 nuclear power reactors in operation worldwide (as of December 2009), with total net installed capacity of 372GW.

There are 435 nuclear power reactors in operation worldwide

Exhibit 31. Number and capacity of nuclear power reactors, 1956-2006



Source: IAEA

The fast growth of nuclear power capacity in the 1960s and 1970s was led by the US after the idea of “turnkey” plants was introduced there in 1963. Westinghouse designed the first fully commercial pressurised water reactor (PWR) of 250 MWe, which was commissioned in 1960. At the same time, the first boiling water reactor (BWR), designed by General Electric, was also commissioned. Compared with fossil fuel plants, the guaranteed fixed price provided the plants with a competitive advantage.

Fast growth of nuclear power capacity in the 1960s and 1970s was led by the US