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Quarterly



Energy, resources and food

Fatih Birol Benefits of being Asia's next-door neighbour

Jack Barnes and Suman Bery The case for greater energy cooperation

Kejun Jiang China's energy security strategies

C. Peter Timmer Agricultural transformation

Katherine Morton China's positive stance on global food policy

and more . . .

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From the Editors' desk

In this issue we address one of the most important concerns in Asia: security over natural resources or about how to ensure we have sufficient food, water, energy, and other resources at an accessible cost and within tolerable levels of risk now and into the future.

The need for a stable food supply, at reasonable prices, has resulted in a much greater focus on 'basic' security needs in terms of the future adequacy of food and water. At the same time, the world is experiencing an energy transformation with adoption of new technologies in unconventional fossil fuel production and renewables and a shift of importance to Asia in terms of future energy demand.

The OECD projects that the global demand for water resources will grow by at least half by 2050 relative to 2000 levels while global food demand is expected to double over the same period. Yet climate change models project that there will be increased climate variability that will likely exacerbate food and water supply shocks.

While domestic resource self-sufficiency is appealing, very few countries have the energy, minerals, land or water resources to provide for their own projected needs. The evidence in this quarterly suggests that support for multilateral institutions, investment mobility, research and development for basic research, effective resource management and international trade are key factors to manage resource security risks.

Managing resource risks in an insecure world will differ by country, the type and possible magnitude of the risks, and national, regional vulnerabilities. Nevertheless, the multi-dimensional nature of resource security demands that critically important natural capital stocks be conserved at a regional and global level and that special consideration be given to the particular vulnerabilities of poor countries while following market-based approaches to ensure adequate resource supplies.

Whatever the national approach adopted towards resource security, we stress that promoting resource security is not a zero-sum game. All countries can benefit from a multilateral and a sustainable market framework that provides incentives for producers and delivers reliable supply to consumers.

Quentin Grafton and Tom Kompas

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Agricultural transformation

C. PETER TIMMER

FOOD security is not a viable social objective unless it is also a profitable undertaking for input suppliers such as fertilizer and seed dealers, farmers who grow the crops and the traders, processors, wholesalers and retailers who market the output. Consumers must then be able to afford to purchase this food, secure in the knowledge that it is safe and nutritious. Achieving food security within the constraints of a complex economic system is challenging because both poor consumers and small farmers must be effective participants in this system.

Although the task of achieving food security is challenging, it can be understood in the context of the long-run dynamic evolution of food

systems, especially the rice-based systems of Asia. The emphasis is on both 'long run' and on 'dynamic,' because the Asian food economy has deep cultural roots and thus historical continuity and accompanying resistance to change. At the same time, Asian food systems are changing extremely rapidly, driven by economic growth and technological innovation. An analytical lens with an historical perspective is needed to understand this combination of continuity and change, and the structural transformation of an economy during the process of modern economic growth provides that lens.

The patterns of structural transformation that accompany long-term economic growth have been remarkably uniform across more than two centuries of modern growth:

rising productivity in the agricultural sector stimulates overall economic growth, and this reduces agriculture's relative contribution to GDP, and the proportion of the labour force that works in the sector. In turn, this leads to a commensurate rise in the share of modern urban and industrial service activities. The migration of rural workers to urban settings allows this transformation to take place. It is closely associated with a demographic transition characterised by rapidly falling mortality rates, slowly falling fertility rates and a subsequent period of rapid population growth which offers a 'demographic bonus' when dependency rates drop to low levels.

The basic cause and effect of the structural transformation is an increase in the productivity of agricultural labour, which can take

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COVER PHOTO: Smoke billowing from a power station in Shenyang, north-eastern China. The country's energy consumption has grown rapidly in the past decade. Picture: Wei Leung / EPA / AAP.



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place in three ways. The first is through an agricultural revolution, which happens when new technology makes it possible to increase output for a given amount of labour. The second and related pattern of structural transformation is the classic Lewis model of development, which allows agricultural workers to migrate to other occupations without lowering total farm output, so that the output is shared among fewer rural people. The Lewis model of development is often related to an industrial revolution. The third and last way of raising labour productivity in agriculture is through higher prices for agricultural output or a price revolution. Over the past two centuries real agricultural prices have declined, but the high prices experienced since 2007 may mean a reversal of that historical trend, with an accompanying slowdown in the rate of poverty reduction.

There are almost always stresses on the poor during periods of structural transformation. Even when absolute poverty is falling, as it typically does during rapid economic growth, the distribution of income—especially between rural and urban areas—usually worsens, challenging policymakers to take corrective action. These corrective actions can take the form of agricultural protection and widespread subsidies to farmers. The net result is higher food prices, and these often worsen urban and rural poverty because most of the poor must purchase their food in markets. A dynamic rural economy stimulated by genuine growth in productivity has favoured the poor in all circumstances. In contrast, a rural economy with farm profits stimulated by protection tends to hurt the poor in both the short and long run because many are left in pockets of poverty.

Much has changed in Asian food

systems over the past half century. In the first place, there was a broad political mandate in Asia to feed both urban and rural populations—a mandate not seen as clearly in much of Africa. Food security has become politically important in recent decades.

A technological revolution in rice and wheat farming was coupled with reasonably good policies to support efficient input and output marketing by a competitive private sector, and public investments in rural infrastructure to make this mandate (largely) possible. Investments in irrigation and drainage were critically important for crop productivity and had a stabilising effect on yields of rice and wheat. Rapid, inclusive economic growth resulting from the technological revolution gave most Asian households access to the food in their fields and markets.

The structural transformation caused by—and resulting from—economic growth has also changed Asia in other ways, for instance by changing the role of rice in the economy. Asia is now a richer, more urban and better-connected region, both within each country and across borders, and it is much better fed.

The changing role of rice in Asia's food security is both a driver and a result of the structural transformation going on in Asia's dynamic economies. Rice is increasingly the food of the poor—even middle-income households are rapidly diversifying their diets. This has significant

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implications for poverty if countries use high rice prices as a mechanism to guarantee 'macro' food security, which is often equated with stable rice prices in key urban markets, and a high level of self-sufficiency in rice, both of which are easier if rice-importing countries maintain high rice prices. But a high price strategy puts 'macro' food security at odds with 'micro' food security, that is, access by poor households to adequate food, and thus is in contrast to a productivity strategy, where both work together.

The share of rice in caloric or energy intake is falling rapidly. Asia now reduces its rice consumption when incomes increase (which is why rice consumption is increasingly concentrated among the poor—they still cannot afford to diversify their diets away from rice). Also, rapid rural-to-urban migration lowers per capita rice consumption quite sharply, both because energy requirements are lower in urban occupations,

and because urban food markets offer a wider diversity of choices. Not surprisingly, better-connected food systems mean that rural households can be less self-sufficient in food production and consumption, especially of rice. At the peak of the Green Revolution in the early 1970s people in Asia obtained an average of 40 per cent of their calories from rice, but that share is now below 30 per cent and falling. Consumers in Asia now get about 70 per cent of their calories from other commodities, including animal products, fruits and vegetables, and wheat products. On average, they spend only about 10 per cent of their food budget on rice (although the figure is roughly double that for the poor). In other words, 90 per cent of food expenditures in current-day Asia are for non-rice commodities and for the value added to those commodities beyond the farm. Modern supply chains add that value at the same time that they coordinate the transactions,

investments and technologies that generate it. This modernising food marketing system influences food security in Asia in direct and indirect ways. Following the changing patterns of rice consumption, the share of rice in agricultural output and in the overall economy is also falling rapidly.

The big question for the future of Asia's food security is about the role of smallholder farmers. How can policymakers learn what works for small farmers? How can farmers get their output to demanding consumers more efficiently? And how can this be accomplished on an economy-wide scale? Historically, only market processes have been scalable, but these market processes do not necessarily care whether small farmers survive or poor people get enough to eat. 'Scalability' is the Holy Grail of development assistance, which has struggled to successfully move from bureaucratically driven local projects to institutionally driven programs, and from there to market-driven policies with economy-wide impact.

Meeting these new challenges demands a high degree of knowledge. Food security requires an analytical and empirical understanding of what is happening to the food economy in both the short run and the long run, at both the micro and macro levels, and translating that understanding into effective policy action. Good food policy analysis does not guarantee that good policies will be designed and implemented, but it is virtually impossible to implement such policies without good analysis. **EAFO**

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A rice crop being harvested in Guangxi province, China, this year. Rice consumption in Asia falls when incomes rise. Migration to urban centres also reduces demand for the staple.

PICTURE: AP IMAGES / AAP

Balancing industrial demand and energy supply

ARUNABHA GHOSH

CONSIDER this: in 2009 the average Indian used 560 kg of oil equivalent (kgoe) of energy—half the usage of the average Brazilian (1,243 kgoe), one-third that of the average Chinese (1,695 kgoe), and one-twelfth that of the average American (7,051 kgoe). Similarly, the average Indian consumed just 571 kilowatt hours (kWh) of electricity, compared with 2,631 kWh used by the average Chinese and 12,914 kWh by the average American.

Why does low energy use per person matter for India's industrial development? For a start, energy access is closely associated with progress in human development. India's large, youthful population cannot become the foundation of the country's economic growth if its education is hampered by unreliable (or absent) power supplies, or its health endangered by exposure to polluting traditional fuels at home. Moreover, low levels of energy use usually reflect low levels of energy supply—meaning that in India's energy-constrained economy, industry is competing for limited resources with several segments of society, not least an aspirational middle class.

Indeed, final energy consumption (defined as the total energy consumed by end-users such as households, industry and agriculture, but excluding the energy sector itself) is dominated by the residential and industrial sectors, the former taking a slightly larger share of the total energy pie

(34 per cent versus 33 per cent for industry). Not only is electricity generation heavily dependent on coal, industry consumes more than 90 per cent of coal used in final energy consumption, a third of natural gas and a fifth of oil products. Coal makes up nearly half of industry's final energy consumption total of 163.3 million tonnes of oil equivalent (mtoe) (see Chart 1).

Competition for energy supplies will intensify over the next few decades. According to the International Energy Agency, India's 2009–2035 energy demand will show the world's highest growth rate. A dominant user of almost all energy sources, the industrial sector will feel the most pressure. The services

sector—including hotels, transport, communications, finance, real estate and business-related facilities—and the agricultural sector, increasingly dependent on groundwater pump sets for irrigation, will be feeling the pressure too.

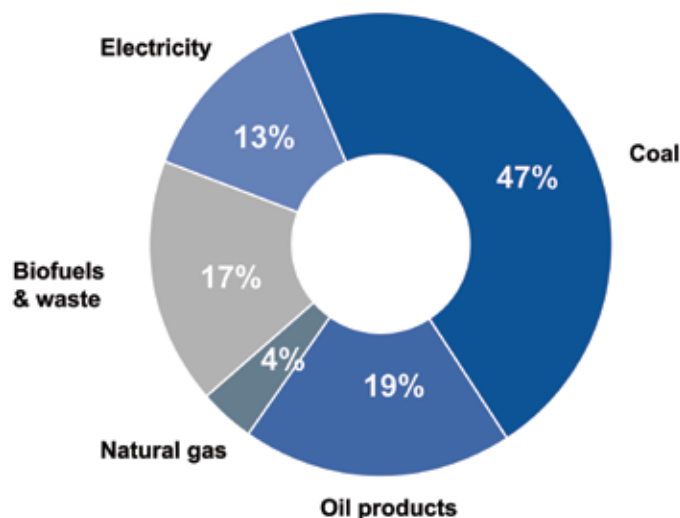
Government planning is expected to sharpen demand in the energy-hungry industrial sector.

The National Manufacturing Policy sets the lofty ambition of increasing manufacturing's share of national income from about 15 per cent currently to 25 per cent by 2025, creating 100 million jobs. But the policy does not spell out the energy resources needed to realise this vision.

Industrial sub-sectors clamouring for energy include iron and steel (16

Chart 1: Final energy consumption by industry

(%, fiscal 2010, ended March 31st 2011)



Source: *Energy Statistics 2012*, Central Statistics Office, Government of India

per cent of final energy consumption), and transport equipment (about 7 per cent). But a large chunk (65 per cent) of final energy consumption is classified as 'non-specified', and measures of energy use across different sub-sectors is also lacking in places. Clearly, there is a need to improve data collection and analysis to prepare for changing patterns of energy demand and usage.

The Planning Commission of India's 2006 estimates projected a primary energy demand in 2032 of 2,043 mtoe, a three-fold increase over current supply. However, future energy supply is unlikely to meet that demand.

Firstly, domestic production of critical primary energy products has been slowing. Crude oil production has remained flat for the past decade, and natural gas output is falling short of expectations, increasing barely 1 per cent annually since 2005. Even coal, of which there are abundant reserves, suffers from low growth rates primarily because of extraction difficulties. As a result, India's net imports of key energy sources are climbing—crude oil imports jumping 10.5 per cent annually since 2005, coal imports by 12 per cent.

Secondly, infrastructure is inadequate. While coal imports are expected to increase by 286 per cent between 2010 and 2016, only four major ports handle coal and are located along the eastern coast, close to where most power plants were historically located. But now some of the ultra-mega power plants are being constructed in the western states, where an industrial corridor between Delhi and Mumbai is also being planned. New railway freight lines or more port facilities will be needed along the western coast, or both.

Likewise, the largest terminals for importing oil and liquefied natural

Ultimately, energy demand for industry cannot be viewed in isolation, at the expense of critical human development priorities of energy access and overall economic growth

gas are along the west coast (closer to West Asian sources). But new sources of oil and gas from Southeast Asia and further afield will require infrastructure development in the east too. Finally, investments in grid infrastructure have long lagged behind a supply-side focus on electricity generation, not only in transmission and distribution networks but also in staffing, training, modelling and scenario planning crucial to the management and efficiency of a national grid.

Given the yawning gap between energy demand and supply, it appears that industry is walking an energy tightrope if plans for rapid expansion go ahead. What are the prospects for balancing industrial energy demand with energy supply?

Under one scenario, the problems are simply ignored. There is no strategic approach taken, nor is there a process to secure access to resources. Here, the best case would be for industry to grow to the extent of available energy. Power plants might have to write down usable capacity based on fuel availability,

and heavy industries might limit their production. A worse outcome would be a reversal of investment trends. Manufacturing and job creation would stumble, and the share of industry in the economy could stagnate or decline.

A second scenario envisages industry internalising and taking the lead in securing access to captive energy sources. Energy from these sources could be via allocated coal blocks or captive generation of electricity. Industry also might seek private and exclusive access to other energy sources, such as building natural gas terminals and re-gasification facilities. A benign outcome would be an increase in energy efficiency in the form of either lower consumption, because of higher energy costs, or better management of resources by the private sector. A less desirable outcome would be heightened corruption and opacity in the awarding of contracts and resource blocks—already a concern. There could be increased demand for (polluting) diesel fuel for captive electricity generation, say, in small- and medium-sized plants. This in turn would skew energy governance even further, as both industry and agriculture would continue to expect inefficient subsidies on diesel and certain other fuels.

A third scenario proposes that the energy challenges will spur innovation. At a policy level, initiatives would focus on energy efficiency. For instance, the recently launched Perform, Achieve and Trade scheme for energy efficiency certificates could be expanded. More importantly, the scheme could offer incentives to increase energy efficiency in plants and along the entire production process. Giving support to energy efficiency in small- and medium-sized enterprises would be another

approach. That said, energy efficiency would only ease some of the pressure, as the energy saved would be supplied to other firms.

Policy innovation involves appropriate energy-resource mapping for all sectors to anticipate and prepare for potential vulnerabilities in physical supply or fluctuating energy prices. This approach might push for rationalising energy supplies and reducing, removing or narrowing the subsidies that badly distort India's energy market. Innovation could also occur in the energy infrastructure and supply chain. This would include more port capacity, new rail freight corridors or transmission lines, investment in software for energy management, training of grid operators, and building up a parallel 'soft' energy infrastructure. Energy-management innovation could also be found in new technologies.

Ultimately, energy demand for industry cannot be viewed in isolation, at the expense of critical human development priorities of energy access and overall economic growth across all sectors. The approach that industry takes to address its energy management issues—ignore, internalise or innovate—will determine Indian industry's development at an economic, environmental, social and political level. It has little choice other than to manage its energy supply in a sustainable way. **EAFQ**

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Securing the region's energy and resources

MIKE HENRY, ANDREW KENNEDY AND PETER DRYSDALE

EAFQ: How important is access to raw materials for Asia's economic outlook?

Mike Henry: Reliable supply of commodities remains an essential underpinning to continued economic development in Asia. Notwithstanding slowing GDP growth in China from double-digit levels to an average of around seven or eight per cent per annum, absolute growth of the Chinese economy in the decade ahead is still expected to be roughly twice that of the past 10 years. Elsewhere in Asia other developing economies are also expected to continue to climb the economic ladder. All of this economic activity will require substantial quantities of raw materials. Those commodities in greatest demand will shift as China progressively transitions from early-stage economic development to a middle-income economy, but in general annual demand for commodities is expected to grow by 50–80 per cent over the next decade and a half.

This begs a couple of important questions. From the perspective of those nations that need raw materials to fuel their growth—how best to

ensure sufficient raw material inputs on as economic a basis as possible? From the perspective of commodity-supplying nations—how best to capture the opportunity?

EAFQ: How do the interests of the commodity consumers and the commodity suppliers relate to each other?

Mike Henry: The interests of both parties here are absolutely aligned. Those that need the raw materials will benefit from timely, reliable additions of new low-cost supply. Those on the supply side can be assured of capturing the opportunity only if they are able to expeditiously develop new supply capacity to fill the market need. These mutual interests will be best served with the provision of a transparent and reliable outlook for demand; transparent and efficient markets; and supply-side policies that facilitate the economics, speed and reliability necessary to develop and maintain projects.

New supply requires capital investment, and in some instances the size of the individual investments required are very large indeed. For companies making decisions to invest, and in turn for banks and shareholders funding those companies, the degree



A view of the Grasberg gold and copper mine in Indonesia's Papua province. Asia's developing economies will require substantial quantities of raw materials in the decades ahead.

of certainty or confidence in the demand outlook is important. A narrower band of uncertainty equates to lower risk, and lower risk is likely to translate into more investment executed in a speedier fashion.

Those companies and nations that need raw materials can have an appreciable positive impact on this confidence firstly by fostering greater transparency in respect of their plans and outlook, and then by pursuing policies that enhance market confidence in the likelihood of their economic ambitions being achieved.

On the supply side of the equation, supply regions can both support regional resource security and, at the same time, maximise the potential for capturing a disproportionate share of the opportunity by taking those steps required to incentivise project development and ongoing operations. Companies look not only to the quality of the underlying resource

but to things like the stability of the fiscal regime, the efficiency of the regulatory process and the degree to which other policies are likely to avoid an erosion of the region's relative cost competitiveness over time. All other things being equal, those that do these things well will capture a disproportionate share of what is otherwise mobile capital and hence the economic opportunity, which will serve to support national prosperity.

EAFQ: How important are global market conditions to resource security and economic development?

Mike Henry: The long-term importance of having efficient markets underpinned by strong liquidity, transparent market clearing pricing and a strong culture of contract performance cannot be overstated. These conditions allow potential investors to formulate the most

reliable possible outlook for the market pricing that will underpin their investments. Ultimately this will enhance the likelihood that new economic supply comes on in a timely fashion to meet market demand. From the perspective of those who need raw materials, markets being allowed to work in an efficient fashion should be looked to as the surest means of ensuring resource-supply security in the coming decades.

EAFQ: How has the global market affected China's conceptions of resource security?

Andrew Kennedy: China's understanding of resource security is evolving. Since moving into the international market, China has tended to adopt unilateral and bilateral measures to enhance its energy security. There have been long-term contracts with major suppliers, efforts to build a national strategic petroleum reserve, investments in new naval capabilities and efforts to diversify its supplier portfolio. These are among a range of unilateral and bilateral measures. The next big task is to invest more in multilateral efforts and work with a range of countries, something China is still figuring out how to go about.

Moving in this direction, China has been in dialogue with the International Energy Agency (IEA), and clearly the IEA and the United States would like to see China become more involved in the organisation. But there is some hesitation on the part of China, for a number of reasons. To begin, the IEA's member states are OECD countries. But more fundamentally there is a trust issue. China sees organisations like the IEA and also, to some degree, the international energy market as being traditionally dominated by the

United States, and China worries about the implications of joining this framework even though it is now an active player in the market. Joining the IEA would require greater levels of transparency on China's part, and it could also mean a loss of a measure of autonomy in the management of its growing strategic reserves.

EAFQ: How do you see India's response to the same issues?

Andrew Kennedy: For a long time the IEA has been interested in engaging both China and India as increasingly important oil importers on the world stage. Both countries have been fairly careful about increasing their interaction with the IEA, but there's been a breakthrough with India this year. In May India held an emergency response exercise with the IEA which they've never done before. This was an important step, and something China has never done, so it will be important to see if China replicates that.

EAFQ: Do the market institutions provide all the security for major resource consumers they need?

Peter Drysdale: Well-functioning international markets are the key to securing supplies for the major resource-consuming economies. The countries in Asia are peculiarly dependent on international supplies of strategic raw materials and energy. After the Second World War the great Atlantic Charter-inspired global institutions established a rules-based system within which countries deficient in natural resources, like almost all the countries in Asia, could trade their way out of poverty—exporting manufactures in exchange for reliable supplies of raw

materials, without recourse to political adventurism. Energy and minerals are traded widely and freely in the world with extremely low barriers to trade. This means that there are ready supplies to large consumers from a number of highly reliable and efficient sources of supply. It also means that remarkably large volumes of materials are delivered to consumers around the world at a very much lower cost than they could be procured alternatively (if at all) from domestic sources. The GATT (now the WTO) was the foundation underpinning the development of large, deep markets in commodities.

Of course, the rules are still not perfect. And there is asymmetry in the rules. There are more effective rules governing market access for manufactured goods than for agricultural goods. And there are more effective disciplines on importers than there are on exporters. Import tariffs and other controls have been negotiated down; intervention on the export side is subject to less discipline. That means that the multilateral system protects exporters of commodities better than it protects importers of commodities against policy disruption of supplies.

But there are institutions that have been put in place to protect against these weaknesses. Major supplier countries have developed arrangements with major consumer countries that underpin reliability of resource and energy supply. That is also why major consumer countries often seek bilateral political understandings and demonstrations of goodwill in their bilateral relationships with major energy and resource suppliers.

For example, Australia is the largest supplier of many strategic raw materials and energy to Asia (notably

to Japan, Korea and now China). Australia's resource trade relationship with Asia also has strategic importance to both sides. Australia supplies over 50 per cent of Northeast Asia's strategic raw materials, and is a crucial element in the region's economic security. Asia is heavily dependent on external suppliers for strategic raw materials including energy, and Australia is the single biggest supplier of resources to the region. Australia has treaty arrangements with Japan, for example, that guarantee reliability of resource supply based on market principles, and it provides de facto assurances of the same nature to its other major customers.

Reliable Australian resource supply to Asia is a crucial element in Asia's security; it is a role that is immensely important to the security of the region and one of huge responsibility.

The relationship is also a critical element in Australia's prosperity and political security. Australia's economic relationship with Asia can, from this perspective, be viewed as a grand contract between Australia and the region—Japan first, then Korea, now China and next India—in the form of the reliable supply of strategic resources and energy commodities in return for stable political relations with the region. This is a fundamental dimension to keep in mind when thinking about Australia's economic relations with Asia. **EAFQ**

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The benefits of being Asia's next-door neighbour

FATIH BIROL

THE global energy map is being redrawn. The International Energy Agency's World Energy Outlook 2012 (WEO-2012) projects that resurgent oil and gas production in the United States, which temporarily overtakes Saudi Arabia as the world's largest oil producer before 2020, to be a key engine of change in energy markets.

Others include some countries' retreat from nuclear power, the spread of unconventional gas production and a strong push for energy efficiency gains in some major economies. One important feature of energy markets remains firmly intact during that period: Asia's dominance as the focal point of energy demand growth and expanding energy trade.

In projecting global energy developments to 2035, WEO-2012 analyses scenarios differentiated by assumptions about policies adopted by governments. In its central scenario, global demand for energy continues its inexorable rise, increasing by more than a third over the period to 2035. Emerging economies account for the vast majority of additional demand, and China and India alone for over half. Asian consumers' appetite for energy could be an economic boon for exporters, and particularly Australia, which can remain a major supplier of coal to the region and is positioned also to emerge as a key supplier of gas.

Coal remains a cornerstone of Asia's energy mix. Though its

emerging economies will gradually mature away from energy-intensive industries and pursue more diverse electricity generation, demand for coal nonetheless rises substantially in absolute terms to 2035—by more than 20 per cent in China, which remains the world's largest coal consumer by a large margin, and by 130 per cent in India. Each must look to imports to close the gap between domestic supply and demand. China imported some 6 per cent of its coal use in 2010. This share is likely to grow in the short term, but imports can be expected to moderate as production expands more quickly than demand. India's own coal supply is unlikely to keep pace with torrid demand growth, causing its import needs to climb precipitously. By around 2020 it will become the world's largest coal importer.

Sitting on the geographic periphery of Asia and richly endowed with coal resources, Australia is already the

world's top coal exporter and at the centre of the region's coal trade. Its dominant position in the market for coking coal (used for steel production) and its fast-growing steam coal exports (used to fuel power generation) make it poised to further capitalise on Asia's coal boom.

Through 2020, we expect to see Australian coal shipments boosted by a quarter, with growth then continuing, albeit at a slower rate. Indonesia, which exports principally steam coal, will see exports grow to 2020, but then hit a plateau. Climate change mitigation policies represent a key uncertainty in the outlook for coal use and exports. The difference in the outlooks for Australia and Indonesia post-2020 can be attributed to such policies, which reduce the role of coal in the power sector, thereby advantaging Australia relative to other exporters for its strength in coking coal.

Gas has bright prospects under a range of assumptions about future policies adopted by governments around the world. Like coal, demand growth will be driven by the emerging economies. It is especially strong in China, where policy support to diversify the energy mix is expected to boost gas use from 130 billion cubic metres in 2011 to 550 billion cubic metres in 2035. China's active pursuit to replicate the United States' experience tapping vast unconventional gas resources—namely shale gas and coal seam gas—ought to eventually put it among the world's

The balance of global supply and demand prospects more generally are expected to prompt fast growth in international gas trade

biggest gas producers, but unrelenting demand growth would also likely necessitate substantial import volumes. The balance of global supply and demand prospects more generally are expected to prompt fast growth in international gas trade, particularly shipments of liquefied natural gas (LNG).

Australia looks poised also to play a major part in the global expansion of LNG trade. Relative to capacity in place now, large additions are expected over the next decade. Of that currently being constructed, over 70 per cent is in Australia, including three first-of-a-kind LNG facilities based on coal seam gas. With annual export capacity projected to rise from around 30 billion cubic metres in 2011 to over 100 billion cubic metres in 2035, Australia may soon rival Qatar as the world's top LNG exporter. But it will do so in a global gas market that may evolve significantly, and particularly in the realm of pricing. Greater trade volumes, increased short-term trading and greater operational flexibility are likely to lead to increasing gas price connectivity between regional markets and to a degree of gas price convergence. Opportunities to arbitrage regional price differentials are likely to spur expanded trade between North America (having already approved the construction of three LNG liquefaction plants) and the Asia Pacific region, which have traditionally been isolated from one another.

Future energy market trends are of course subject to shades of uncertainty and Australia is not isolated from this. In the near term, economic growth is probably the most significant question mark, but over the longer term it is the policy pathways chosen by governments that will have the greatest effect on the global energy map.



Woodside Petroleum's Pluto A gas production platform in the Indian Ocean, 200 kilometres off the Pilbara coast. Australia could soon rival Qatar as the world's top exporter of liquid natural gas.

Governments must take big decisions on climate change mitigation, energy subsidies, nuclear power and resource pricing, and production and export strategies. Nevertheless, Asia's thirst for energy is one certainty that we can count on over the longer term, which puts Australia in the enviable position as the supplier next door. **EAFC**

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Time for an integrated development agenda

SHENGGEN FAN

ACCORDING to new estimates from the Food and Agriculture Organization (FAO) of the United Nations, nearly 870 million people suffer from hunger today. More than 50 countries, many of them in South Asia and Africa south of the Sahara, have levels of hunger that are 'extremely alarming,' 'alarming,' or 'serious' according to the International Food Policy Research Institute (IFPRI) 2012 Global Hunger Index. Furthermore, according to the World Health Organization, more than two billion people suffer from micronutrient deficiencies. A significant number of them live in Asia.

Food and nutrition insecurity not only continues to exist at unacceptable levels in many regions but is further threatened by emerging factors and challenges like food price volatility, population growth and urbanisation, natural resource scarcity and climate change. In order to achieve global food and nutrition security an integrated and more innovative development agenda must be adopted in terms of strategies, investments, technologies, institutions and partnerships.

Global demand for food is expected to rise by 60 per cent by 2050 as a result of a growing and more prosperous population, according to the FAO. Meeting this demand using conventional methods of agricultural production will put increased stress on our ecosystem, especially on

water and land resources, while also contributing to climate change. As a whole, an integrated approach that recognises the inextricable linkages between water, land, energy and food production will be critical in meeting the growing demand for food while reducing the trade-offs between short- and long-term goals. The poor have limited access to these resources and an integrated systems approach should highlight the trade-offs and help to ensure that benefits in one realm do not come at the expense of benefits in another. For example, according to a recent study by Roderick Rejesus and others in the Philippines, a rice production technique called alternate wetting and drying—applying water days after the disappearance of ponded water, as opposed to continuous flooding to prevent the pond water disappearing—was found to economise on the use of scarce irrigation water without significantly reducing yields and profits.

But, to apply an integrated framework effectively, several important knowledge gaps need to be filled. For example, to properly design and implement policy, measurement tools are needed to evaluate the impact of water-related projects (such as expansion of irrigated areas or hydropower development) on ecosystems, climate change and food security. National governments, the private sector and civil society should be actively engaged in this process and must contribute to actions that increase overall resource-use efficiency

while reducing the trade-offs.

Agricultural development should also be leveraged to improve nutrition and health outcomes, and not focused only on increasing production. Agricultural growth strategies and investment policies need to be designed with a nutritional lens, identifying the likely trade-offs between implementing production growth strategies, poverty reduction and targeted nutrition programs. Innovations like nutrition-focused value-chain approaches and biofortified crops are examples that improve consumer nutrition while creating economic opportunity for farmers.

RECENT studies have also shown that within the agricultural sector individual subsectors like staple crops or livestock have different impacts on nutrition outcomes. An IFPRI study conducted in Ethiopia showed that the contribution of growth in staple crops to poverty reduction and calorie intake is greater than the contribution of any other agricultural or nonagricultural sector modelled in the study. Another example is the partnership between PepsiCo, UN World Food Programme (WFP) and USAID to significantly increase nutritious chickpea production by many Ethiopian smallholders. This combines multiple development goals, such as sustainably improving smallholders' income and increasing the availability of nutritious food for consumers, including women and children. Factors like increased



A boy savours his free lunch at the Anna Nagar school in New Delhi. Global demand for food is expected to rise by 60 per cent by 2050.

access to land and equality between the sexes in many developing countries (especially South Asia) have also contributed to improved health and nutrition outcomes for women and children. Agricultural development policies in developing countries should, therefore, aim beyond increasing smallholder productivity to include these factors that contribute to improved nutrition.

Given the right incentives, the private sector can also provide effective and sustainable investment and innovation to help in the fight against hunger, malnutrition and poverty. Novel business solutions targeted to poor consumers include nutritionally fortified and affordable foods customised to poor people's preferences, expanded retail distribution networks, and improved consumer knowledge and trust. For poor smallholder producers, solutions include innovative agricultural inputs targeted to their needs, improved

market information, increased access to financial services and expanded rural infrastructure. The role for governments here is to provide an enabling environment for the private sector to operate while also putting in place monitoring and evaluation systems to ensure that operations are socially and environmentally responsible.

FOOD and nutrition security should also remain at the top of the agenda for future G8 and G20 meetings and previous commitments must be met. Last year, among many other commitments, G20 countries worked together to reduce global food-price spikes and volatility by supporting systems that enhance agricultural market transparency. But the G20 must implement additional commitments, such as setting up the Agricultural Price Risk Management tool and other risk-coping tools and country capacity-building programs.

In 2012, G20 countries have been committed to improving agricultural productivity, something very much needed after many years of stagnation. Clear milestones and accountability mechanisms should be set to ensure that commitments are met and have the intended contributions.

Organisations within the United Nations that deal directly with food and nutrition security issues, including the FAO, the International Fund for Agricultural Development and the World Food Program, should also be reformed and further strengthened to effectively deal with emerging challenges in a timely manner.

Emerging countries such as Brazil, China, India and Indonesia, which have experienced rapid growth and increased integration into the global economy in recent years, have also significant potential to contribute to global food security. Firstly, given the large share of the world's undernourished living in India, and

The future of nuclear power in Asia

VLADO VIVODA

to some extent China, policies and initiatives to combat hunger and increase global food security are especially pertinent within these emerging countries. Secondly, emerging countries increasingly affect growth and development prospects in other developing (but less-developed) countries directly through aid, trade and foreign direct investment, and indirectly through commodity prices and competition in third markets. These countries need to prioritise their public spending on agricultural research and development, improve access to input and output markets for smallholder farmers, and scale up productive social safety nets to protect the poor from risk and vulnerability. Linkages between emerging and other developing countries should also be designed to enhance the long-term, pro-poor benefits of trade, investment, technological cooperation and mutual learning for both sides.

Australia has also been a major player in combating global food insecurity. Institutions such as the Australian Government Overseas Aid Program (AusAID) and the Australian Centre for International Agricultural Research have been influential in pushing the agricultural development agenda. So too have individuals like Sir John Crawford, who served as an architect of the Consultative Group on International Agricultural Research (CGIAR)—a global agricultural research partnership—and as the first-ever board chairman of IFPRI, one of the 15 CGIAR research centres. It is thus important for Australia to continue to invest in the future of global food and nutrition security.



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BEFORE the nuclear disaster at Japan's Fukushima Daiichi Nuclear Power Plant on 11 March 2011 ('3/11'), Asia was seen as the nuclear powerhouse of the future, but in the immediate aftermath of the nuclear catastrophe there was much uncertainty about the industry's Asian, and global, future. Some analysts suggested that Asia's nuclear renaissance was over while others remained cautiously optimistic about the region's nuclear power future. Now, nearly two years after the Fukushima disaster, plans for nuclear power in Asia remain mostly in place.

With increasing competition for oil and gas among Asian nations and the negative impact of carbon pollution, nuclear power is still considered by many regional states as a matter of survival, both in terms of growing energy demands and environmental security.

But in Japan, not surprisingly, the future of nuclear power is still unclear. Before the disaster, Japan generated 25–30 per cent of its electrical power from 54 nuclear reactors, and planned to increase capacity to 50 per cent by 2030. By that time it was planned that 14 new reactors would have entered operation. Twelve of them were under construction or active development in early 2011.

Long one of the world's most committed promoters of civilian nuclear power, the 3/11 disaster has changed attitudes in Japan. Many Japanese blame the government for allowing the accident to happen and are strongly in favour of abandoning nuclear power. Many of Japan's plants have been closed, or their operation suspended for safety inspections. While the last of Japan's 54 reactors went offline for maintenance in May 2012, leaving Japan completely without nuclear-produced electrical power for the first time since 1966, in July 2012 two reactors in the Ōi Nuclear Power Plant were restarted to tackle anticipated electricity shortages during summer peaks.

While output from other nuclear power plants might be expected to resume at some stage in the near to medium term, the long-term forecast for nuclear power production in Japan is that it will be considerably lower than pre-3/11. Few, if any, of the proposed nuclear plants are expected to enter service, and many of the existing plants may never be restarted due to safety concerns or public opposition. While the public overwhelmingly supports a phase-out by 2040—and in mid-September the government hinted that this may be the preferred policy option—Japan's powerful 'nuclear village' is strongly

opposed to a phase-out. Consequently, the future role of nuclear power in Japan's energy mix will be determined by the outcome of the current policy debate.

China hosts the world's largest nuclear development program. On top of 16 existing nuclear reactors, 26 are under construction and a further 51 reactors are firmly planned. In the immediate term, the State Council responded to the 3/11 disaster by suspending the approval of further nuclear power projects until new safety plans were in place, and requiring checks on operational, under-construction and approved reactors. The suspension of unapproved projects has not had an immediate impact on China's nuclear program, given the number of projects already approved and under construction. In addition, Beijing has moved closer to ending its suspension after unveiling a plan to upgrade security standards at nuclear facilities by 2015. A recently released five-year nuclear safety plan has prompted another round of speculation that Beijing may resume its ambitious nuclear expansion plans in the near future. Consequently, the Fukushima disaster is unlikely to have a long-term impact on China's nuclear growth.

India has 20 nuclear reactors in operation in six nuclear power plants, while seven other reactors are under construction. The Indian government responded to 3/11 in near record time, with officials saying within a week that its nuclear program had been recently reviewed and was safe. The government's message is that it's business as usual for nuclear power. New Delhi's stance is unsurprising in a country where power demand is surging and national electrification and grid integration programs are incomplete.

Having passed the Indo-US nuclear agreement in 2008 (effectively ending a 34-year US ban on supplying nuclear technology and fuel to India), and clearing the way for Australian uranium exports to India, New Delhi's plans to increase its nuclear capacity are moving faster than ever.

But since 3/11 populations around proposed Indian nuclear plant sites have launched protests, raising questions about atomic energy as a clean and safe alternative to fossil fuels. The state government of West Bengal has even refused permission to a proposed facility intended to host six Russian reactors. A Public Interest Litigation has also been filed against the government's civil nuclear program at the Supreme Court. Yet much of the opposition relates to local land and employment issues, and issues related to imported (as opposed to indigenous) reactors, rather than to more general concerns about nuclear safety. The rate at which nuclear power expands in India will depend on how these issues are resolved.

China, India and South Korea have reaffirmed their nuclear programs, albeit with caveats and plans to review safety measures and emergency procedures

South Korea has 23 nuclear reactors that produce around 30 per cent of the country's electricity, and has plans to increase that share to 60 per cent by 2035. Eleven reactors are scheduled to come on stream between 2012 and 2021. In addition, Korea is seeking to export its nuclear technology, and aims to sell 80 reactors abroad by 2030. Korean enterprises are among those hoping to pick up overseas contracts at the expense of Japanese companies, and are pursuing opportunities in Jordan, the United Arab Emirates, Turkey, Indonesia, India, China and Malaysia. Although in December 2011 protesters demonstrated in Seoul and other areas after the government announced it had picked sites for two new plants, internal opposition to the country's domestic nuclear program is relatively small.

Taiwan has six operating nuclear reactors and two advanced reactors under construction. While comprehensive safety reviews have found no concerns, nuclear energy has emerged as a contentious issue. In March 2011, anti-nuclear protesters were demonstrating for an immediate halt to the construction of the island's fourth nuclear power plant, and there are now calls for a referendum on its future. The protesters were also opposed to plans to extend the lifespan of three existing nuclear plants. In November 2011, the government acceded to their requests, and two existing reactors are expected to close in 2016.

Indonesia has plans for four nuclear power plants by 2024. With growing electricity shortages, Indonesia is unlikely to halt its plan to build its first nuclear power plant. It claims its plants will be safe, thanks to the use of more advanced technology than the four-decade-old Fukushima reactors. Elsewhere in Asia, Thailand

froze its plans to build nuclear plants after 3/11 but reversed course in late 2011, concerned over continuously increasing electricity demands. Under its current 20-year plan, Thailand will have four or five plants operational by 2030. Vietnam, presently nuclear-free, has signed nuclear cooperation agreements with a range of countries and in early 2012 announced a partnership with Russia that includes a US\$9 billion deal to construct 13 nuclear plants by 2020. Finally, Malaysia and Bangladesh each plan to build two nuclear reactors, by 2022 and 2018 respectively.

In Europe, the Fukushima catastrophe has reshaped the nuclear landscape, decimating industries in Germany, Italy and Switzerland—countries that share good safety records and negligible seismic risk. But in much of Asia, the aftershocks have been muted. Major regional nuclear powers, China, India and South Korea, have reaffirmed their nuclear programs, albeit with caveats and plans to review safety measures and emergency procedures. Other countries, such as Indonesia, Thailand, Vietnam, Malaysia and Bangladesh, remain committed to developing nuclear power largely as a means to tackle electricity shortages.

While there has been increased local and environmentalist opposition to nuclear power in most Asian countries, it has not been sufficient to reshape government policies that promote nuclear power. The only exceptions are Japan and Taiwan, where the jury is still out on the future role of nuclear power, although gradual phase-outs are the most likely option. **EAFO**

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Visitors examine a model nuclear reactor designed by South Korea's Kepco corporation at a nuclear power exhibition in Hanoi in October 2012. Several Southeast Asian countries are committed to introducing nuclear energy to tackle electricity shortages.



Sustaining Southeast Asia's forests

FITRIAN ARDIANSYAH

AVOIDING and reversing the loss and degradation of forests is a crucial element of any sustainable development and climate change solution formulated in Southeast Asia.

Southeast Asia's forests contain some of the richest and most valuable resources and habitats on earth. These include the Greater Mekong Subregion that covers 60 million hectares of tropical forests and rivers in Cambodia, Laos, Myanmar, Thailand, Vietnam and China, and the Heart of Borneo that comprises 24 million hectares of equatorial rainforests stretching along the borders of Indonesia, Malaysia and Brunei.

These forests and terrestrial

ecosystems have a vital role to play in the fight against global warming. They also have significant economic and ecological value. Hundreds of millions of people depend on the healthy productive capacity of these natural systems to sustain key ecosystem services such as clean water, food and fibre.

These forests are also home to a significant part of the world's biodiversity and possess a high level of endemism across all groups of plants and animals. Southeast Asia's forests are the only place on earth where orang-utans, tigers, elephants and rhinoceroses still co-exist and where forests are large enough to maintain viable populations.

Deforestation and forest

degradation are making a significant contribution to environmental degradation in this region and overall global emissions of greenhouse gases. In 2009, the Food and Agriculture Organization reported that deforestation rates in Southeast Asia remained high at 3.7 million hectares per annum. In general, forests and terrestrial ecosystems in Southeast Asia, including peatlands, wetlands and rivers, are in a state of rapid ecological decline due to human over-exploitation.

The degradation of forest and wetland habitats affecting hydrological regimes is threatening water supply and the viability of one of the most important freshwater fisheries in the world—including, for instance, in

the Tonle Sap fishery in Cambodia, where the larger migratory species have declined significantly. The biggest threat to the Mekong River's ecological system is the long-time deforestation of the river basin.

The island of Borneo, as well as Sumatra and many other places in this region, has also experienced high deforestation rates. According to several studies, between 1985 and 2005 Borneo lost an average of 850,000 hectares of forest annually—roughly a third of the island's total rainforests—due to indiscriminate logging and forests being cleared for timber and oil palm plantations.

The increasing frequency of forest and land fires between 1997 and 2007 is indicative of the pressure to deforest. A combination of plantation and timber companies, unresolved land tenure disputes and land clearing by a massive number of individuals are the main causes of these fires.

Because of these issues, the governments of Southeast Asia are under pressure to devise smart development strategies that not only promote economic growth but also conserve the areas' globally important biodiversity, ecosystems and natural resources.

Regional cooperation is emerging. Initiatives include the Mekong River Commission (MRC), which coordinates the formulation and implementation of sustainable development for the Greater Mekong Subregion, and the Heart of Borneo initiative, which facilitates cooperation among parties in protecting, conserving and sustainably managing remaining forests and adjacent areas.

Since 2009, countries in the Greater Mekong Subregion have agreed to use the Biodiversity Conservation Corridors Initiative (BCCI) to accelerate efforts to address

conservation and climate change. One BCCI initiative is to channel economic stimulus to the rural poor within the corridors. The aim of this initiative is to strengthen sustainable management of forest and water resources. As people become poorer and need resources to get out of poverty, there is likely to be huge pressure for further and faster natural resource extraction—hence, action to address poverty tends to have positive results on the environment.

The Heart of Borneo recently launched a 'green economy' approach aimed at concretely and seriously tackling threats from unsustainable land-use activities and further improving enabling conditions like good economic policy. This will create positive incentives for stakeholders to employ sustainable practices and foster good governance, clear land tenure and reformed sectoral development.

Reports also show an increase in the private sector's involvement in the promotion, development and application of sustainability principles in their management of key commodities, including forestry (through the Forest Stewardship

Stronger collaborative efforts among countries, state and non-state actors in Southeast Asia is the key to significantly reducing deforestation and mitigating its impacts.

Council) and palm oil (through the Roundtable on Sustainable Palm Oil).

In November 2007 only 0.8 million hectares of Southeast Asia's natural forests were certified under the Forest Stewardship Council. Now more than two million hectares of natural forests have been certified under a similar scheme. In mid-2011, just three years after certification commenced under the Roundtable on Sustainable Palm Oil, the palm oil industry reached one million hectares of certified production area globally. The biggest contributors were Malaysia and Indonesia.

ASEAN has commenced the Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation (REDD+) initiative. Since 2008 ASEAN and its member countries have developed programs to improve in-country capacity and have initiated demonstration projects so that stakeholders are ready to implement REDD+.

These efforts to retain the remaining forests of Southeast Asia may nevertheless be inadequate given constant pressures from global and regional demand for commodities like palm oil and timber. A 2010 United Nations report estimated that the illegal timber trade in Southeast Asia was worth US\$3.5 billion.


There is an urgent need for ASEAN countries to scale up their collaboration on deforestation so that they are seen as a strong front that can negotiate the channelling of financial and technical support to address deforestation in their region. At the United Nations Framework Convention on Climate Change, ASEAN is not seen as a strong lobby group that can influence the negotiation of the financial and policy aspects of REDD+.

In setting up a monitoring system

for deforestation, countries in the region can learn from Brazil, which is considered to have an advanced deforestation monitoring system. The Brazilian system combines real-time satellite observation and regular ground checking. Using an ASEAN platform, countries in Southeast Asia have the opportunity to replicate such a system in a cost-effective and transparent way.

Stronger collaborative efforts among countries, state and non-state actors in Southeast Asia are the key to significantly reducing deforestation and mitigating its impacts. Further involvement of producers in the REDD+ initiatives through timber concessions and incentives for oil palm plantations could accelerate the implementation of sustainable practices.

Financial institutions in the region and at global level also have a significant role to play. They must develop robust investment screening policies to discourage high-risk investment patterns leading to deforestation. Consumers of related commodities can help by favouring goods that are produced through certified sustainable operations.

If done properly, efforts like these would lead to fundamental changes in how Southeast Asians manage, protect and sustain their forests. The impact of those efforts will be felt by the global community in the form of emissions reductions, and by people in Southeast Asia through their ability to maintain timber and non-timber forest production, water supply, and other ecosystem goods and services. 

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The time for transboundary management has arrived

ROBERT G. WIRSING

IF ONE were on the lookout for the region with the most meagre potential for cooperative management of its transboundary river basins, South Asia would be a strong contender. Merely to mention the larger co-riparian states sharing the region's two biggest and most important Himalayan river basins—India, Pakistan, Afghanistan and China sharing the Indus basin, and India, Bangladesh and China sharing the Ganges-Brahmaputra-Meghna (GBM) basin—is usually enough to dampen enthusiasm for basin-wide river management. Kept apart by distrust stemming from histories of rivalry, these five states seem especially poor candidates for basin-wide cooperation.

China, India, Pakistan and Bangladesh together account for just over half of the world's irrigated lands

Aroused by the uncertainties of climate change, worried hydrologists may argue that there just isn't enough time left for business-as-usual unilateralist attitudes to prevail. Nevertheless, South Asia seems to many observers a far better candidate for water war than for water peace.

Apart from distrust, the impediments to basin-wide management include some potent structural features of South Asia's political geography. One is India's towering size and strength relative to its smaller neighbours and the advantage that gives India in exploiting its upper riparian position on the rivers shared with Pakistan and Bangladesh. Enclosing within its borders less than 10 per cent of the GBM basin, Bangladesh suffers one of the least favourable river dependency ratios (91.3 per cent) on the planet—and thus has little geographic leverage to deploy in its dealings with India. Pakistan is better off, but its own river dependency ratio (about 75 per cent) still leaves it highly vulnerable to neighbouring India's dam-building plans on the upper waters of the Indus system.

A second structural impediment emerges from the political challenges facing South Asian governments, including the delicate coalition arrangement of the Indian central



The Ganges near its source in Uttarakhand, an Indian state that borders China: mutual distrust is an impediment to cross-border water-sharing arrangements.

government. This problem was evident in September 2011 when the chief minister of the Indian state of West Bengal, Mamata Banerjee, withdrew her support at the eleventh hour from a water-sharing agreement between India and Bangladesh over the Teesta River. Her exit dealt a death blow to the hard-won agreement, which would have been the first formal India–Bangladesh agreement over Teesta’s waters since 1996. The failed agreement was up against demographic and economic circumstances in West Bengal—with 91.3 million people, one of India’s poorest and largest states, and every bit as dependent on the GBM basin as Bangladesh—that appear to have left little room for compromise.

Perhaps the most readily visible reason for change is demographic. Four countries sharing the Indus

and GBM basins—China, India, Pakistan and Bangladesh—alone have populations totalling over 2.84 billion, about 41.3 per cent of the global total. This is expected by 2050 to reach a combined total of 3.47 billion, or about 40 per cent of an expected world total of 9.316 billion. Keeping pace with these numbers, and the threatened drop in per capita water availability they entail, will require massive increases in fresh water extractions from the region’s surface and ground water. These increases will be needed to ensure the basic food security of these populations and meet the demand for adequate water supplies arising from the unprecedented scale of the region’s industrialising and urbanising trends.

Adding immeasurably to the bleak outlook for the region’s water resources is the extraordinarily heavy

dependence of its agricultural lands on irrigation. By far the greatest concentration of the world’s irrigated land—close to 65 per cent—is in Asia, about 35 per cent in South Asia. China, India, Pakistan and Bangladesh together account for just over half of the world’s irrigated lands. The highest irrigation density of all is found in Northern India and Pakistan, in the Ganges and Indus basins. The mounting threat of water scarcity to Pakistan’s agriculture helps to explain its classification as one of the most severely water-insecure countries on the planet.

Moreover, tens of millions of farmers in these countries are turning to ground water supplies of fresh water to escape the uncertainties of antiquated supply-driven irrigation systems. Over the past 10 years, scientific data warning of the long-

term high risk this poses to the region's aquifers has been accumulating, adding substantially to the urgency of the water resource crisis.

Yet another sign of the need for a shift from competition to collaboration in river basin management is in South Asia's chronic shortage of power supplies, casting doubt over the region's capacity to ensure future energy security. India is already the world's sixth-largest energy consumer. With its primary energy demand expected to grow overall by about 127 per cent in the period 2008–2035, accounting for 18 per cent of the total global rise in energy consumption, India will be second only to China in contributing to the increase in global demand.

The imperative to increase energy supplies has turned New Delhi's attention to indigenous hydropower resources, although only about 19.9 per cent of India's hydropower potential has so far been developed.

India's greatest share of as yet untapped hydropower potential is found in the country's north and northeast, where it has launched a dam-building spree that inescapably runs up against the fresh water needs of India's lower riparian neighbours, Bangladesh and Pakistan. Of the hydropower schemes underway, those in the northeastern and northern

Official denials of any Chinese plans to divert the Brahmaputra's waters have been plentiful, and the Indian government's public response to Beijing's soothing words has been cautiously optimistic

Indian states in the Indus, Ganges or Brahmaputra basins account for a stunning 79 per cent of planned installed capacity.

India's swelling energy imperative is magnifying the importance of these rivers to its future energy security, and this importance quickly turns into political tensions between India and Pakistan and Bangladesh. Significantly, the massive dependence of these co-riparian neighbours on the river systems' shared waters for their agricultural irrigation requirements is fueling increasingly bitter rivalries and complicating India's plans to exploit the hydropower potential of those same rivers.

Looking to South Asia's water future, the elephant in the room is, of course, China—the upper riparian of the Brahmaputra River. China is already building a cascade of major hydropower dams on the Brahmaputra, but these are located well upstream from the Indian border. It also has an eye on the Great Bend in the Brahmaputra, just across the border from the Indian state of Assam,

for hydropower generation. These are worrisome developments for the lower riparians, India and Bangladesh, but it is China's increased interest in a massive river diversion scheme on the Brahmaputra—one that would divert as much as 20 per cent of the river's flow to China's parched northern plains—that has aroused the greatest anxiety.

Unfortunately, opacity has generally characterised China's water planning, especially when it has had transboundary implications. Official denials of any Chinese plans to divert the Brahmaputra's waters have been plentiful, and the Indian government's public response to Beijing's soothing words has been cautiously optimistic. But some Indian strategic thinkers have been sounding the alarm about China's aggressive water strategy. Leading Indian strategist Brahma Chellaney, for example, warns that China, with its hand firmly in place on Asia's Tibetan water tap, is 'acquiring tremendous leverage over its neighbours' behaviour', making water the newest weapon in its political armoury. If China goes ahead with the proposed diversion of Brahmaputra waters, 'it would constitute', he declares flatly, 'the declaration of a water war on lower-riparian India and Bangladesh.'

The time has clearly arrived to move South Asia's transboundary Himalayan rivers towards basin-wide management. While the obstacles in the path of any such effort are clearly immense, the costs of failure to do so—which include but are by no means restricted to the threat of violent interstate conflict—are virtually certain to be even greater. **EAFO**

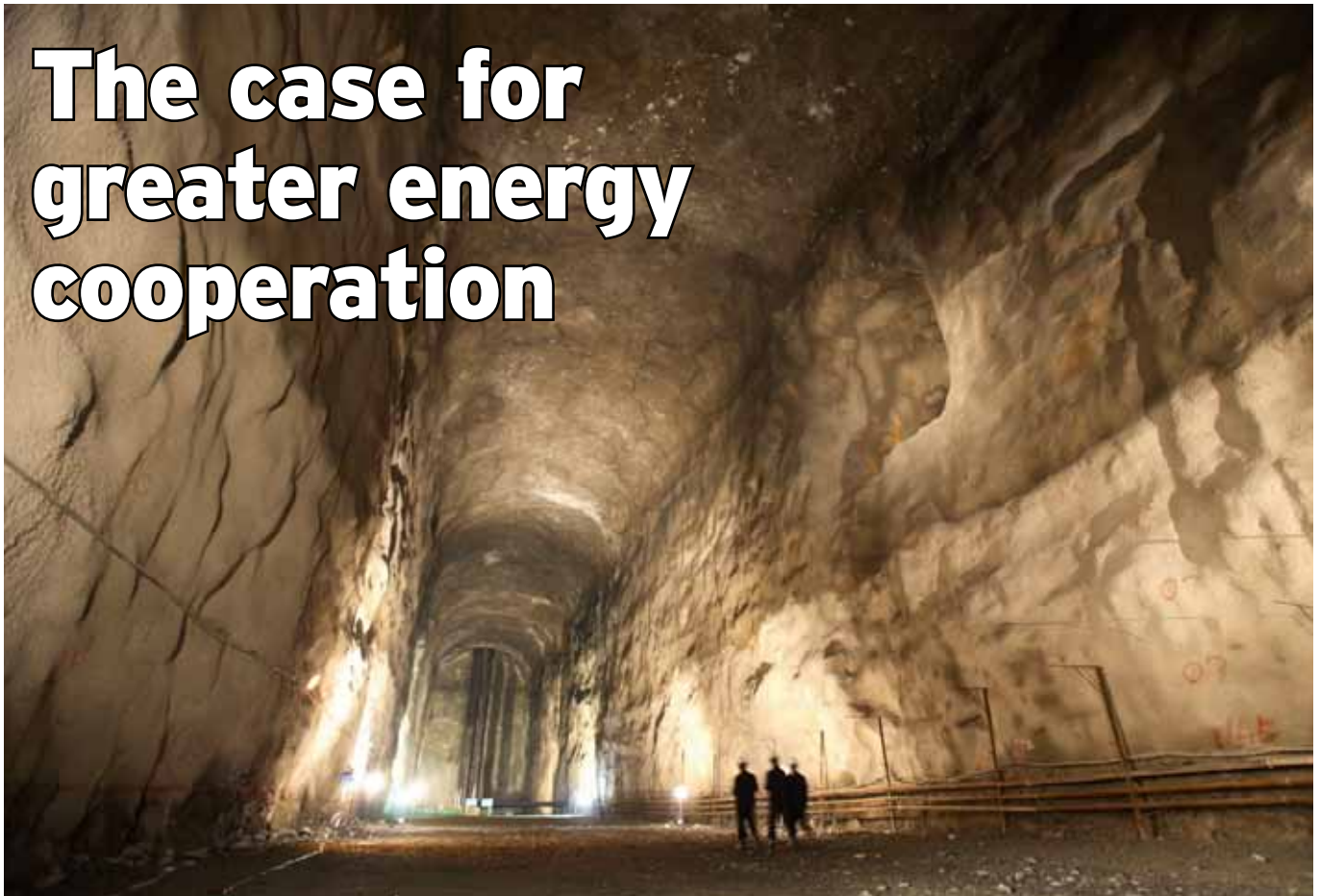
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EASTASIAFORUM
Quarterly

IN OUR NEXT ISSUE . . .

**Demographic
transition**

The case for greater energy cooperation



JACK BARNES AND SUMAN BERY

LED BY China, Asia—the ASEAN nations, China, India, Japan, South Korea, Australia and New Zealand—was the major contributor to growth in the global economy in the first decade of this century. Asian demand for primary energy grew by over 70 per cent in this period and accounted for more than 65 per cent of total global primary energy growth. While some countries—Japan, South Korea, Australia, New Zealand and Singapore—are rich, others, including the most populous (China, India, Indonesia, Malaysia and Thailand), are middle-income countries now in the energy-intensive development phase. Primary energy consumption ranges from 150 gigajoules per capita

(GJ/cap) in Australia to 12 GJ/cap in the Philippines. By way of contrast, China sits at 50 GJ/cap, India at 16 GJ/cap and Japan at 110 GJ/cap.

As the middle-income countries become major players in global energy it is only to be expected that governments will become increasingly concerned with security of energy supply. This is critical to the steady improvement in the standard of living required to approach the comforts enjoyed by developed nations.

Asia's energy growth is led by China, which has accounted for some 50 per cent of global energy demand growth in the last decade. China is now the world's largest energy consumer and second-largest consumer of oil. Asia accounts for around 60 per cent of traded liquefied

ABOVE: A 19 million barrel underground oil storage facility in Yeosu, South Korea.

natural gas (LNG) and 70 per cent of traded seaborne coal. Despite substantial indigenous resources in the form of coal (China, India, Indonesia and Australia) and oil/gas (Malaysia, Brunei, Indonesia and Australia), the region looks set to remain a net importer of energy.

Recent events have brought energy security into sharper focus around the world. Accidents, natural disasters and geopolitical events have all played a part in this: the 2010 Macondo well blowout in the Gulf of Mexico halted deepwater production there, albeit temporarily; the 2011 Fukushima nuclear accident in Japan led to

additional energy imports to replace nuclear power lost by damage or shutdown; the Arab Spring uprising in Libya in 2011 and US and EU sanctions on Iranian exports in 2012 also disrupted oil supply. Each of these events increased oil prices, although the impact was partly offset by the global financial crisis that reduced demand growth.

Shell analysis projects Asian primary energy demand could further rise by around 40 per cent over the current decade. In contrast, European and North American primary energy demand will increase by less than 5 per cent. Asia's growth is driven by both a burgeoning population and the region's rising prosperity. Securing reliable access to energy to meet this demand will be challenging. For example, as mature oil provinces go into decline, new oil will come from more difficult reservoirs or remote locations, increasing both cost and supply risk. Coal, while relatively abundant, has drawbacks on both local air quality and global warming impact. Developing new energy resources and infrastructure will require massive investment. The International Energy Agency (IEA) estimates investment in wider Asia in power, oil and gas over the next 20 years could amount to US\$10 trillion. So, while Europe and North America benefitted from relatively abundant energy through their period of industrial growth, Asian countries in their energy-intensive development phase face a more complex future—not least the need to deal with growing global CO₂ emissions that threaten to become a greater source of tension between developed and developing countries.

Energy security strategies in developing Asia are typically based on exploiting domestic resources, encouraging energy efficiency and

buying international energy assets, often through government-controlled national companies. While the latter course may not lead immediately to the direct shipment of oil and gas to the sponsoring country, it can help in areas such as capturing project learning, accessing new technologies and growing capabilities in global markets and trading.

In an increasingly competitive energy world, a wider range of energy security policies should be considered. These span three broad categories: increasing supply robustness through diversity, improving resilience through flexibility or redundancy and, finally, reducing energy intensity.

Today, China imports more than half of its oil, much originating from the Middle East. More than 15 million barrels of oil (one-sixth of global demand) travel through the Straits of Malacca each day, presenting a possible security weak point. A similar vulnerability is faced by oil passing by the Horn of Africa. Before the Fukushima accident, Japan sourced one quarter of its electricity from nuclear power. These points demonstrate the potential risks inherent in over-reliance on a single source of supply.

The first set of strategies aims to reduce the likelihood of disruption

... perhaps the most sustainable option for enhancing energy security lies in reducing the energy intensity of an economy

through increasing system robustness. These include: developing domestic resources with relatively short and controllable supply lines; sourcing energy imports from many locations with different supply routes; building a balanced mix of fuel-types in the supply portfolio, including renewables, nuclear, hydro-electric or geothermal energy; and building fuel storage infrastructure as a buffer to supply disruption or price volatility, such as the IEA-managed strategic oil stocks for OECD countries. Coordination of stock releases in the region with the IEA might also help improve overall oil supply resilience.

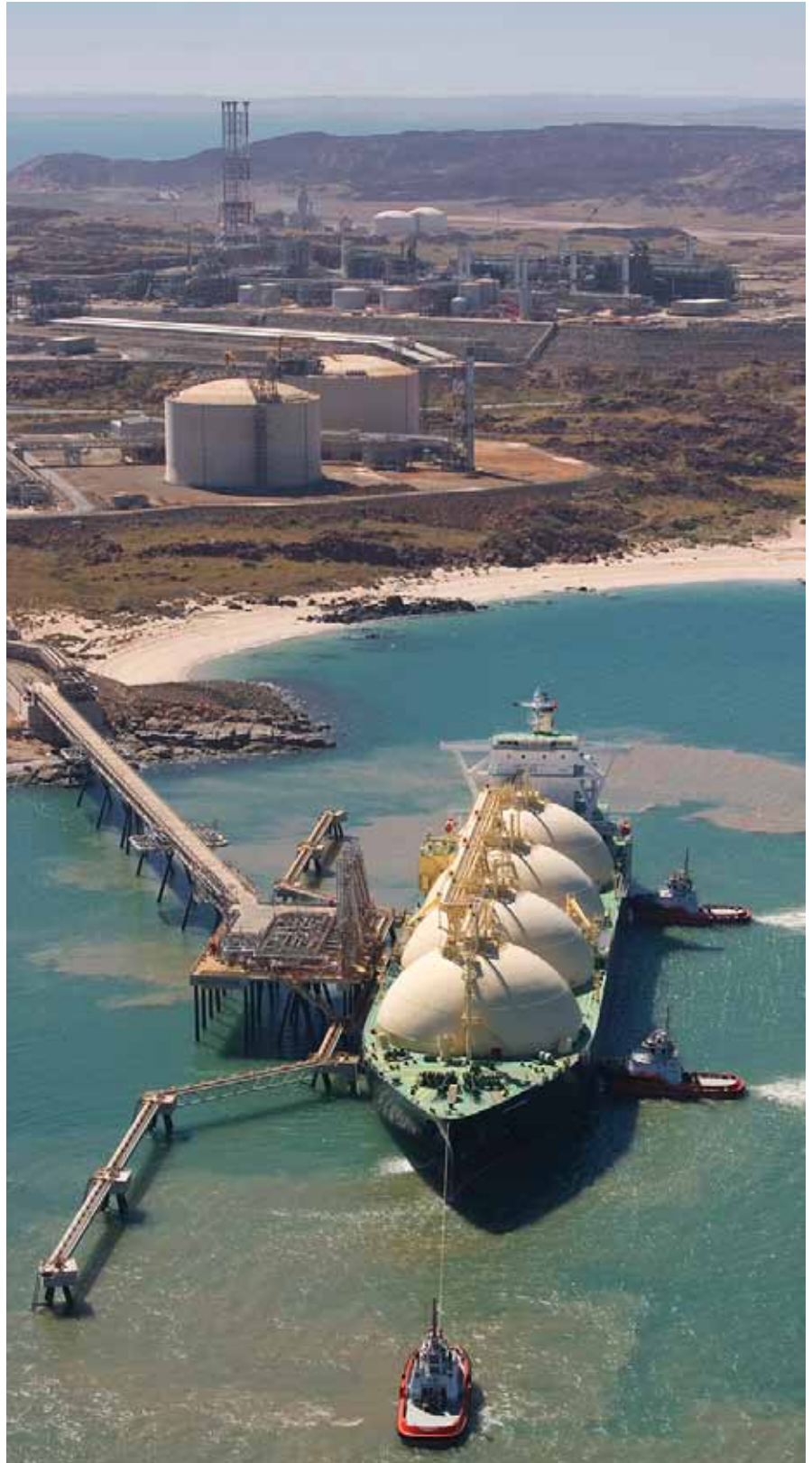
The second set of strategies helps to reduce the magnitude of any disruptive event by providing system flexibility and redundancy. The ability to rapidly supply more oil and LNG into post-Fukushima Japan is an example of how liquid and connected markets can improve system resilience. A well-functioning market creates price transparency and can help to reduce price volatility under normal market operating conditions, improving economic efficiency. Infrastructure redundancy can also help, albeit at incremental cost. Excess system capacity, multiple and interconnected pipelines, multi-fuel power stations and transnational power grids are all examples of ways to improve interconnectivity through infrastructure. Assessing the cost-benefit of investment in redundancy can be difficult because of the low probability but high cost of major disruptions. But even here there are often options to reduce costs. For example, the cost of building a dual gas and power grid in a new city is relatively small, at around 15 per cent more than the cost of a single grid, whereas the incremental cost is much higher if retrofitted. For those

living in remote areas, local renewable generation can also offer resilience against poor infrastructure or provide access to energy where none exists.

Finally, perhaps the most sustainable option for enhancing energy security lies in reducing the energy intensity of an economy. To be sure, efficiency has a role to play here, but other options are available. Well-planned and compact cities with interconnected public transport infrastructure can help to reduce overall transport-demand growth and have the added benefit of controlling congestion. Bus rapid transit systems are one cost-effective means to meet city transport needs. Urban design and planning can lock in the long-term energy demand pattern of cities, for good or for bad. More good solutions and fewer bad solutions are needed. Fuel subsidies, while seeking to help the poor, can also drive energy waste. While removing subsidies too quickly is politically challenging, as demonstrated recently in India, reducing such payments should be the long-term goal of countries that continue to subsidise energy.

The future energy system is characterised by growing demand, increasing cost of supply and the need to manage energy's climate footprint. Few countries can claim true energy independence, and thus energy security is a problem of geopolitics as much as economics. As the main region of energy growth in the coming decades, Asian countries face challenging energy policy choices. Whether they cooperate or compete for access to energy will shape long-term relationships regionally and globally. In our view, cooperation is more likely to lead to a more secure energy future for all. **EAFO**

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Loading liquified natural gas from Woodside's Pluto A plant on the Burrup Peninsula, north-west of Karratha. Asia accounts for around 60 per cent of the world's traded liquified natural gas.

China is changing the renewables business

ERIC KNIGHT

CHINESE companies are using innovative business models to change the cost structures and capabilities involved in delivering renewable energy technology. Through strategic partnerships with technology-led companies in the United States and Europe, they are rapidly reducing the cost of production and effectively entering the value-added parts of the global technology economy.

In the popular imagination, China's industrial base is largely built on agriculture and manufacturing. This is still generally true. Agriculture employs an enormous proportion of the workforce and vast lands are dedicated to the painstaking process of growing rice or harvesting wheat. More recently, attention has been given to Chinese farmers leaving their hometowns in search of a better life in the city. Many of these migrant workers have moved into manufacturing or servicing China's immense construction boom. The Chinese government alone has committed to building 20 new cities a year for the next decade. But value-added goods and services are an increasingly important part of the Chinese economy—and the renewable energy sector is chief among them.

Many Chinese businesses in the clean tech space are adjusting their strategy in two ways. The first has been dubbed 'frugal innovation' by *The Economist*. Chinese businesses

have found ways to make money from manufacturing high-tech goods in a low-tech way. Take BYD, China's leading battery manufacturer. Over the company's first 10 years its founder, Wang Chuan-Fu, brought the cost of the lithium ion battery down from US\$42 to US\$12. He is reported to have taken designs he had seen in Japan and replaced Japanese machinery with the hands of Chinese workers. Wang proved that it was possible to train large workforces to do repetitious tasks with minimal human error.

The significance of 'frugal innovation' is that it has enabled Chinese companies to dramatically reduce the production costs of certain clean energy technologies. Wang's lithium ion batteries now feature in electric cars which are taking Silicon Valley by storm. In the mid-2000s,

when Wang had first proposed his electric car model to auto executives in Detroit, they had laughed at him. Within a few years even Warren Buffett was queuing up to invest.

'Frugal innovation' is one trend which is shaping the Chinese entrepreneurial landscape. The other is Chinese businesses 'leapfrogging' parts of the traditional value chain. A number of Chinese renewable energy companies have skilfully moved from being low-tech manufacturers to owning intellectual property (IP). They have done this through a process of inorganic growth—acquiring the IP of strategic partners in Europe and the United States, and deploying it via their low-cost workforce.

Skills and training is the main challenge for Chinese companies making this leap. A workforce trained to build steel sheets cannot necessarily manage complex engineering designs. However, a number of Chinese companies have overcome this by training their employees through internships, secondments and knowledge-sharing agreements with strategic partners.

Take the case of Goldwind, China's largest wind company. Through the 1980s and 1990s, Goldwind was stuck at the low-tech end of a high-tech industry. They were given wind turbine designs and were commissioned to produce component parts at commodity-like prices. Goldwind had the foresight to reposition itself further up the value chain through strategic partnerships.

Building business relationships makes short-term sense, but partnerships have long-term implications, and whom you choose as a partner is strategically important



A worker assembling a wind turbine at Guodian United Power Technology's plant in Baoding. China is moving vigorously into the 'clean tech' space.

The company sent its most talented employees on secondments to clients in Europe and the United States. In particular, it set up partnerships with REpower and Vensys—two European companies that were leaders in the market. In exchange for well-priced manufacturing contracts, Goldwind made sure its engineers learnt how to design wind turbines from scratch.

The process was extended over a decade. But in 2008, Goldwind raised €41 million (US\$53 million) and bought a 70 per cent stake in Vensys. The deal gave Goldwind special access to the European company's intellectual property—something which was extremely valuable. Instead of patiently originating its own R&D and trialling new designs, it pursued inorganic growth and strategic partnership. The

resulting company had the best of both worlds—lean manufacturing and sophisticated intellectual property.

The leapfrogging model has been seen in other parts of the renewable energy sector in China. Sinovel and Suntech both have close strategic partnerships with IP-led companies in America and Australia respectively. They are ambitious deals and it is too early to evaluate their final impact. But both have taken a strategic approach to developing their employees' skills.

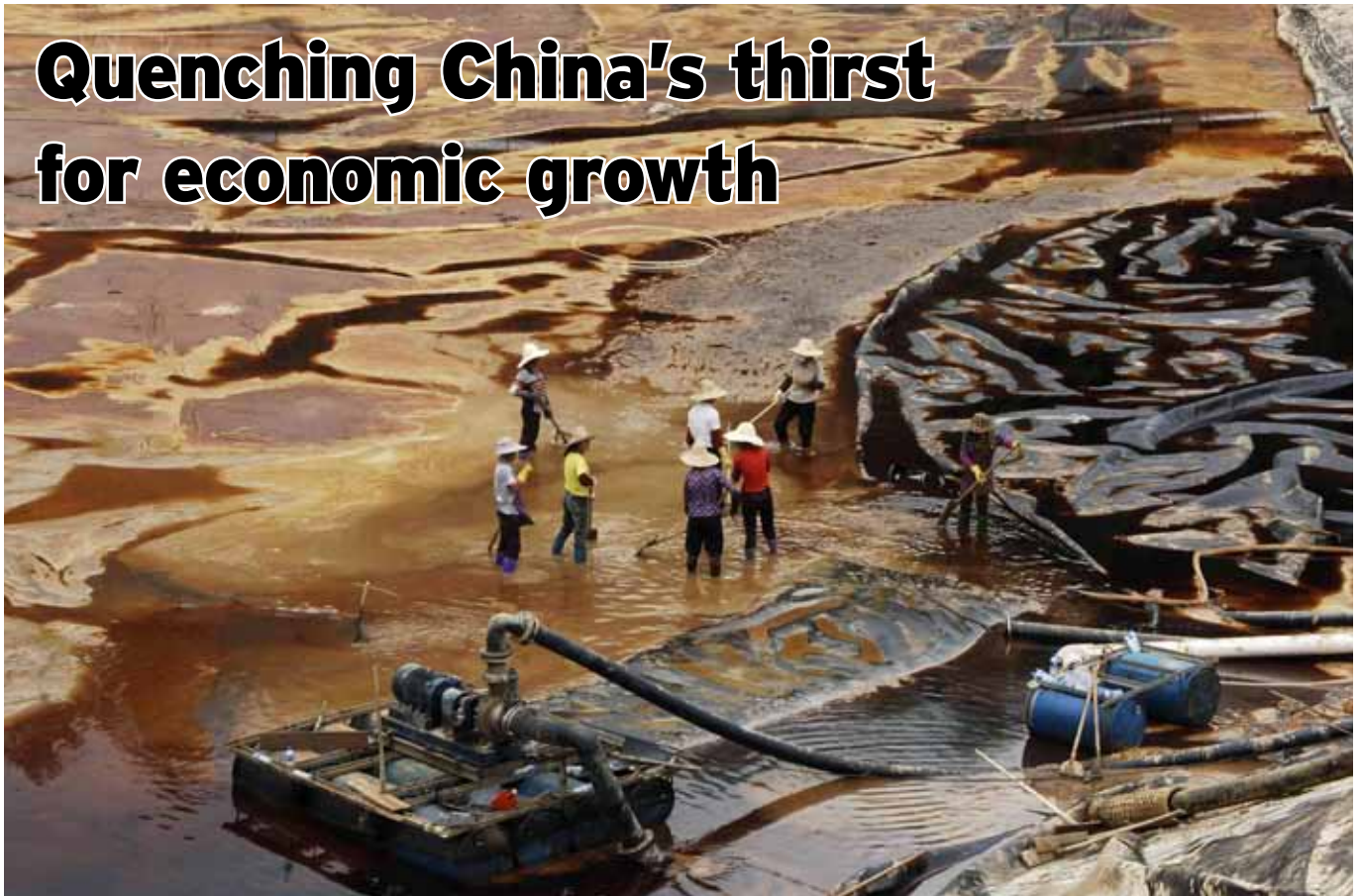
THE implication of these case studies is to rethink how foreign companies partner with Chinese businesses in the renewable energy sector and beyond. Building relationships makes short-term sense. But partnerships have long-term

implications—and whom you choose as a partner is strategically important.

China, and Asia more broadly, is more than the engine room for the world's low-cost manufacturing. Increasingly, it is home to some of the world's most industrious and well-educated employees. Encouraging their ambitions—whilst retaining the integrity of intellectual property developed abroad—is the real challenge facing us in the Asian Century. **EAFO**

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Quenching China's thirst for economic growth



HONG YANG, ZHUOYING ZHANG
AND MINJUN SHI

THE astonishing speed of China's economic growth during the past four decades has seen it make unprecedented progress in national development and improvements in the living standards of its people. But alongside this achievement is a continued intensification of water shortages and deterioration in water quality. Between 1980 and 2010, total water use increased by 35.8 per cent, from 443.7 billion cubic metres to 602.2 billion cubic metres. Total industry and household wastewater discharge doubled during the same period.

China's water endowments are unfavourable. Average water resources per capita are a mere one-quarter of

the world average. The uneven spatial and temporal distribution of water resources exacerbates the quantity problem.

Since the late 1980s water shortages have emerged in many areas in China, particularly in the north. In some northern cities the current water supply can barely meet 70 per cent of demand during the dry season. Of 600 medium- to large-sized cities, more than half have insufficient water supplies, and more than 100 are experiencing severe water shortages.

In many northern cities, water scarcity has become a bottleneck to continuing economic growth. Competition for limited water resources has led to a reallocation of agricultural water to urban sectors, putting irrigation under great pressure in many areas in the north. Food

ABOVE: Workers drain polluted water after a spill from a copper mine in Shanghang in 2010. Water quality has drawn much attention in China.

production is facing the challenge of having to produce more food with less water. The water that is needed for maintaining healthy environmental and ecosystem functions has been held back to give priority to meeting the demands of the economic sector.

Along with intensified water shortages, water pollution and environmental degradation are serious problems across the country. Currently, many rivers and lakes in the eastern part of the country have water quality below grade five, meaning that the water is too polluted to be suitable for any use. Sources of water pollution are mainly wastewater discharge from

industrial and household sectors and non-point source pollutants from agriculture.

The impact of China's international trade in goods and services on its water resources warrants scrutiny. The intensity of water use by China's manufacturing-dominated economy means that the country is a net exporter of virtual water, or water embodied in goods. The annual net virtual water export was estimated at 39.04 billion cubic metres in 2002 and 68.18 billion cubic metres in 2007. This is a 74 per cent increase over five years. The improvement in water-use efficiency in individual sectors has not been able to offset the additional virtual water exported due to the expansion of international trade during this period.

In addition to the impact on the quantity of water resources, China's international trade also affects its water quality. The wastewater discharge from food and tobacco processing, textiles, clothing, paper production and metal smelting accounts for a large percentage of the total industrial wastewater discharge.

The water-quality issue has drawn much attention in China and the country has invested extensively in wastewater treatment facilities since the 1990s. Yet there has been little improvement so far. In many areas water quality is deteriorating.

China is making efforts to improve institutional systems that regulate water withdrawal and uses. River basin conservation commissions under the Ministry of Water Resources have been entrusted with more power over the administration and management of the water defined by basin boundaries and consistent with the hydrological cycle of water resources. Issuing water withdrawal permits has been gradually implemented in some river basins.

An 'investment for water saving and water rights transfer measure' is being trialled in the Yellow River Basin. It concerns water reallocation from agriculture to industry. As obtaining additional water in the water-scarce basins is difficult the increase in industrial water demand must be met by transfers of water from the agricultural sector. Given the widespread low efficiency in irrigation the potential for water saving is high. Industries are encouraged to invest in water-saving projects in the existing irrigation schemes in exchange for the rights for the use of part of the saved water. The measure is regarded as a 'win-win' solution for low water-use efficiency and water shortages in water-scarce regions.

UNFORTUNATELY, all the water rights transfers to date have been conducted within individual provinces. No cross-provincial water rights transfers have taken place. Provinces are generally unwilling to give up their water share entitlements. This is mainly because of the administrative complexity of water rights transfer across provincial boundaries. But it is also because individual provinces recognise that water scarcity is a long-term trend in many parts of China and want to hold their shares of water for their own economic development.

China is now using economic incentive-based approaches such as water pricing and wastewater to allow the market to adjust water demand and supply. Yet the price mechanism alone is proving inadequate for capping total water use, which is rising in many areas. Integrated approaches using economic and non-economic measures are necessary to tackle the water shortage and pollution problems.

Environmental water use and

ecosystem water requirements have received increasing attention since the late '90s. Thirty per cent of the average river flow is commonly used as a rule-of-thumb percentage for the amount of water required to maintain healthy aquatic ecosystems. Yet the ratios of water withdrawal to water resources in the major northern rivers all exceeded 70 per cent. In the Hai River Basin the ratio exceeded 100 per cent.

Facing the enormous challenges of water shortages and pollution the Chinese government is implementing more stringent controls over water use and wastewater discharges. In January 2011 the State Council released a 'Red Head' document (No. 1) in which several ambitious controlling Red Lines were set. For the year 2030, total water use will be capped at 700 billion cubic metres compared with approximately 600 billion cubic metres in 2010. Water intensity will be reduced to 40 cubic metres. Agricultural irrigation water-use efficiency will be lifted to above 0.6 compared with the current 0.5. Water quality will be 'good' in 95 per cent of water bodies.

There are many challenges to surmount before these targets can be reached. Positive results require the establishment of accountable water resource management and evaluation systems, monitoring systems, investment mechanisms, regulations, laws and enforcement agencies. How successful China will be in achieving these goals remains an open question.



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China's positive stance on global food policy

KATHERINE MORTON

THE policy debate on China and food security tends to be rather neo-Malthusian. The overriding concern is that China's population will demand more food than international markets can supply. Some commentators worry that competition over food may become a trigger for international conflicts—there are plenty of pessimistic forecasts predicting future food wars and clashes over scarce agricultural commodities. What these alarmist accounts fail to consider is that the Chinese want to be self-sufficient. That desire has led to a domestic policy of independence that acts as a safeguard against price volatility and means the burden of supplying the Chinese market does not fall heavily on international markets. But can China's policy of self-reliance endure?

Contrary to some reports, Chinese domestic demand was not a major cause of the global food crisis in 2007–08. China was not dependent on imports, which meant that it was shielded from the destabilising effects of market fluctuations. In other words, at the time China had enough food in stock to absorb the international price rise. China currently holds the world's largest grain reserves (70 per cent of which are wheat or rice), which have a storage capacity estimated to be around 200 million tonnes, or roughly 30 to 40 per cent of total domestic grain production. For eight consecutive years China has enjoyed

bumper harvests of over 500 million tonnes of grain per year, largely on account of technological advances. But while China produces nearly enough grain to feed its population by itself, it cannot feed its livestock. And since the Chinese will eat more protein as they grow wealthier, producing enough grain to feed animals as well as people poses a major challenge.

China has always been preoccupied with feeding its own population. For many Chinese, the real economic miracle achieved over the past three decades of 'opening and reform' is the fact that China has managed to feed roughly 21 per cent of the world's population on only 9 per cent of the world's arable land. The government has taken notice of volatility in food prices in recent years and is determined to support domestic production. China's political leadership is especially concerned about this issue because exposure to price volatility in international markets could lead to social unrest and political instability.

But while China has managed for centuries to remain self-sufficient, it

It is no surprise that Chinese farmers are now seeking new opportunities at home and abroad

will not be able to do so in the future. Ten per cent of the Chinese population is estimated to be undernourished, the rural labour force is declining, and agricultural productivity is increasingly vulnerable to climate change, natural disasters and water shortages. For planning purposes, China must have at least 1.8 million mu (120 million hectares) of arable land to produce enough food to meet future demands. But around two-thirds of available land in China is now classified as either barren or low in agricultural potential, and smallholder Chinese farmers are leaving the land. If farmers do decide to stay they must overcome lower returns on traditional crops and the rising costs of diesel fuel, chemical fertilisers and pesticides. It is no surprise that Chinese farmers are now seeking new opportunities at home and abroad.

China has recently begun expanding its agricultural investment overseas, a move that reveals a more flexible approach towards self-reliance. Still, it is difficult to substantiate criticisms that China is now 'grabbing land' overseas to produce food to ship back home. Chinese corporations are involved in producing food in neighbouring countries for the domestic market, one example being the 400,000 hectare farm on the China–Russia border jointly owned by China's Huaxin Group and Russia's Armada software company. But the situation is quite different on the African continent, where Chinese companies produce food to meet local



Beef on sale at a stall in a Jakarta market. Asia will eat more protein as levels of wealth increase.

needs or to sell on the international market.

The issue of global food security in the 21st century is undoubtedly complex. Experts agree that we can no longer rely upon an abundant supply of cheap food. Environmental challenges now severely constrain sustainable agriculture and the world's growing prosperity has not made it easier to eradicate hunger: almost one-fifth of the world's population remains undernourished. Food prices are likely to remain high in the near future, so the world needs a stronger regulatory framework to mitigate the negative effects. Food security today is as much about stabilising markets as it is about ensuring an adequate supply of safe and reliable food to the world's most vulnerable communities. So more than ever, food security depends on open markets.

China is now more integrated into the global food economy. It has

expanded agricultural investment overseas and is increasingly active as a food donor. These new activities bring new international obligations. In recent years, Beijing has expanded agricultural development projects throughout Africa, Asia and Latin America, and increased emergency food relief. In 2011 China pledged US\$70 million in grain aid to drought-stricken countries in the Horn of Africa, a donation promoted in the official media as the largest contribution in the history of the People's Republic. China's responses to regional and global food policy challenges are large enough now that they have an important impact on whether food distribution is fair and reliable.

To date, the Chinese government has been supportive of collective efforts to establish a food security safeguard system, reduce competition between food and fuel, and strengthen

the regulation of food reserves in response to emergencies. It has increased its donations to the Food and Agricultural Organization (FAO), the World Food Programme and the International Agricultural Consultative Group, and now plays a stronger role in the newly reformed FAO Committee on Food Security. There are tensions over what approach works best in delivering food aid, and it is not entirely clear whether Chinese policymakers are interested in promoting open market access. But China's engagement in global food policymaking is positive. China's domestic and international experience might even see the emergence of a new global norm—collective reliance. 

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China's energy security strategies

KEJUN JIANG

ENERGY security has typically focused on energy imports, but increasingly the security of energy production, energy transportation, the energy environment, energy prices and energy investment have also become important considerations. Given this diversification of interests, China must now consider its energy security from a new perspective.

Due to the rapid development of transportation technologies, energy-efficient, alternative-fuel and electric vehicles have made good progress across the world. This is determining the direction of future development. Sources including the International Energy Agency's World Energy Outlook have concluded that world oil consumption will reach its peak before 2025. For China as well, oil consumption will reach its peak before 2025.

The global transportation sector will be the major consumer of oil. At present, the world's major oil-consuming countries are strongly promoting energy-efficient, alternative-fuel and electric vehicles. Energy-efficient cars now occupy a major share in the market. Many of these vehicles require only six litres of fuel per 100 kilometres, with some using as little as four litres per 100 kilometres. At the same time, natural gas and bio-fuels have also entered the field. The United States is now promoting the development of natural gas vehicles. And after considerable

progress in the past few years, bio-fuels are entering a steady phase of development; the bio-fuel sector is waiting on a second generation of manufacturing technology to allow it to fully commercialise. Based on current progress, the next rapid growth period for bio-fuels should arrive in five years' time.

Electric vehicles have quickly been promoted internationally and have entered large-scale commercial use in the United States and Japan. This rapid progress and the environmentally friendly features of electric vehicles can already be held up to the public as evidence of a successful and mature technology. This success should lead to a rapid development in electric vehicles in the next five years. These factors will make automotive oil consumption in the United States and Europe reach its peak soon.

A similar situation applies to China. Ownership of vehicles in China may reach 400 million in 2030, with the increase in vehicles mainly relating to automobiles. If these new vehicles are mainly private cars, China would be able to limit its fuel consumption to eight litres per 100 kilometres, or even to below seven litres per 100 kilometres, with the proper government policies. By 2020, China's new cars are expected to consume less than six litres per 100 kilometres. With the annual running distance of private cars around 1600 kilometres and with the development of alternative fuels and electric vehicles, gasoline and diesel consumption for 100 million

private cars (an approximation of the current figure) will be below 50 million tons or even 30 million tons in the long term. Given these factors, China should already be thinking about when it is likely to reach peak oil consumption, and its national oil companies should be revising their strategies accordingly.

CHINA'S energy consumption grew rapidly in the past decade, with consumption of fossil fuels the major contribution. Yet the exploration, production, import and combustion of fossil fuels have also raised concerns about health, air quality and other environmental conditions, challenging national strategies relating to energy security and sustainable development. As the international community enters a relatively stable era and China diversifies its energy imports, the difficulty of securing energy imports and exports is gradually weakening. Hence, China is currently well placed to focus on other aspects of its long-term energy security. Coal, for example, has long safeguarded China's energy security, but this situation is gradually becoming more complex.

China imports a great deal of coal, but it is still considered a more secure option than oil because the latter relies on imports from often-volatile regions. Nevertheless, there now appears to be a growing number of problems between China and various coal exporters, such as increased tensions with Vietnam

over competing claims to the South China Sea. Climate change policies will potentially impact on coal prices in other countries, like Australia. Meanwhile, frequent accidents in coal mining and high mortality rates caused by occupational diseases are also major factors in energy security, attracting the attention of both the Chinese government and the public. These factors will be unique security issues for China.

The scale of coal utilisation technologies is increasing. In the power generation industry, which accounts for more than half of China's coal consumption, new coal-fired generators produce up to one million kilowatts. If such a large-scale unit breaks down the entire power grid is substantially influenced.

Coal combustion is now also the primary contributor to air pollution and greenhouse gases in China. Even with the most advanced de-dusting facilities, problems relating to fine

particle matter (PM2.5), which is a health risk, caused by coal combustion will not be solved. Many parts of China took action to reduce or even desert coal consumption to improve air quality after reports of the effects of exposure to PM2.5 were made available to the government and the public earlier this year.

RELATIVE to coal and oil, the exploitation and utilisation of natural gas is cleaner. From the perspective of energy security, demand for natural gas in China will increase rapidly in the near future. Due to a shortage of domestic production, imports of natural gas are likely to be more than 50 per cent, constituting a problem of external dependence similar to that of oil. In contrast to oil, however, exporters of natural gases are located in relatively stable regions. Price is thus more likely to be an influential factor. Sources of natural gas imports should also be diversified

early so China can take the initiative in this still-emerging market.

Another security-related problem of natural gas is transportation safety. Memories of the gas explosion in Kai County several years ago are still fresh. The length of China's natural gas pipelines will extend to more than 100,000 kilometres in the future. With such long distances, there must be good mechanisms to guarantee safety and security.

China's energy future looks positive, with a movement away from polluting heavy power sources to more environmentally friendly ones without much associated additional cost. Much work still needs to be done, however, to secure these trends and ensure they are not derailed by bad policy. **EAFQ**

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PICTURE: / AAP



By 2020 China's new cars are expected to consume less than six litres per 100 kilometres.



Commitment needed to achieve food security

PETER WARR

FOOD security and agricultural development are back on the international agenda after a long absence. Between 1980 and 2011 annual foreign assistance for agricultural development fell from US\$8 billion to US\$3 billion, dropping from 17 per cent to 3 per cent of total foreign assistance to less-developed countries. In the 1980s 25 per cent of US foreign aid went to agriculture. In the 1990s this proportion fell to 6 per cent, and to 1 per cent in 2011. The share of World Bank lending going to agriculture was 30 per cent in 1978, 16 per cent in 1988 and 9 per cent in 2011. Within many developing countries themselves, public commitment to investment in

rural infrastructure and to agricultural research and development has also waned.

Complacency about the adequacy of food supplies was shaken by the international food price increases of 2007–08 and subsequent price surges, which have included dramatic rises in the price of rice, wheat and maize. The international price of rice, the staple food of most of Asia, more than tripled between 2003 and 2008.

Price changes generate both gainers and losers. When food prices rise, net sellers of food gain and net purchasers lose. Most Asian countries have large numbers of farmers, yet the net purchasers of food generally outnumber them, even within rural areas. Net purchasers include all nonagricultural workers and all

landless labourers working within agriculture. Poor people are the most vulnerable to increased food prices because food is a large component of their total budgets. For them, and for the institutions concerned with their welfare, the international food price increases of 2007–08 were deeply unsettling.

Food is not a typical commodity. It has no substitutes and its storage life is limited. The prospect of food insufficiency is frightening for anyone, which is why it makes sense to speak of ‘food security’ and not of, say, ‘clothing security’ or ‘entertainment

landless labourers working within agriculture. Poor people are the most vulnerable to increased food prices because food is a large component of their total budgets. For them, and for the institutions concerned with their welfare, the international food price increases of 2007–08 were deeply unsettling.

security.' People can survive for a long time without new supplies of clothing or entertainment, but food is different. 'Security' implies a concern with the future and not just today. The concept of food security therefore relates to forward-looking expectations about the continuous availability of food, both at the household and national levels.

For most households, food insecurity is a matter of purchasing power. The rich are never hungry, except in the most extreme circumstances of wars or natural disasters, and even then the poor are more severely affected. The key to enhanced food security at the household level is sustainable poverty reduction, regardless of whether food prices are volatile.

Because of its dependence on weather, agricultural production is volatile, and this leads to periodic episodes of food shortages in some regions. International trade is a powerful mechanism for overcoming temporary food shortages. But international markets are volatile too, and the responses of national governments to this volatility have undermined the capacity of international trade to perform its stabilising function.

At the national level, food security is often interpreted as food self-sufficiency, meaning that sufficient food is present within the country to make imports unnecessary. The aversion to imports arises, in part, from mistrust of international markets as reliable sources for a nation's food requirements. But the concept of food self-sufficiency is different from food security at the household level and can be in conflict with it.

Consider a country that normally imports food. One way to reduce imports is to prohibit them. This

will raise food prices within the country, discouraging consumption and stimulating additional supplies, thereby reducing imports. But the increase in food prices means that the level of food consumption for households will be reduced and, for some poor households, may fall below nutritional requirements. In this way food self-sufficiency can be in conflict with food security.

The short-term response of some food-importing countries exacerbated the international price increases of 2007–08. Fearing that the country would be unable to obtain the rice needed for domestic consumption, the government of the Philippines—then the world's largest importer—sharply increased its demand for imported rice to replenish the stocks held by its food agency, the National Food Authority. This panic buying further exacerbated the international price increases.

Food self-sufficiency can also conflict with food security if exporters restrict trade in response to international price volatility. This happened during the 2007–08 crisis when Russia introduced export bans on wheat, and India and Vietnam

did the same for rice. These bans were intended to protect domestic consumers from high international prices. Although the bans attracted a great deal of international criticism, the political reasoning behind them is easily understood. The export bans predictably contributed to international price spikes. Estimations suggest that, between them, the export bans and the panic buying explain most of the international price increase for rice.

National food security is best achieved not through trade restrictions but through poverty reduction initiatives and improved agricultural productivity. Raising productivity facilitates expanded food production without raising domestic prices—which directly affect the poor—and without necessarily drawing large areas of additional land into agricultural production, which often involves destroying forests and other ecologically important habitats.

The flow of new agricultural technologies emerging from the Consultative Group on International Agricultural Research system has slowed. Renewed international commitment is required. But so is investment within the developing countries themselves, both in agricultural research and in training the next generation of agricultural researchers. Research and training are critical for maintaining the momentum of productivity growth in agriculture and for finding ways to adapt to climate change. 

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... food security is often interpreted as food self-sufficiency, meaning that sufficient food is present within the country to make imports unnecessary

China's climate change policy: greener growth?

FRANK JOTZO AND
YONGSHENG ZHANG

CHINA'S economic transformation is so rapid that around two decades from now, the country is likely to join the ranks of high-income societies, according to the joint report *China 2030* by the Development Research Center and World Bank. Quality of life for most of its people is being enhanced, but there are also downsides and even threats to the continued rise in prosperity.

Rapid growth has led to environmental destruction as well as social and regional imbalances. A cleaner environment, without the risks of recurring climate change-related disasters, is rising up the priority list. China is potentially vulnerable to climate change-induced water shortages and a host of other climate-related threats.

As one of the world's largest emitters and a likely trendsetter for many developing countries, China's greenhouse gas trajectory is crucial for future global climate change. The challenge is to keep the economy growing, but in a manner that involves ever less emissions. Coupled with other environmental and social concerns, this is often termed 'green growth'.

Green is not usually the colour that comes to mind when one observes the urbanisation and industrialisation underway in China. Yet improvements are being made. The emissions intensity of China's economy has

been declining, except during a period in the early 2000s. Emissions intensity, measured as kilograms of carbon dioxide from fossil fuel use per renminbi of GDP, decreased by 15 per cent from 2005 to 2011, according to the International Energy Agency.

China's national emissions target, pledged to the international community, is a 40 to 45 per cent reduction in emissions intensity from 2005 to 2020. This is likely to require substantial policy action. China already has programs in place to speed up improvements in energy efficiency and to deploy large amounts of renewable and nuclear power alongside the expansion of high-efficiency coal-fired power plants. The next wave of policy efforts is set to be market-based and include the use of emissions trading.

THE motivation for China's policy effort is not only to limit climate change but also to transform its development model to one that is more innovation-driven. This would improve China's competitiveness and domestic energy security in the long run and potentially allow it to attain a leadership position in advanced energy technologies.

In most advanced economies, absolute emissions levels have fallen in recent years due to slow economic growth coupled with continued improvements in emissions levels and the development of new energy sources. In the United States there is dramatic change. Measured

against 2005 (the base year for America's international climate change commitment) carbon dioxide emissions during January–April 2012 were down 19 per cent and 14 per cent for the power sector and the economy as a whole, respectively. America's target of a 17 per cent reduction by 2020 is in reach.

Because China is still in the process of industrialising and urbanising its absolute emissions levels continue to rise, up by approximately 57 per cent in 2011 over the 2005 level. When and at what level might absolute emissions turn around? China's emissions-intensity target may give the answer. If both GDP and emissions continue growing quickly for a few years and GDP growth slows down in the second half of the decade, then China's emissions growth may need to level out before 2020 if the target is to be met.

For China's emissions growth to peter out within a decade may seem an extraordinary proposition given the huge amount of urbanisation still to come. By then, China will have significantly higher average per capita emissions than Europe and Japan. But despite its reliance on coal and the prominence of heavy industries, China should be able to stay below the much higher per capita levels of the United States, Canada or Australia.

Limiting the environmental footprint of China's economy requires a transformation from the traditional fossil fuel-based growth model to a green growth model, decoupling



Miners lumping coal to their homes after a shift in a mine in Shanxi province. Greening China's economy means applying society's ingenuity and effort towards activities that place less stress on the natural environment.

growth from carbon emissions and resources-dependence. It is no longer feasible for China to follow the same high emissions process the already industrialised economies of the West used to industrialise their economies. It must develop a new growth model.

Greening the economy does not mean less economic growth. Such a process can be a new source of growth and improve the quality of growth. Greening the economy means applying society's ingenuity and effort towards activities that place little stress on the natural environment—for example, better information technology rather than larger offices and more long distance travel; better public transport rather than more roads; smaller homes of high quality rather than ever larger ones that are poorly built.

Governments can help make growth greener by creating the right framework for change and investing in the necessary infrastructure. In other cases they need to get out of the way and allow markets to effect change. The decline in US carbon emissions stems in part from market-driven shifts, such as the expansion of shale gas and reduced energy use in response to higher oil prices.

IN CHINA, state-owned enterprises in the energy sector and in heavy industry, both critical for greening growth, exercise a large amount of control. Monopoly state ownership of heavy industries tends to act as a brake on innovation and structural change.

Yet a commitment to market-

based emissions control has emerged. Emissions trading pilot schemes are in preparation in Guangdong and Hubei provinces, as well as in Beijing, Shanghai, Tianjin, Chongqing and Shenzhen. These will cover over a fifth of China's population and a significant share of its emissions.

A national emissions trading scheme is likely to start in the second half of the decade. This will be the largest market-based scheme for emissions control. It could become the core of an effective long-term climate policy framework for China.

It will be a long and winding road. China's plans for emissions trading epitomise the struggle between the old and new ways of organising the economy. While the leadership is pushing ahead with plans to introduce

market-based emissions control, the electricity sector, which has the largest potential to cut emissions, remains in a straightjacket of regulation. Power supply prices are not fully market-based and stand in the way of an efficient response by end-users. Planners rather than markets determine which power stations supply the grid at any point in time. For emissions trading to work properly, both these factors need reform.

Comprehensive energy pricing reform is widely considered a much taller task than introducing national emissions trading. The principal concern centres on social stability. Many observers fear market-based power prices could put a large number of people at a disadvantage.

China's effort to curb emissions is significant for global climate change. But for China to achieve both economic growth and climate change mitigation it needs to transform its development model, decoupling economic growth from emissions and making 'greening' a source of growth. To achieve this transformation, the government needs to put in place well-designed policies. The market system needs to be further consolidated through structural reforms, and well-designed environmental market mechanisms need to be introduced, such as a broad-based national emissions trading scheme. Climate policy could become a catalyst for broader reform. **EARQ**

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Turning point: a bigger role for APEC

TAKATO OJIMI

THE world's energy environment is undergoing great changes. In particular, the Asia Pacific region, which accounts for over half of the world's energy consumption, is approaching a turning point with regard to energy security.

On the demand side, despite a relative slowdown in the economic growth rate across Asia as an effect of the European financial crisis, primary energy consumption is still showing steady increases. On the supply side, concerns over the safety of nuclear energy are escalating globally after the Fukushima nuclear power plant accident in Japan and decisions to review the energy mix have been on the political agenda in many countries. Counteracting this ambiguity in the future of supply is the shale gas revolution.

Energy security has increased in importance since the 'Arab Spring' as the resulting political instability and other geopolitical risks in the Middle East make energy resources there less reliable. The Asia Pacific is particularly at risk from these developments because it imports much of its energy from the Middle East.

To tackle these hot issues, 'energy intensive' discussions have taken place within APEC's Leaders' meetings

and Energy Ministers' meetings. At the Vladivostok summit this year, following the declaration agreed upon at the 2011 Honolulu summit, APEC leaders agreed 'to develop an Action Plan in order to achieve the aspirational goal to reduce APEC's aggregate energy intensity by 45 per cent by 2035'.

According to the Asia Pacific Energy Research Centre's (APEREC) calculations, satisfactory improvements in energy intensity are observable in the period 2005–2008. But emission-intensity levels have stagnated at around 34 per cent as of 2010. Greater efforts are needed to fulfil APEC's challenging goal of a 45 per cent reduction by 2035.

APEREC is contributing to this effort by implementing a Peer Review on Energy Efficiency program, issuing policy guidelines to economies in the region and undertaking sector-specific activities such as the Cooperative Energy Efficiency Design for Sustainability. Efforts to address the issue from the supply side include the Peer Review on Low Carbon Energy Supply and some regional initiatives of Low Carbon Model Town projects in Tianjin, China, and Samui Island, Thailand.

Nuclear power continues to be an important energy source for Asia. The recent APEC Leaders' meeting made a

declaration to 'Ensure the safe and secure use of nuclear energy as a clean energy source in interested economies by sharing expertise, knowledge and best practices, improving nuclear safety standards and coordinating emergency response and preparedness mechanisms'.

For Japan, where nuclear energy has been one of the most important sources of energy supply, public opinion on nuclear energy is split, and even the energy-starved government is cautious about planning new energy policies. Yet the number of nuclear power plants will increase throughout the rest of Asia in the near future. This makes it vital that APEC deepen cooperation and learn from Japan's recent experiences by paying closer attention to safety, staff training and sharing crisis-management policies.

NATURAL gas has a smaller impact on the environment than any other fossil fuel. Its reserves are also relatively evenly distributed, meaning that we can safely predict its continued market expansion and expect steady investment in the development of natural gas and liquefaction facilities along with expansion of trade in liquefied natural gas (LNG).

At this year's summit in Russia, which is a large producer and exporter of natural gas, APEC leaders recommended that authorities 'Review the current state and prospects of energy markets of the APEC region, with a view to increasing the share of natural gas in the energy mix as one of the most widespread and cleanest burning fossil fuels in the region.'

In response, Japan's Ministry of Economy, Trade and Industry



A workman at an exploration site on the Longgang natural gas field in Lishan, in China's southwestern Sichuan province. Natural gas has a smaller environmental impact than other fossil fuels and its reserves are also evenly distributed.



Delegates confer at the APEC Energy Ministers' meeting in St Petersburg in June 2012. The meeting encouraged APEC's Energy Working Group and the Asia Pacific Energy Research Centre to improve the response to oil and gas emergencies in the APEC zone.

and APERC jointly held an 'LNG Producer–Consumer Conference' in Tokyo in September this year. It was attended by over 500 delegates from around the world, including the energy ministers of Japan, Australia, Canada, Qatar and South Korea, with the aim of increasing transparency in the demand and supply of LNG and facilitating better trade in the resource.

Many APEC economies have a high level of energy dependence on the Middle East, which is notoriously volatile. There is thus a need to strengthen security strategies to prepare for emergencies. Previously, initiatives for responding to oil supply shortages were taken under the International Energy Agency; but, since the use of LNG is predicted to spread throughout the APEC region in the near future, the need to explore emergency response exercises for both

oil and natural gas is increasing.

With this understanding the latest APEC summit decided to 'Promote activities to improve the response to oil and gas emergency situations in the region.' This was a follow-up to the APEC energy ministers' clear directive to 'encourage the Energy Working Group and APERC to work on activities to improve the response to oil and gas emergency situations in the APEC region, including emergency response workshops and exercises'.

APERC releases an APEC energy demand and supply outlook report every two to three years. The fifth edition is currently being finalised, with the target year of 2035. APERC predicts that, on the energy demand side, energy efficiency will improve by 45 per cent by 2035 under an assumption of 4 per cent economic

growth per annum across the region. This would see APEC meet its energy intensity target.

Oil production within the region will also increase, but not enough to meet expanding consumption. Imports of oil from outside the region will thus also increase. This is clearly a danger for energy security and economic stability within the region. Alongside oil, demand for all fossil fuels is forecast to increase, and as a result CO₂ emissions are predicted to grow by 72 per cent by 2035.

The projection outlined above assumes 'business as usual'. If serious changes in policy can be enacted it would be possible to create a framework which is softer for the environment. In particular, if there is increased use of natural gas, the fossil fuel that emits the least CO₂, we can expect a much better energy balance to become reality. In such a scenario, if restrictions such as price interventions and export prohibitions in the gas sector can be lessened, APERC predicts a 30 per cent increase in gas production by 2035. If this gas displaces coal power, CO₂ emissions will be reduced by 15 per cent in electrical production and will contribute to a 5 per cent reduction in CO₂ emissions throughout the APEC region.

In the quarter of a century since APEC was founded it has dealt with a number of energy crises. These have always battered the region. Even now, energy problems in the APEC region are running hot. To combat these challenges all the APEC economies must strengthen cooperation in the energy field to enjoy continued and lasting stable growth and prosperity.



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The role of greater farm productivity and trade

KYM ANDERSON

RAPID trade-led economic growth in emerging economies is shifting the global economic and industrial centres of gravity away from the north Atlantic, raising the importance of Asia in world trade, and altering the commodity structure of Asia's trade. This is a process that began with Japan's re-emergence in the 1950s. Hong Kong, Korea and Taiwan joined the process from the late 1960s, then some Southeast Asian countries. The much more populous China and India are now its drivers.

The early-industrialising Northeast Asian group represents just 3 per cent of the world's population. Its rapid growth was easily accommodated, including in primary product markets. But China and India account for more than two-fifths of humanity. Their rapid industrialisation and income growth have far greater significance for primary product markets and for food and energy security. The increasing impact of China and India has already been felt over the past decade in terms of historically high international food, mineral and energy prices. The pressure on food prices has been exacerbated by new biofuel policies in the United States, European Union and elsewhere that provide an incentive to redirect crop use from foodstuffs to biofuels. Agricultural export booms in emerging economies like Brazil are only marginally offsetting these effects on food prices.

I recently completed global

economy-wide modelling work with Dr Anna Strutt of Waikato and Adelaide universities that projected the world economy to 2030. We asked how the model's baseline projection would be affected by changes in farm productivity or agricultural trade policies.

In the baseline the share of developing countries in global GDP rises from barely one-quarter in 2007 to almost one-half by 2030, and their average per capita income rises from 33 to 56 per cent of the global average. This increase in spending power boosts the global demand for food along with other goods and services. The net result in that baseline projection is that the real international prices for agricultural and food products in 2030 are slightly above the 2007 level. This rise contrasts with the decline in real food prices over much of the 20th century, and is despite projecting rapid farm productivity growth over the same period.

If the economies of China and India were to grow by one-quarter less than in the baseline scenario to 2030 this would not lower international food prices. The reduction in projected demand in that scenario is accompanied by a parallel slowdown in farm (and other) productivity and thus in these emerging economies' projected food supply that would maintain the baseline price projection.

Should slower Asian growth lead to less investment in R&D to the extent that annual global primary sector productivity growth fell by

a further one percentage point, it would cause real farm product prices in international markets to be about 10 per cent higher in 2030. This underscores the importance of continued investment in agricultural R&D, especially since the social rate of return to such further investments is very high because of past underinvestment. Assigning public funds for this purpose is highly likely to be growth-enhancing, and more so the greater the need to adapt to climate change.

However, it matters where agricultural R&D is undertaken. At one extreme, if investments are only in relatively poor agrarian African economies with high population growth rates, that would boost not only food supply but also food demand there. This is because such technological improvement in those countries raises real incomes in very populous rural areas. At the other extreme, if productivity growth was confined to high-income countries the boost to demand would be much lower because less than 3 per cent of the workforce would directly benefit from that productivity boost. If faster grain productivity growth is confined to middle-income China and India over the projection period, the impact is in between those two extremes: it would boost those countries' grain self-sufficiency by several percentage points, as well as their per capita consumption of calories and protein. But it would only reduce the rise in international farm product prices by

less than 1 per cent in aggregate and 3 per cent for grains.

It also matters which farm technologies are the focus of any new R&D. Conventional crop-improvement breeding is very slow, taking on average 25–30 years from initial research expenditure to widespread improvements on farms in cases of successful R&D. New biotechnologies and nanotechnologies, by contrast, allow accelerated and more-targeted crop breeding, including for such desirable traits as higher yields, more nutrients or

drought tolerance. In many cases these traits can be stacked, further speeding developments. Parts of the world that have allowed the adoption of new biotech crops have enjoyed substantial benefits, as have consumers insofar as those technologies have lowered international food prices. Many countries have denied themselves these new crop technologies, including China and India except for cotton. Denying developing countries' farmers and food consumers those potential benefits is enormously costly.

If developing countries neglect to

expand investments in agricultural R&D they not only forego economic growth and the chance to alleviate poverty but also the associated boost to food self-sufficiency. Should this prompt demands for protection from food imports that governments are not able to resist, the consequent growth in agricultural protectionism would raise domestic food prices and thus harm net buyers of food in those developing countries. It would also reduce export prospects for farmers in food-surplus economies. And it would make international food markets even 'thinner', so prices would be even more volatile.

If the World Trade Organization's Doha Development Agenda could be resurrected and concluded with commitments to open markets multilaterally, its trade reforms would not only boost global economic welfare but also reduce global inequality and poverty. Multilateral reform of agricultural trade would also 'thicken' international food markets and reduce the capacity of countries to 'beggar thy neighbours' by insulating their domestic markets from variable world prices. This would be especially the case if export restraints could be disciplined more by the WTO. A desirable consequence of comprehensive multilateral trade reform would be fewer fluctuations in international food prices and fewer and less-severe food price spikes. Benefits could be compounded by removing biofuel subsidies and mandates, thereby reducing the link between food and fossil fuel prices.

EAFO

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Drying chillies in Andhra Pradesh: new agricultural technologies promise substantial benefits.

PICTURE: EPA / AAP

Sino-Russian cooperation on gas: reality and implications

PICTURE: SERGEI ILLITSKY / EPA / AAP

KEUN-WOOK PAIK

FOR 10 years after 2000, cooperation between China and Russia in the natural gas sector was very limited. Owing to political problems arising from Russian company TNK-BP's ownership of the Kovykta gas field in Eastern Siberia, Moscow decided to prioritise the development of Chayandagas and the surrounding four major gas fields in the Sakha Republic. These were all allocated to Russian company Gazprom, and even though the 1.7 trillion cubic metres (tcm) of reserves in these fields is not as big as Kovykta's 2 tcm, Chayandagas alone is plentiful enough to spur Gazprom to pursue a 30 billion cubic metres/year (bcm/y) long-distance pipeline development. Even though Kovykta is under Gazprom's control, Russia's current priority is to develop Chayandagas and to export to Asia first.

China's demand for gas has increased significantly during the 2000s, and the development of the West–East Pipeline (WEP I) across the country during the first half of the decade laid solid ground for China's natural gas expansion. This has now been augmented by the construction of WEP II to import a large volume of gas from Turkmenistan as part of a WEP corridor (including WEP III, IV and V) during the current 12th Five-Year Plan.

However, expectations for natural gas sector cooperation between Russia and China are still not promising.



Gazprom's 'swing supplier' strategy with gas exports makes Beijing planners uncomfortable.

This is especially the case given that Gazprom has prioritised gas exports from the Russian federal subject of Altai (in West Siberia) to west China—something not regarded favourably by Beijing given it would much prefer that Russia prioritised the supply of East Siberian gas to northeastern China. And since China has prioritised Central Asian (in particular Turkmenistan) gas as an equity supply source, Altai gas was not a ‘must-have’ option for China. Altai gas must overcome this problem if it is to access the Chinese gas market by the mid-2010s. Even if the current price issue were to be settled this year, supplying Altai gas by Gazprom’s target of 2017 will not be easy, with 2018–2020 being a more realistic date.

Gazprom’s ‘swing supplier’ strategy of prioritising Altai rather than East Siberian gas exports is making Beijing planners very uncomfortable, as China’s gas supply is being shared with the European market in accordance with Gazprom’s tactics. After the global financial crisis of 2008 the European Union’s appetite for Russian gas contracted and this drove Gazprom to a more aggressive Asian gas export policy. Given East Siberia remained without a developed pipeline structure, Altai gas exports fitted neatly into Gazprom’s strategy of switching its European gas exports to China. Similarly, the Eastern Siberia–Pacific Ocean oil pipeline has allowed Russia to export its crude oil to the Asian market directly, thereby alleviating Russia’s dependence on European buyers.

Further complicating the Altai-to-west-China pipeline development is that Beijing’s need for Russian gas is not as desperate as its need for Russian oil. Natural gas is still considered the most expensive fuel source for power generation, accounting for only around

15 per cent of total gas consumption. It also tends to be treated as a peak load energy source, not a base load source. Though Beijing claims that more natural gas will be used in the gas-for-power sector in the future, this would be prohibitively expensive without reform of the distorted electricity, gas and coal pricing system.

These issues lie behind the state-owned China National Petroleum Corporation’s (CNPC) inability to accept the oil-related border price which Gazprom is demanding. Chinese planners find Gazprom’s price excessive because CNPC cannot increase domestic gas prices, which are strictly controlled by the Chinese National Development and Reform Commission’s price department. When it became clear that this price stalemate would continue, Beijing immediately made the decision to construct the WEP II pipeline to bring gas from Central Asia. The equity gas option offered by Turkmenistan was enough to compensate for the burden of the high border price for imports (as it can make profits from the upstream sector based on its equity stake).

Gazprom’s current stance is that Russia will move ahead with exporting its oil and liquified natural gas (LNG) to ‘Asia’. It takes the view that if China wants to buy, that is fine, but if not then other countries will be happy to

A failure of the Sino-Russian gas relationship will deprive both countries of a potential win-win solution

do so. At the same time Russia (unlike the Central Asian states and many other countries in the world) refuses to allow China to own any part of the field and pipeline development. This rigid stance is central to why Beijing has not accepted Gazprom’s commercial terms.

Western media and energy security specialists argue that Russian President Vladimir Putin is using gas exports as a blackmail weapon against European buyers. When Russia has suspended its gas supply to Ukraine or Belarus, Putin has threatened to re-direct the gas exports to China. To date such threats are only verbal, but they will become much more real once the necessary Altai pipeline infrastructure is completed. Once gas exports via the Altai route to China begin, Western media will point out how the Altai export option enhances Russia’s negotiation position vis-à-vis European buyers. But Chinese planners should not be blamed for ‘robbing’ the Europeans of their gas when they would prefer to buy from East Siberia, not Altai in West Siberia.

The key point is that the Chinese do not need Altai for the WEP system to work because they can obtain Central Asian gas. They do need East Siberian gas—which currently lacks pipeline infrastructure—because regional gas capacity in the three northeastern provinces of China is small and, without access to East Siberia or Sakhalin, the alternative is large-scale LNG imports.

Sino–Russian gas cooperation in the first decade of the century was so limited because Russia tried to replicate its experience with oil exports but found China unwilling to agree. This unwillingness was due to four main factors. First, Russia refused to allow equity in fields or pipeline projects and therefore refused China

any control in the value chain. Second, Russia demanded unattractively high prices. Third, China had alternative import options (the Central Asian republics, Myanmar and LNG imports) as well as the potential to expand domestic production. And finally, there was a lack of trust on both sides. Russia wanted to avoid depending completely on China as a market and China wanted to avoid over-dependence on Russia as a source of supply. The failure of the price negotiations is a reflection of all of these problems.

The current outlook is that Russian gas potential will be largely unfulfilled. The Chinese gas market will thus be much smaller than it could be and large Russian gas reserves will remain stranded for decades. But if the current outlook changes and potential is more completely realised it could make a huge difference to the global gas market. Failure to achieve large-scale gas pipeline imports from Russia will force China to significantly expand LNG imports. This will increase the competition for LNG supplies between importers in Northeast Asia (Japan, Korea and Taiwan) and other buyers of LNG in regions as far away as Europe. A failure of the Sino–Russian gas relationship will therefore deprive both countries of a potential ‘win–win’ solution to their energy and development problems and increase future global rivalry in the market for LNG. **EAFO**

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Saving the fish in Asia and the Pacific

TOM KOMPAS

FISHERIES play an increasingly important role in human societies worldwide. The world fish food supply has grown dramatically over the last five decades at an average rate of 3.2 per cent per year, well surpassing the world’s average population growth of 1.7 per cent per year. In 2010, the world supply of fish was 148 million tonnes, of which marine fisheries contributed more than half, at 80 million tonnes. Of these, the Northwest Pacific had the highest production of fish, with 20.9 million tonnes (27 per cent of the global marine catch), followed by the Western and Central Pacific with 11.7 million tonnes (15 per cent), the Northeast Atlantic with 8.7 million tonnes (11 per cent), and the Southeast

Of the 60 per cent of the world’s fisheries in need of rebuilding only 1 per cent are making progress. The task is daunting . . .

Pacific, with a total catch of 7.8 million tonnes (10 per cent).

Sustainability in fisheries is doubly important because this sector provides 17 per cent of the world population’s intake of animal protein. And, as of 2010, 55 million people are estimated to be engaged in the primary sector of fish production as fishers or fish farmers, with as many as 660–820 million people, or about 12 per cent of the world’s population, involved in fish production, processing and related industries.

Yet it is clear that ocean and capture fisheries are not being managed sustainably. Many fish stocks are depleting, some rapidly. Estimates for over-fishing range from 28 per cent to as much as 63 per cent of world stocks, with estimated fish stocks that have already collapsed ranging from 7–14 per cent of the total. Regions with fish stocks in greatest need of recovery include the Northeast Atlantic, the Mediterranean Sea and the Black Sea, followed by the Northwest Atlantic, the Southeast Atlantic, the Southeast Pacific and the Southern Ocean.

As part of the World Summit on Sustainable Development in 2002, most countries committed themselves to a target to maintain or restore fisheries stocks to levels that could produce the maximum sustainable yield by 2015. This target will not be

met. Of the 60 per cent of the world's fisheries in need of rebuilding only 1 per cent are making progress. The task is daunting. Overall estimates for rebuilding fish stocks require a cut of 36-43 per cent in fishing capacity compared to 2008 levels, resulting in the loss of employment of 12-15 million fishers and costing up to US\$400 billion for potential boat and licence buybacks.

A variety of instruments are employed in maintaining or restoring fish stocks depending on the situation at hand and, in many cases, political will. They range from input controls such as limiting the number of

vessels or restricting season length to the use of output controls in setting total allowable catch, often combined with tradable rights to fish or individual transferable quotas. While the evidence for the benefits of the varied instruments in the sustainable management of fisheries is mixed, experience suggests that a combination of rights-based systems with strong legal structures is likely to be the most successful approach.

Although fish stocks in Asia and the Pacific have fared better than in Europe and North America, it is clear that 'business as usual' will similarly seriously deplete the region's fish

stocks sooner rather than later. Both Yellowfin and Bigeye tuna are already classified as over-fished in the Western and Central Pacific fishery and stock status for Southern Bluefin tuna is in considerable doubt.

Fortunately, two recent innovations in fisheries economics, if properly applied, can help to generate more certain and beneficial outcomes for the region. The first involves breaking with practice and using the right harvest target—maximum economic yield instead of maximum sustainable yield. The second involves the correct design and expanded use of marine reserves or 'no-take' zones. Both generate



A successful buyer hauls his tuna from Tokyo's Tsukiji market. Both Yellowfin and Bigeye tuna are already classified as over-fished in the Western and Central Pacific fishery and the status of stocks of Southern Bluefin tuna is in considerable doubt

PICTURE: MARK BAKER / AP PHOTO / AAP

'win-win' outcomes, protecting and enhancing fish stocks for future generations and also generating larger profitability for industry and national economies.

Maximum economic yield is a harvest target that designates a catch level that maximises the difference between total discounted revenues and the costs of fishing. In other words, it seeks to maximise fishery profits, not harvest yields. This will almost always occur at fish stock levels that are greater than stocks at maximum sustainable yield. The reason is simple. If you take into account the cost of fishing it pays to have 'thick' or large fish stocks so that each time a line is dropped or a net is cast, the cost of fishing per unit of catch is lower and thus profits are higher. Catching more fish instead to increase short term revenues, ignoring costs, or moving to maximum sustainable yield simply results in lower profitability and lower stocks of fish. Proper fisheries management requires stocks to be larger than those associated with maximum sustainable yield.

The gains from following a maximum economic yield target can be remarkable. In the management of tuna stocks in the Western and Central Pacific fishery, for example, the use of a maximum economic yield target can generate an extra net present value of \$5.4 billion over a 50 year planning horizon, or about \$108 million per year. If the fishery follows a 'business as usual' path the cumulative expected net present value is \$2.0 billion, or about \$57 million per year over the same planning period, with some danger of fishery collapse along the way. The bioeconomic losses from 'business as usual' are thus \$3.4 billion, and the resulting loss to Pacific Island nations is considerable.

Of course maximum economic

Estimates . . . show that added profitability can more than compensate for the loss in employment from stock rebuilding, both in the fishing industry and in fish processing sectors

yield targets generate smaller harvests in some cases and lower levels of employment. But higher future profits can be used to compensate fishers fully for initially lower harvests and net returns as fish stocks recover. Profits could also be used to finance transfers of funds to some countries which suffer most in the short term from stock rebuilding. Estimates, again for the Western and Central Pacific fishery, show that added profitability can more than compensate for the loss in employment from stock rebuilding, both in the fishing industry and in fish processing sectors. In some cases this compensation can be by order of 10 to 15 times the magnitude of overall household incomes.

Marine protected areas, marine reserves and 'no-take' zones are proven to provide substantial biological and conservation benefits. A growing body of research shows that fish populations inside a 'no-take' zone can more than quadruple, providing enhanced fish stocks and needed resilience.

The fishing industry has always objected to the use of marine reserves, claiming that closing fishing grounds will simply lower profitability and catch. But this turns out not to be the case, especially when the effects of adverse shocks to fisheries, such as bad weather or the effects of climate change, are considered. Again, the reason is simple: reserves generate resilience, not only biologically but economically. They act as buffer stocks, so that the spillover from fish stocks in a nearby 'no-take' area can compensate for a negative shock to a fishery. The effect is common in already established reserves. The buffer stock effect can be substantial, leading not only to higher catches over time, but both quicker return to profitability and higher sustainable profits. In the end, reserves generate more catch, more fish, and more profits. They should be the principal fisheries management tool in Asia and the Pacific.

Something needs to be done, or fish stocks in Asia and the Pacific region will follow their North American and European counterparts on the road to collapse. The longer action is delayed, the more costly and possibly irreversible the consequences will be. Some fisheries in the world will never recover. The use of a maximum economic yield harvest target and the establishment of a system of marine reserves throughout the region are the best advice that economists can offer. 'Business as usual' simply will not do.

EAFO

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