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SPECIAL REPORT

ELECTRIC POWER

What Next for Asian Power Generators?

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INTRODUCTION

The global economic crisis has affected electricity generators worldwide and nowhere more so than in Asia. The robust, often double-digit growth in power consumption that had been the norm for almost a decade was replaced towards the end of 2008 by a sudden contraction in demand throughout much of Asia.

This meant that generators whose twin priorities had been building new plants and finding the fuel to operate them were suddenly faced with the prospect of surplus capacity for the first time in years. And the overhang of capacity is expected to continue increasing in many Asian countries in the next few years as initially sluggish recovery in power demand is outstripped by the commissioning of generation projects which are already under construction or at an advanced stage of planning.

This is indicated by the Asian power generation project tracker published by Platts. Based on monthly data carried in the newsletter Power in Asia, the annual surveys from 2002 to 2008 show a rapid acceleration in the number and capacity of projects reaching key development milestones such as securing approval, signing engineering, procurement and construction or turnkey contracts, and starting construction.

For example, while projects with 36,000 megawatts (MW) of capacity were approved in 2002 the figure had more than doubled to 80,000 MW by 2008. And with 400,000 MW of new capacity being announced between 2005 and 2008 alone, it is apparent that a very large amount of capacity is moving through the project development pipeline towards eventual operation (Exhibit 1).

The emergence of surplus capacity is by no means necessarily a disadvantage. Many of the generators and governments whose main concern had been to play catch up with burgeoning demand and avoid power shortages now have the prospect of substantial reserve margins, giving them the opportunity to draw breath and plan for—rather than react to—future growth. And for fuel importers in particular, the slump in power station feedstock prices in tandem with international commodity prices is an unqualified benefit, for now at least.

The key question is how the breathing space will be used by Asian generators and the governments who in many cases own and in all cases regulate them. The current global situation may involve severe stresses for power sector players but it also offers considerable opportunities.

ASIAN POWER IN THE GLOBAL ENERGY MIX

These are not parochial matters. The directions taken by Asian generators and governments—not just on matters such as future fuel and technology choices, but also wider issues such as power market structure and ownership—will affect not only the future shape of the regional power sector but also that of the regional and global energy businesses as a whole.

This is because Asian electricity production accounts for a significant and growing share of regional and global energy consumption. And it accounts for an even larger share of the international trade in energy.

The rate of past and anticipated growth in Asian electricity production is well above the global level. According to data and projections carried in the reference case of the International Energy Agency's 2008 World Energy Outlook, Asian power generators used 25.6% of all Asian energy in 1990 with the figure rising to 38.3% in 2006 and being projected to reach 45.1% by 2030.

Exhibit 1: Project activity by year in Asia and Australasia, MW

Year	Announced	Approved	EPC Award	Construction	Operation
2003	50,466	35,949	17,551	35,390	13,043
2004	63,336	57,446	45,128	25,365	24,168
2005	103,906	59,302	32,209	19,217	64,500
2006	141,870	71,705	26,568	48,850	101,720
2007	106,553	62,501	49,170	31,064	112,102
2008	57,726	80,280	52,813	47,612	110,037

Note: The data refer to projects announced, approved, signing an engineering, procurement and construction or turnkey contract, starting construction, or entering operation in the particular year – not all projects up to that year.

Source: Platts Power in Asia

Moreover, while Asian generators used 6.5% of world energy in 1990 this more than doubled to 13.4% in 2006 and is projected to reach 19.5% of total world energy consumption in 2030, according to the IEA. The increase is expected to occur since Asian power generators' share of the global energy used for power production is projected to rise from 19.2% in 1990 to 46.3% in 2030 (Exhibit 2).

THE LEGACY OF 1997

One thing to bear in mind is that Asia's power generators have been here before. The 1997 Asian financial crisis may not have had the global dimension of the current crisis, but it had the same depth and inflicted the same pain across much of the region.

This is not to suggest that Asian generators and governments predicted the current crisis any better than their counterparts elsewhere in the world. But the strategies many of them adopted after 1997 have positioned at least some of them to recover more quickly.

The 1997 crisis was in many ways similar to the current crisis and had similar root causes, notable being uncritical lending to projects with marginal economics and borrowers who were poor credit risks. And the outcome was the same, with a sudden and sharp contraction of growth in economic activity and consequently in electricity demand. Asian tigers became paper tigers overnight.

The 1997 crisis came after several years of strong growth which had seen a large amount of generating capacity built to keep pace with demand. Much of the plant had been built by the private sector in the form of independent power producer (IPP) projects developed under the single buyer model, which was then seen as a half-way house between full state ownership and the eventual liberalization of the power sector.

The sudden halt to economic and electricity growth in 1997 left generators with a pipeline of projects under construction that turned into a large surplus of capacity as the crisis dragged on into the last years of the decade. With much of the new capacity comprising IPP projects predicated on the sale of their power on a take-or-pay basis at a relatively high price, the finances of the power offtakers, more often than not state-owned utilities, came under increasing pressure.

This was especially so as IPP power sales were typically priced in US dollars whereas the offtakers derived their revenues in local currencies either from state-regulated and more often than not below-cost retail electricity tariffs or from government subsidies. And the Asian financial crisis had resulted in many regional currencies being heavily devalued against the US dollar, exacerbating the problem.

The resultant pain was sometimes borne by the host utility and government, as in the case of Thailand, but often resulted in attempts to renegotiate the power sales tariffs within IPP power purchase agreements to share or shift the burden. These attempts were, however, often rebuffed by IPP developers backed by cast-iron contracts and themselves locked into loan repayments in US dollars or other hard currencies.

The outcome in countries ranging from Indonesia to Pakistan was a long, increasingly bitter process of negotiations that often ended up in international arbitration proceedings. The disputes took years to resolve and in one case, the Karaha Bodas geothermal project in Indonesia, only reached conclusion in 2008.

Exhibit 2: Asian generators' role in the regional and global market, million metric tons of oil equivalent

	1990	2006	2030
Asian power generators	572	1575	3298
All Asian energy use	2238	4111	7320
World generator energy use	2985	4424	7130
World energy use	8757	11730	17014
Asian generators as % of:			
	1990	2006	2030
All Asian energy use	25.6	38.3	45.1
World generator energy use	19.2	35.6	46.3
World energy use	6.5	10.4	19.3

Source: IEA World Energy Outlook 2008 (reference case)

THE POST-1997 LANDSCAPE

It is thus unsurprising that the 1997 crisis had a profound impact on the various players in the Asian power generation business. For instance many international investors, especially from the United States and Europe, withdrew from the region citing the high level of risk and disappointing returns. The pace of withdrawal was given impetus by the financial problems and competitive pressures many of the investors faced in their home markets from the early 2000s.

Those international developers and lenders who remained in the region became cautious about investing in any but the most robust projects in the most solvent and contractually-committed economies. Most of their investments tended to be made in consortium with local and regional partners with experience in the power sector or other tangible qualifications, rather than the more nebulous local partners chosen primarily for political connections who had been a feature of some pre-1997 deals.

For their part governments and host utilities also became more cautious. For instance competitive bidding of projects tended to replace direct negotiations with would-be developers in the choice of investors. And the offer of sovereign guarantees or other incentives to IPP developers became more sparing and conditional.

In much of Asia there was a government retreat from the idea of power sector liberalization and in particular the introduction of wholesale and retail competition. This was driven in part by the caution resulting from the 1997 crisis but also by the perceived failure of the process elsewhere, notably the California debacle of 2001. Soon after that, the upsurge in Asian economic activity and electricity demand pushed building additional capacity, rather than operating existing plant more effectively through a competitive market, to the top of the agenda.

The privatization of existing state-owned assets, which had been planned in several jurisdictions in the first half of the 1990s, also dried up in much of Asia after 1997, albeit for valuation as much as ideological reasons. Thus Singapore decided to abandon the sale of its generating assets in the face of weak market sentiment in the late 1990s, but did proceed with the introduction of one of the few competitive markets in the region. In the mid-2000s the government revived the sale of the generators, now operating in a partly-liberalized market, as regional acquisition activity and prices revived. It has now sold all three of its state generating companies.

The void left by the pull out of North American and European developers from the late 1990s has been filled in large part by regional and local players. These include traditional utilities from Japan, Hong Kong and elsewhere expanding into the same business areas overseas; trading houses, conglomerates, and infrastructure and financial investors, again from countries such as Japan and Hong Kong; and local IPP developers, the latter often facing saturated home markets and seeking opportunities in neighboring countries and beyond.

Typical of the latter is Malaysia, which saw the emergence of a large number of domestic IPP developers in the first half of the 1990s. With limited opportunities at home, and with the advantage not only of having operated IPPs but also of substantial experience in using Islamic finance, Malaysian developers have more recently looked to the burgeoning IPP market in the Middle East and in regional countries such as Indonesia.

Thailand's well-established IPP developers have also ventured abroad, investing in neighboring countries such as Laos and Cambodia to make up for limited opportunities at home. Thai investors are well placed as investors here since the main potential market for power produced in countries such as Laos and Cambodia is not at home but as exports to Thailand.

Some of the local and regional players investing overseas have sought not only IPP opportunities in countries offering better returns than their home markets but also experience of operating in competitive electricity markets. The acquisition of Australian assets and Singapore's Tuas Power by the China Huaneng Group was partly informed by this motive, while some Japanese and Hong Kong power companies have also invested in these assets.

But this is a minority trend, with most investors in the Asian generating business looking to invest in IPP projects rather than merchant projects involving commercial risk. This is not just a matter of choice but necessity—with the exception of Singapore, the Philippines and Australasia and, to a limited extent, South Korea and Japan, the Asian power sector is dominated by generating plants operating under the IPP model or directly owned by state power utilities.

A MOVE TO COMPETITION?

Will the dominance of the IPP-based market structure change and a more competitive model emerge in the Asian power sector? In the near term the answer is no, albeit a qualified no, in most of the continent. And even in those markets characterized by wholesale competition and some level of retail contestability, most generators act as retailers and physically hedge their risks, leaving little scope for financial trading.

The limited development of competition in part reflects the fact that there are few electricity transmission links between Asian countries or even within some of the main economies. And many of the region's power systems are relatively homogenous in terms of the type and cost of the power generators they are served by. These are not ideal conditions for the operation of a competitive generation market.

Moreover, where links between different countries or generation systems exist, the rules governing power exchanges and trading more often than not lack full transparency or remain to be formulated. And the difficulties are exacerbated by a central problem—the fact that retail power tariffs in many Asian countries are state regulated and in many cases do not match the cost of production.

But there are areas where competition may be introduced. For about a decade China has experimented with pilot projects for a competitive generation market, with the northeastern, eastern and southern grids hosting trial schemes. These trials mean that development of the rules and mechanisms needed for the introduction of a competitive market in parts of the country are in place or well advanced.

From 2003 the trials were, however, overtaken by the double-digit growth in electricity demand. This meant that the focus of state attention switched to building sufficient capacity to avoid power shortages—hardly the ideal circumstances for introducing a competitive generation market in any case.

Much the same applies to India, where legislation was enacted in 2005 to allow the introduction of competition among other market reforms. While several power exchanges and trading systems have since been established, they have been hamstrung by regulatory and direct political intervention. Most of the interventions have been driven by concerns that, given nationwide power shortages, the only upshot of competition would be higher prices that would be politically unpopular.

Vietnam is another country where plans have been elaborated for the long-term—in this instance meaning the mid-2020s—introduction of a fully liberalized power sector. But with annual power demand growing north of 15% for most of the decade, Hanoi's key concern to date has been securing the finance needed to build sufficient generating plants to catch up with demand.

The same applies to the Greater Mekong Subregion, an area where cross-border transmission links are being developed with support from multilateral and bilateral agencies such as the Asian Development Bank. In part the program has an eye to the future development of a competitive power market spanning the various countries and disparate power systems in the region, but this objective is very much a long-term goal.

It is thus arguable that the breathing space afforded by the current global crisis could lead to the eventual introduction of competition in more parts of the Asian power business. It may also stimulate greater competition in countries such as Japan and South Korea which have competitive market structures in place but have experienced little activity to date because of political and institutional constraints to implementing the process.

But for the most part progress will be slow. Nor will it occur across the continent as a whole with countries such as Indonesia, Thailand and Malaysia facing constitutional or entrenched political constraints to power sector liberalization.

And as always, the elephant in the room of the Asian power market is the below-cost retail electricity tariffs —often involving cross subsidies between different customer groups—that apply in much of the continent. Without the resolution of these problems, competition and its benefits for consumers will remain a distant prospect.

FUELING FUTURE CAPACITY

As already noted the burgeoning growth in electricity demand from the early 2000s pushed the construction of new capacity to the forefront of generator and government concern. The immediate headache was financing the capacity, with that concern usually being resolved by utilities and governments remaining committed to IPP or state-owned plants whose funding was underpinned by long-term power purchase agreements or direct state subventions, respectively.

However, the choice of fuel and thus technology became of increasing concern as international energy prices began spiraling upwards from the mid 2000s. This affected not just power producers dependent on fossil fuel imports but also those using indigenous feedstock priced against international benchmarks or affected by increasing production costs.

The increasing price of energy affected not just the cost of operating plants but also of building them. Thus developers in countries ranging from Laos to Saudi Arabia faced project cost increases as concrete and steel prices rose by 50% or more in 2007 and the first half of 2008. Contractor costs also soared, both because of more expensive material and labor inputs and the limited number of eligible contractors compared with the burgeoning number of projects under development.

GAS-FIRED CAPACITY

But the real concern for much of the second half of the 2000s was less the one-off cost of building the plants than securing fuel to operate them for thirty years or more. Gas-fired projects based on both pipeline and liquefied natural gas (LNG) supplies were particularly affected. With oil-linked gas prices soaring and becoming more volatile from 2005 there was a slump in gas-fired projects in much of the region while oil-fired plants, already limited primarily to small generators serving isolated grids, became even more marginal in the overall Asian market.

The decline of gas is apparent from the Power in Asia project tracker. This indicates that gas shifted from being the preferred option in the early to mid 2000s to the fuel of last resort in most jurisdictions by 2007 against the background of tightening gas supply combined with substantial price hikes and volatility.

For example in 2004 the 24,442 MW of announced gas-fired capacity covered by the tracker accounted for 39% of the total capacity announced in Asia during the year. But by 2007 there was only 5,525 MW of announced gas-fired plant, accounting for only 5.2% of the total capacity.

The malaise continued further down the project development pipeline the following year. In 2008, only 2,519 MW of gas-fired plant was listed as having secured approval – a mere 3.2% of the total (Exhibit 3).

For the short term at least, there is thus likely to be a dip in the proportion, if not the overall level, of Asian gas-fired capacity and output.

According to IEA data, in 2006 Asian and Australasian gas-fired generators produced 797 TWh or 12.5% of the region's total electricity production. The 209,000 MW of gas-fired plant operating in 2006 accounted for just over 15% of the total stock of regional generation capacity.

The share of gas-fueled generation in total Asian and Australasian electricity output is projected by the IEA to fall to 9.6% in 2015, although actual production is projected to increase to 976 TWh. Similarly, while operating capacity is projected to increase to 267,000 MW, it is expected to fall in percentage terms to 12.1% of total plant in that year.

This may appear to be bad news for the international gas trade since Asia, and within it Asian generators, are the main consumers of LNG and the target market for many of the proposed new LNG and cross-border gas pipeline projects. Asian purchasers accounted for 65% of world LNG trade in 2007 (Exhibit 4).

But gas capacity and use is still projected to rise in absolute if not percentage terms. The IEA reference case projections imply that 53 million metric tons of oil equivalent per year more gas will be used by Asian generators in 2015 than in 2006, although the forecasts were prepared before the global economic crisis took full hold. This represents a substantial amount of new gas production capacity, much of which is likely to comprise LNG export projects in the Middle East, Australia, and possibly Papua New Guinea, as well as Central Asian gas pipelined from Turkmenistan and elsewhere.

COAL-FIRED GENERATION PROSPECTS

The anticipated decline in the share of gas-fired capacity means that coal looks set to consolidate its commanding position in the Asian power sector. Because of its dominant role in China, India, and Indonesia, backed by its lesser but still key position in the power sectors of Japan, South Korea, Taiwan, Australia and elsewhere,

Exhibit 3: Asian and Australasian activity by fuel in 2008, MW

Fuel	Announced	Approved	EPC Award	Construction	Operation
Coal	23370	54332	30353	21723	66440
Gas and oil	6385	2519	10464	1847	11658
Hydroelectric	6273	6921	6960	9123	22751
Nuclear	16340	13230	3700	10213	220
Renewable	5358	3278	1336	4706	8968
Total	**57726**	**80280**	**52813**	**47612**	**110037**

Note: The data refer to projects announced, approved, signing an engineering, procurement and construction or turnkey contract, starting construction, or entering operation in the particular year – not all projects up to that year.

Source: Platts Power in Asia

Exhibit 4: Asian role in international LNG trade in 2007, billion cubic meters

Seller/buyer	China	India	Japan	Korea	Taiwan	Total Asia	World
Qatar	-	8.27	10.87	10.79	0.57	30.50	38.48
Malaysia	-	0.07	17.65	8.15	3.92	29.79	29.79
Indonesia	-	-	18.07	5.12	4.55	27.74	27.74
Algeria	0.42	0.44	0.78	0.24	0.14	2.02	24.67
Nigeria	0.08	0.64	0.88	0.24	0.23	2.07	21.16
Australia	3.30	-	16.05	0.56	0.33	20.24	20.24
Trinidad	-	0.21	0.57	0.22	-	1.00	18.15
Egypt	-	0.07	1.62	1.48	0.41	3.58	13.61
Oman	0.07	0.21	4.81	6.74	0.21	12.05	12.17
Brunei	-	-	8.57	0.78	-	9.35	9.35
UAE	-	0.07	7.41	0.07	-	7.55	7.55
USA	-	-	1.18	-	-	1.18	1.18
Eq. Guinea	-	-	0.36	-	0.56	0.92	1.42
Total	**3.87**	**9.98**	**88.82**	**34.39**	**10.92**	**147.98**	**226.41**

Source: Cedigaz

the fuel accounts for more than half of all Asian and Australasian generating plant and more than 60% of the region's power output.

In 2006 coal-fired capacity totaled 668,000 MW, accounting for 48% of all Asian and Australasian generating plant according to IEA figures. Since most of the capacity operates on baseload, the 3,763 TWh of coal-fueled output accounted for almost 60% of total electricity production in the same year (Exhibit 5).

Since then the share of coal-fired capacity and generation has increased markedly. Based on the project tracker data, Platts calculates that at least 140,000 MW of coal-fired plant was commissioned in Asia and Australasia in 2007 and 2008 alone, accounting for 63% of the 222,140 MW of total capacity installed in the two years.

The increase was in large part the result of a massive power plant building program in China from the mid-2000s. The official China Electricity Council has said that total grid-connected capacity increased to 792,530 MW in 2008, when more than 80% of the 3,426 TWh of total electricity supply was produced from coal. More than 90,500 MW of predominantly coal-fired capacity was added in 2008 following a 10.3% increase in 2007 and a 15% increase in 2006.

Exhibit 5: Asian and Australasian electricity output by fuel, TWh

	1990	2006	2020	2030
Coal	985	3763	7672	9553
Oil	431	361	306	256
Gas	258	797	1141	1638
Nuclear	294	568	992	1196
Hydro	408	805	1381	1710
Renewable	23	76	406	772
Total	**2399**	**6370**	**11898**	**15125**

Source: IEA World Energy Outlook 2008 (reference case)

While China has driven the increasing concentration on coal it is far from alone. From the mid 2000s coal became the fuel of choice in jurisdictions across the region.

One example is Cambodia, which had under 400 MW of mainly oil-fired capacity in 2006, with the plants being spread across more than twenty isolated grids. But in the same year, a group of Thai investors proposed building a 3,660-MW coal-fired plant in the Koh Kong region predicated on the sale of its output to Thailand. A number of other investors also proposed coal-fired plants based on either local use or export of the power.

Another case is Vietnam, whose 2006 power development plan proposed in one of its scenarios the potential construction of up to 118,000 MW of coal-fired capacity by 2025. Some of this would be fueled with indigenous coal from the established northern coalfields and prospective fields in the Red River delta, while other plants would be fired with imports.

Coal was seen by these and other countries as a better fossil fuel option than gas in terms of its potential cost and volatility because of the fuel's reserve base and geographical spread. There are substantial indigenous coal resources in countries such as China, India, Vietnam and Australia, combined with a range of established international suppliers with a proven track record of exporting to markets such as Japan, Malaysia, Philippines, South Korea, and Taiwan.

But the sheer amount of indigenous and especially imported coal-fired plant proposed in the various Asian markets in the past few years has raised question marks over the ability of either local producers or exporters in Australia, Indonesia, and South Africa to meet the rapid projected growth in demand. The scale of the task can be gauged by the fact that in 2008 some 78,145 MW of coal-fired capacity was announced, according to Platts data, implying additional coal requirements of 150 to 250 million mt per year just for these plants alone.

Not all of the planned coal-fired plant will be built, at least in line with the original timetable, and it is likely that the more economically marginal projects will be scrapped altogether. For example several coal-fired projects in the Philippines have been postponed or cancelled since the onset of the global economic crisis.

Even so, coal-fired output and capacity will necessarily increase, and substantially so. The IEA reference scenario envisages that 6,512 TWh of coal-fired electricity will be produced in 2015 from 1,200,000 MW of capacity, and with subsequent growth to 9,553 TWh and 1,860,000 MW projected by 2030 (Exhibit 6).

The global economic crisis may defer the time at which these levels are reached but, given the limited alternatives and the need for the power, it is not a question of whether but when coal-fired generation reaches these levels. Sourcing the coal to fuel the plants and coping with the resultant greenhouse gas emissions will be gargantuan tasks and represent one of the key challenges facing Asian policymakers in the coming decades.

Exhibit 6: Asian and Australasian generating capacity by fuel, GW

	2006	2020	2030
Coal	668	1200	1860
Oil	124	130	94
Gas	209	267	418
Nuclear	80	120	151
Hydro	281	411	572
Renewable	26	79	253
Total	**1388**	**2207**	**3348**

Source: IEA World Energy Outlook 2008 (reference case)

NUCLEAR PROSPECTS

One of the main solutions to avoiding excessive reliance on coal-fired plant in Asia was a resurgence of interest in nuclear power in the second half of the 2000s. As the number of coal-fired plant proposals burgeoned and coal prices increased from 2006 onwards, power companies and government policymakers throughout the region expressed increasing interest in the nuclear option.

Nuclear power is already well established in the Asian power sector, with reactors accounting for a substantial amount of baseload capacity in the electricity supply systems of jurisdictions including Japan, South Korea and Taiwan. There are also long-established programs and operating plants in countries such as India and China. Asia accounted for 21% of the world's operating reactor capacity and 58% of constructing plants at May 1, 2009, according to the World Nuclear Association (WNA).

From the mid 2000s the existing Asian nuclear power producers announced plans for a very substantial increase in new capacity. There was also an upsurge of interest in joining the nuclear club among other regional countries. Indeed, national data collected by the WNA indicate that 64% of the 131,145 MW of planned and 47% of the 299,405 MW of proposed reactors up to 2030 will be built in Asia (Exhibit 7).

Notable among the countries planning a step increase in their nuclear capacity are China and India. Since 2006 Chinese power companies have proposed the construction of a succession of projects not only in the southern and eastern coastal provinces that host existing capacity, but also in the less-developed inland provinces and other parts of the country.

Together with the agreement of several high-profile deals with international equipment vendors, the plans mean that China is now looking at a much-expanded nuclear program. By 2030 up to 35,320 MW of planned and 94,000 MW of proposed reactor capacity could join the 20,687 MW of operating and constructing plant, according to the WNA.

Meanwhile India has signed a ground-breaking nuclear agreement with the United States after a tortuous negotiating process. The agreement could lead to the installation of 27,715 MW of plant by 2030, according to the WNA.

Among the nuclear aspirants are countries ranging from Abu Dhabi to Vietnam, and Indonesia to Thailand, with very few countries across Asia not having expressed an interest, however optimistic, in building nuclear power plants. In most of these countries the first nuclear reactor is unlikely to be commissioned before the early 2020s, although several countries are seeking the fast-track construction of their first reactor for operation from the second half of the 2010s.

Exhibit 7: Asian nuclear reactor plans to 2030, MW

	Operating	Construction	Planned	Proposed
Bangladesh	-	-	-	2000
China	8587	12100	35320	94000
India	3779	2976	9760	11200
Indonesia	-	-	2000	4000
Japan	46236	2285	17915	1300
Korea, North	-	-	950	-
Korea, South	17716	5350	9450	-
Pakistan	400	300	600	2000
Thailand	-	-	2000	4000
UAE	-	-	4500	15500
Vietnam	-	-	2000	8000
Asia	76718	23,011	84495	142000
World	372220	39948	131145	299405
Asia (%)	21	58	64	47

Source: World Nuclear Association (May 1, 2009)

While nuclear power has the potential to contribute a significant amount of new capacity from the 2020s it will still represent a relatively small proportion of overall Asian capacity. Less than 1% of total generating plant will be nuclear in 2030, according to the IEA World Energy Outlook reference case.

Nuclear could, however, play a key role in displacing existing or planned imported coal-fired baseload capacity in some countries, such as South Korea, thus possibly exerting a disproportionate impact on regional trading patterns. There will, however, be little near-term impact in this regard.

This largely reflects the high unit capital cost and long lead times needed to build nuclear plants. Investment costs usually easily exceed $2,000/kW, while the time taken from project announcement to commissioning is often longer than a decade.

HYDROELECTRIC OPTIONS

The same issues affect hydroelectric plants, which currently account for about 20% of total Asian and Australasian generating capacity and produce about 13% of regional electricity output. Projects take a long time to implement and have a high unit capital cost, especially where resettlement and other social costs are included in the overall investment program.

Also in common with nuclear plants, hydroelectric projects can face opposition from local and environmentalist groups. The potential impact of hydroelectric dam projects on water availability and flows may also raise concerns about water shortages or disrupted irrigation and flood control systems among communities or even countries downstream from the plant.

All this means that hydroelectric capacity is unlikely to increase its share of the overall Asian generation mix, with the IEA projecting that the 20% of total capacity applying in 2006 could fall to 17% by 2030. The hydroelectric contribution of 13% of regional electricity output in 2006 is similarly projected to fall to 11.3% in 2030, in both cases in the reference case of the 2008 edition of the World Energy Outlook.

Hydroelectric projects may, however, still play an important role in the evolution of a more integrated Asian power sector. Several of the main proposals to create regional grids, for instance within South Asia or the Greater Mekong Subregion, are predicated on the construction of large hydroelectric plants.

The projects often center on the export of electricity to power-starved areas, for instance in India, from countries such as Nepal or Bhutan with undeveloped economies and low per capita income. The projects are thus often driven by wider economic and social goals.

But several of the projects also envisage the development of power trading through the creation of larger grids hosting generating plants with diverse technology and offering different seasonal availability of power. For instance, power produced from Himalayan hydroelectric plants may complement local coal-fired generation in Indian grids served by cross-border or inter-regional transmission links.

RENEWABLES ON THE MOVE

Smaller run-of-river projects raising fewer environmental concerns will also account for an increasing, if still relatively small, proportion of future Asian hydroelectric capacity. In an increasing number of cases these projects, in common with other renewable energy plants, are being developed with one eye on funding from the sale of carbon credits.

Carbon credits, or more properly certified emissions reductions, are available if a project secures registration under the clean development mechanism (CDM) of the Kyoto Protocol. The scheme is relatively new, with most projects being small and with the status of the program after the expiry of the Kyoto Protocol being uncertain. But the availability of carbon credits as an additional source of funding has been one of the drivers behind the recent very rapid growth in the amount of Asian renewable energy capacity, albeit with the increase starting from a low base.

Carbon credit funding applies to some gas-fired generation projects as well as renewable energy-based schemes such as wind, solar, biomass-fired and small hydroelectric projects. The gas-fired projects securing registration have included several large-scale Chinese and Indian LNG-fired plants—whose output is deemed to displace electricity that would otherwise be produced from coal-fired facilities—as well as generating plants

fueled with landfill methane, coalmine methane and the waste gases produced by industrial plants such as blast furnaces. But renewable energy projects have been among the main beneficiaries of the CDM program.

While there are other types of CDM projects, power generation plants are one of the largest and fastest growing recipients of carbon credits. And among the power generation plants the great majority are located in Asia and, within Asia, the overwhelming majority of the capacity is currently found in China (Exhibit 8).

Renewable energy currently accounts for a very small amount of total Asian generating capacity and, even with the likelihood of very rapid growth over the next two decades and beyond, is expected to remain a minor contributor to the overall generation picture. Renewable-based projects will also for the most part only be economically viable if they receive special financial provisions, including premium feed-in tariffs within long-term sales contracts, as well as carbon credits.

But the limited share projected for Asian renewable energy-based generation capacity by the IEA and other forecasters does reflect the very low starting point. And even if the renewable sector accounts for only a small proportion of overall future capacity, it is clear that Asia could be a key market for many renewable energy technologies. This includes not only well established systems such as wind turbines but also less established systems such as tidal and wave energy plants.

Exhibit 8: Asian generation projects securing CDM registration by quarter, MW

	1Q08	2Q08	3Q08	4Q08	1Q09
Hydroelectric	498	777	177	886	3667
Wind	250	361	205	1335	1612
Natural gas/LNG	3143	-	1850	-	3044
Coalmine methane	-	-	30	31	22
Landfill gas	-	3	8	5	19
Waste energy/gas	421	33	284	788	335
Biomass/biogas	90	120	10	48	76
Total	**4403**	**1293**	**2563**	**3092**	**8775**
China	3678	1016	2535	2746	8128
India	708	220	19	323	474
Other Asia	17	57	10	24	173

Source: Platts (based on individual project data from the United Nations Framework Convention on Climate Change)

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