SHAPING A NEW ENERGY LANDSCAPE

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A Singapore Perspective

SHAPING A NEW ENERGY LANDSCAPE

By Chee Hong Tat,
Chief Executive, Energy Market Authority

The Singapore Energy Market Authority (EMA) convened the fifth Singapore International Energy Week (SIEW) in October 2012, where energy ministers and business leaders gathered to exchange perspectives on the dynamic changes in the energy landscape. The overarching theme of "Shaping a New Energy Landscape" prompted robust discussions on how governments and businesses could work together to build a sustainable energy future. For the first time, the energy event also included activities to raise awareness of energy issues among the youth.

This special publication captures the key takeaways from SIEW 2012, which involved delegates from more than 60 countries. Many Asian economies are expanding their energy infrastructure in tandem with economic growth, while balancing the need for energy security and environmental sustainability. These challenges were discussed by the Energy Ministers from Brunei, Lao PDR and Malaysia who attended SIEW 2012.

Singapore's energy sector has also witnessed many exciting developments in recent years. One key project is the LNG terminal which is scheduled to commence operations in the second quarter of 2013. This will enhance our energy security and enable Singapore to purchase gas from different countries around the world. The open-access terminal will start with two tanks and a capacity of 3.5 million tonnes per annum (Mtpa), before reaching 6Mtpa by early 2014. This is when a third tank and additional regasification facilities will be completed.

Global developments such as the rise of unconventional gas will have a significant impact on Asia, where energy demand is growing rapidly and is expected to double in the coming decades. It is therefore critical for the global energy community to come together to deliberate the opportunities and challenges in this new energy horizon.

With this objective in mind, the EMA hopes that SIEW 2013 will once again provide the platform for insightful discussions and meaningful exchanges among energy leaders from the public and private sectors, as we collectively examine a way forward for our energy future. ■


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CHARTING OUR ENERGY FUTURE

In a wide-ranging interview, Singapore's Minister in the Prime Minister's Office and Second Minister in Home Affairs & Trade and Industry, S. Iswaran, maps out the city-state's approach to ensure affordable, secure and sustainable energy supplies to meet rising energy demand. He also elaborates on the significance of the opening of Singapore's first liquefied natural gas terminal.

Singapore has recently witnessed a major milestone in its energy landscape, with the opening of the country's first liquefied natural gas (LNG) terminal. The terminal has an initial throughput capacity of 3.5 million tonnes per annum (Mtpa) with the successful completion of its first two tanks. This will increase to 6 Mtpa by the end of the year when a third tank is completed.

Singapore's impetus to develop LNG infrastructure is clear. "The LNG terminal plays a pivotal role in boosting Singapore's energy security and competitiveness," said Minister Iswaran.

"It is a key piece of infrastructure that will allow us to diversify our energy sources by importing natural gas from the global gas market, thus enhancing our energy security. It will also enable Singapore to benefit from changes in the global gas market and enhance the price competitiveness of our energy supplies," he added.

The Government's decision to construct the LNG terminal was also driven by a number of other potential benefits for the Singapore economy.

The Minister explained: "LNG imports will provide an additional source of feedstock for our petrochemical sector. At the same time, there are opportunities for the development of ancillary services, such as LNG trading, bunkering and break-bulk services."

Such is the significance of LNG for Singapore that last October, even as anticipation was ramping up for the terminal's opening this year, plans were announced to add a fourth tank and expand the terminal's capacity to 9 Mtpa.

Fast-forward to today, and Singapore's Energy Market Authority (EMA) is conducting a study on the feasibility of several sites for possible future LNG infrastructure. This is part of the Government's long-term energy infrastructure planning to ensure that Singapore is able to meet future natural gas demand.

In addition to LNG infrastructure, Singapore is also developing a framework for its future import of LNG. Singapore's first tranche of LNG is brought in by BG Singapore Gas Marketing Pte Ltd (BGSGM), which has been awarded an exclusive franchise for up to 3 Mtpa or the year 2023, whichever is attained earlier. Power generation companies and industrial users have committed to purchasing around 2.7 Mtpa of LNG, or about 90 per cent of BGSGM's franchise. With LNG set to play a larger and growing role in Singapore's energy mix, Minister Iswaran shared that efforts are underway to put in place a robust LNG import framework that achieves Singapore's objectives of enhancing energy security and ensuring that end-users receive competitively-priced gas.

He explained: "There are several considerations that underpin a viable LNG import framework from our perspective.

"First, while Singapore's incremental gas demand in the near term may be relatively small, Singapore's total demand for gas could eventually increase to about 15 Mtpa in the next 10 years. Any procurement framework must be able to effectively address this future demand.

"Second, future LNG import should enhance the price competitiveness of our gas supply and minimise volatility. This could be achieved through a diversified portfolio of LNG from geographically-diverse supply sources and, where possible, a blend of contract durations and price indexation.

"Third, the future LNG import framework should optimise the available capacity and operational efficiency of the LNG terminal, while allowing Singapore's domestic end-users to benefit from opportunities that may arise from developments in the global gas market, such as the emergence of new gas supplies and movements in gas prices."

Last year, EMA published a consultation paper to seek industry views on the possible options for Singapore's future import of LNG. This elicited a range of views. Some industry players were in favour of demand aggregation that could allow for scale in procurement to secure more favourable prices and terms; others felt that having multiple aggregators would allow for better price discovery.

Minister Iswaran said that EMA will launch a second consultation on the proposed LNG import framework for Singapore in May. Taking industry feedback into consideration, EMA will launch a competitive Request-for-Proposal (RFP) process for Singapore's incremental near-term demand. The RFP process will allow end-users to access the most competitive LNG supplies as it enables them to take advantage of changing market conditions and the emergence of new suppliers. The consultation will also seek industry's views on providing end-users with more options and flexibility to meet their needs, such as through allowing new piped natural gas imports on a case-by-case basis, as well as allowing gas users to import spot LNG cargoes.

REGIONAL GAS OUTLOOK

Singapore is not alone in its LNG development plans, as Asia looks to natural gas to meet its growing energy needs.

Minister Iswaran said: "We expect that gas will play an increasingly important role in meeting Asia's energy demand for power, transport and industrial use. Additionally, as natural gas is a cleaner fossil fuel, it can help countries meet their environmental sustainability objectives."

So, to what extent will Asia be able to benefit from recent global gas market developments?

The Trade and Industry Minister said that a major factor is the shale gas revolution in North America. The US – formerly the world's second-largest gas importer – may soon become a net LNG exporter which could significantly affect global supply and demand dynamics.

SINGAPORE AS AN LNG TRADING HUB

He also recognised the value of establishing an LNG trading hub in Asia. While there is a global market for oil, there is still a wide disparity between gas prices in the US, Europe and Asia. For this to narrow, links between physical gas markets within Asia, as well as the related financial markets, must be strengthened. He said: "If an LNG trading hub is indeed successfully established in Asia, it could bridge the difference in LNG price between Asia, Europe and the US. The entire region stands to gain."

Presently, 14 companies have an LNG trading or marketing presence in Singapore. The Minister shared that International Enterprise (IE) Singapore – the Government agency that drives Singapore's external economy and promotes international trade – has been spearheading efforts to attract LNG players to use Singapore as an Asian base for their LNG trading business. The opening of the LNG terminal could attract more LNG traders to Singapore, helping it to eventually emerge as an LNG trading hub in Asia.

We expect that gas will place an increasingly important role in meeting Asia's energy demand for power, transport and industrial use. Additionally, as natural gas is a cleaner fossil fuel, it can help countries to meet their environmental sustainability objectives

ALTERNATIVE ENERGY OPTIONS AND ENERGY EFFICIENCY

While natural gas holds much promise for Singapore and the region, Singapore is also pursuing other energy alternatives for greater diversification of its fuel mix.

"Singapore will continue to explore all energy options for the longer term. One example is solar energy. We continue to invest in research, development and demonstration projects for clean energy to build our capabilities, develop new technologies, and prepare for the deployment of clean energy sources when they become commercially viable," said Minister Iswaran.

Energy demand management is another strategy that complements Singapore's exploration of new options for its energy supply.

"We need a whole-of-community effort to build a sustainable energy future. In particular, all end-users must play a part in managing our energy consumption, and make the best use of this scarce resource," he said.

For businesses, the Singapore Government co-funds investments and provides tax rebates for energy-efficient equipment or technologies. The Singapore Government has also complemented these incentives with a gradual tightening of energy efficiency requirements. For example, the Energy Conservation Act, which came into effect on 1 April 2013, mandates energy management practices, the submission of energy efficiency improvement plans, and energy monitoring and reporting for large energy users.

LOOKING AHEAD

With the introduction of LNG and in view of local and regional developments, Singapore's power sector is set to grow.

To ensure that households and businesses reap the benefits, the country is further liberalising the retail electricity market to give more consumers the option to become contestable. This would allow them to buy electricity from either the wholesale market or the retailers, who could provide packages at competitive market prices.

Singapore is also studying the implementation of a demand response programme to allow consumers to monitor and manage their electricity demand in real time.

Minister Iswaran said that Singapore will continue to work closely with its ASEAN neighbours to strengthen regional energy connectivity.

He concluded: "The future of the energy sector in Singapore and the region holds much promise. We have seen technological innovation open up new sources of oil and gas, harness renewable energy more effectively, and help reduce energy consumption. The approach to address our energy future has to be inclusive – involving all stakeholders in the energy supply chain and addressing issues of concern to them. In Singapore, we are committed to policies, partnerships and infrastructure that will enable us to obtain sustainable, secure, and competitively-priced energy." ■

FOUR CRITICAL CONSIDERATIONS ON ENERGY

Responsible for the future of energy on both a micro and macro scale, energy ministers from Brunei, Lao PDR, Malaysia and Cambodia, give their insights on the future of energy

From energy security to climate change and regional coordination, the energy ministers of ASEAN must balance critical decisions that will steer a course for their rapidly growing countries for decades to come.

Ensuring secure, stable, affordable and environmentally-sustainable energy supplies is not always easy, especially when the demands of fuelling vibrant and dynamic economies run up against the need to mitigate climate change.

Whether the fuel mix choices that governments make in 2013 will still be relevant and cost-effective in 2030 and beyond – and whether those choices will fulfill their international obligation to reduce greenhouse gas emissions – is all part of the unforgiving political terrain that ASEAN's ministers must chart.

For Lao PDR, with its abundant water resources and energy-hungry neighbours, hydro has been the future fuel of choice. For Cambodia, the development of hydro and even solar is aimed at easing its reliance on imports. In Brunei, the oil-rich sultanate is looking to renewables as the age of easy oil draws to a close. For Malaysia, exploration and overseas expansion are set to balance the challenges of dwindling reserves.

Underscoring the choices of these ministers, meanwhile, is the realisation that regional co-operation will be key to driving the success of ASEAN; much now rests on the experience and skill of their stewardship.

BRUNEI

YANG BERHOMAT PEHIN DATO DR AWANG HAJI MOHAMMAD YASMIN BIN HAJI UMAR, MINISTER OF ENERGY AT THE PRIME MINISTER'S OFFICE

Oil and energy have been a part of the Brunei story for more than 80 years, but today the time of "easy oil" has long since passed. Crude oil and natural gas production account for 90 per cent of its gross domestic product – the sultanate pumps 167,000 barrels of oil a day, making it the fourth-largest producer in Southeast Asia – and Brunei aims to expand its upstream and downstream development of hydrocarbons to maximise the economic spinoffs of the sector.

According to Brunei's Minister of Energy at the Prime Minister's Office, Yang Berhomat Pehin Dato Dr Awang Haji Mohammad Yasmin bin Haji Umar, the country's first Energy White Paper, due to be launched this year, will deliver a roadmap to the year 2035 for the entire energy sector.

The paper outlines large increases in investment for exploration and development, awarding new frontier blocks to global consortiums. The paper also provides investment incentives for marginal fields, where secondary and tertiary recovery methods will maximise the extraction of hydrocarbons. Downstream, the country is looking into developing high-value products.

All these should increase local content in the industry by more than 60 per cent and local employment to 40,000 by 2035, the Minister said on the sidelines of the Singapore International Energy Week 2012 in October.

Come 2035, Brunei also plans to reduce energy intensity by 45 per cent from 2005 levels, in line with the 2011 Honolulu Declaration. As of 2012, the country has already reduced its energy intensity by 11.3 per cent, equivalent to 346 tonne oil equivalent per US$1 million of GDP," Mr Pehin said.

Brunei is looking into renewables and has set up its first solar power plant, producing 1.7MW of electricity. There are plans to build a 25MW waste-to-energy power plant. The Energy Ministry is reviewing the viability of other renewable energy resources and early studies have shown that there is potential from solar, wind and hydropower.

For Asia, Pehin Yasmin predicts that the share of natural gas will increase substantially, driven mainly by demand for power generation. However, coal and oil will remain key fuels in the region's energy mix through to 2035.

As Asia's economies become increasingly interdependent, energy co-operation in the form of a common grid driven by commitment from ASEAN will be a necessary pre-condition for the region's growth.

While there are obvious benefits from a common power grid, significant challenges remain, said the Minister. He added that ASEAN needs a more diversified mix of energy sources. There is also the pressing issue of how to shape the region's future through connectivity while meeting national and regional needs for energy security, economic growth, and sustainability.

"In my view, the challenges in realising true energy co-operation require concerted political will and collaboration of all stakeholders – the political, public, private and social sectors. At a country level, there is the challenge of aligning domestic regulations with regional priorities. And as we all know, that is not easy to achieve given that it involves, I believe, more entrenched structural reforms and policy co-ordination," he said. ■

LAO PDR

MR SOULIVONG DARAVONG, MINISTER OF ENERGY AND MINES

Landlocked and generating 45 per cent of its energy from firewood, Lao PDR is an unlikely contender for the title of powerhouse of Southeast Asia.

But with a potential of 26,000MW of hydropower and strategically situated near Thailand, Vietnam, Myanmar, Cambodia and China, Lao PDR is touting itself as the future "Battery of Asia".

Today, most of its power is earmarked for export to its energy-hungry neighbours in Thailand and Vietnam.

There are currently 10 hydro projects under construction. In 2010, the massive Nam Theun 2 dam began operations and is expected to deliver a projected $2 billion in revenue to the Lao PDR government over the next 25 years.

"Fifteen years ago, we had only 200MW of capacity," explained Lao PDR Minister of Energy and Mines, Soulivong Daravong, on the sidelines of the Singapore International Energy Week 2012 last year. "Today, we have 2,570MW."

As the country's fortunes turn – it is currently on track to post 8.3 per cent growth in 2012, according to the International Monetary Fund (IMF) – the government's attention is slowly turning to the domestic market, where energy demand is rising at a rate of more than 10 per cent annually.

Financing projects of this scale has been outside the scope of a country that derives half of its GDP from subsistence farming, but development banks and the private sector have been quick to see the attractiveness of the Laotian hydro story. ASEAN economic integration, planned for 2015, is likely to provide an additional boost to Lao PDR's growth prospects by creating a single regional market.

The government's ambitious plans for hydropower export have not been without controversy.

In November 2012, Lao PDR gave the green light for the construction of a US$3.5 billion Thai-financed mega-dam in the Lower Mekong, called the Xayaburi hydropower project.

It has come under fire from environmentalists and neighbours who say it will disrupt fish migration patterns and affect local communities.

Lao PDR has worked hard to overcome these challenges, taking expert advice and monitoring the implementation of its projects.

Mr Daravong said: "Of course, hydro power projects in our country have to be sustainable. For that we need the latest technology and we need a lot of expertise from those countries that have done this sort of work before us.

"We were criticised over Nam Theun 2 from everywhere in the world, but now so many countries ask to come to see the project and learn from it. The World Bank has even nominated it as one of its best projects," he said, noting that money from the project continues to aid with resettlement and help with the biodiversity of the area.

While Lao PDR has had a good record of finding solutions during times of adversity, the hydro boom is fast shaping up as a driver of the country's economic rebirth.

Mr Daravong said the country's hope is that the turnaround is sustainable.

"For my part, I'm optimistic," he added. ■

MALAYSIA

DATO' SRI PETER CHIN FAH KUI, MINISTER OF ENERGY, GREEN TECHNOLOGY AND WATER

Malaysia is taking firm steps towards a sustainable energy mix, but aware of the challenges involved, its Minister of Energy, Green Technology and Water, Dato' Sri Peter Chin Fah Kui, acknowledged that in the near term, the country will continue to rely on fossil fuels. These still serve a large chunk of the country's power generation and industrial needs.

"When we talk about Malaysia's needs, we will have to adapt our fuel mix structure," he said. "Our current energy mix is skewed to fossil fuels, [but] we are committed to including renewable energy into our fuel mix, not as our base load, but rather as peak [load].

"Of course, we need to be mindful that we are committed to reducing carbon emissions by 40 per cent, with the proviso that we have the technology and the investment needed," Dato' Sri Peter Chin said.

Speaking on the sidelines of the Singapore International Energy Week 2012 last October, he noted that gas was the cleanest traditional energy source available, but was also "expensive". Hence, Malaysia is looking at how to better leverage technology in energy production, such as clean coal technologies. However, the country will adopt nuclear energy only "with the acceptance of the population".

"We will begin in earnest the education process, so the population will be able to make informed decisions whether to accept or reject nuclear energy," he said.

To stimulate the growth of renewable energy, Malaysia launched its Feed-in Tariff (FiT) at end of 2011, and has been promoting biomass and biogas alongside solar energy. Dato' Sri Peter Chin conceded that there is still some way to go, as Malaysia's renewable energy goals have consistently been under target for the past two five-year plans.

Conservation and energy efficiency will continue to feature high on the national agenda, said the Minister, noting that rumours over the demise of the Malaysian oil gas sector are premature.

"I'm not sure what year we will run out of fossil fuel – we all know fossil fuels are limited. But, of course, we are mindful that if we can conserve that resource for as long as we can, that is also a good strategy."

Key to conserving future stocks will be the eventual lifting of fuel subsidies. While cheap fuel at the pumps may be electorally popular, it imposes no market discipline on an increasingly expensive commodity.

"The government has announced in no uncertain terms that it wants to roll back subsidies – even the Prime Minister himself has said this," Dato' Sri Peter Chin said. "However, it's the timetable that's important. We are looking at areas where the population's income level may not be able to sustain a high energy tariff. Otherwise, these people will be the victims. We will continue to roll back subsidies, but the timetable has to be looked at in a practical and pragmatic manner."

Simultaneously, Malaysia is also embarking on structural reforms for its electricity distribution framework. The country plans to introduce a more liberalised electricity market to ensure that supply is sustainable, predictable and capable of supporting the nation's long-term socio-economic goals, said the Minister during his speech at the Singapore Energy Summit 2012. ■

CAMBODIA

MR ITH PRAING, SECRETARY OF STATE FOR ENERGY

Coming late to a party can have its advantages. Cambodia is finding that it has access to the latest technology as it revs up the search for more energy solutions.

"We are looking at the latest clean coal technology and with hydro we are getting the best and most reputable developers coming out of China," Cambodia's Secretary of State for Energy, Ith Praing, said on the sidelines of the Singapore International Energy Week 2012 in October.

Cambodia imports more than 45 per cent of its electricity. Only 35 per cent of its population is on the national grid. Its electricity prices are among the highest in Asia – those living in rural areas pay as much as US$1 per kilowatt hour.

Mr Ith Praing estimated that Cambodia needs energy infrastructure investment of more than US$1 billion. Much of it will come from public-private partnerships as soft loans are difficult to access.

The Cambodian government released its updated power masterplan five years ago that has already achieved its most critical objective – a transmission line that runs from the north to the south of the country to drive economic and social development.

"What we aim to do is develop our indigenous resources to bring down our levels of electricity imports… because this, in turn, will bring down the cost of power," Mr Ith Praing said.

Demand for power is expected to increase by 500 per cent over the next 15 years, reaching 3,000MW by 2050. While the country has long-term contracts with its neighbours Thailand and Vietnam, generating its own power is now a significant arm of the Cambodian masterplan.

The government has awarded concessions for foreign private participation in hydro projects with a total capacity of about 800MW – five projects ranging from an 18MW micro-dam to a large 338MW hydro scheme operating from 2011 to 2014.

The potential for hydro power is estimated at about 10,000MW, but at present it realises just three per cent of this. Diesel-generated power plants are still the mainstay, leaving the country vulnerable to the vicissitudes of the oil market.

Cambodia is also examining other viable renewable energy alternatives, in particular solar, which can take advantage of the country's long dry monsoon cycle. The country has not launched any projects because the cost of the technology is too high.

Financing remains a challenge. Private-sector involvement in Cambodia's hydro sector currently stands at 100 per cent due to the country's difficulty in accessing the soft loan market. However, as Cambodia's GDP improves, these loans could start to come onstream.

Ultimately, Mr Ith Praing said Cambodia's goal is to become a net exporter of electricity, but conceded that there may be limits even to the Mekong's vast resources.

"We have to consider our indigenous water resources and what they can produce. The mainstream of the Mekong has great potential, but even this can be exhausted. All the resources of the Mekong have not been utilised yet, and this is under very careful study," he added. ■

Only strong policy and fiscal reform will make the right conditions for effective energy investment

FINANCING THE FUTURE OF ENERGY

As Asia's economies expand and the need to power them grows exponentially, one recent event gave the region pause for thought: a massive blackout in India which effectively left more than a billion people without power.

This dramatic event underscores the delicate and increasingly complex link between policy and financial frameworks in providing the Asia-Pacific region with the energy it needs to grow.

With electricity prices capped for consumers, producers have been forced to sell their product at a loss. India's power utilities are currently running losses estimated at three trillion rupees, and this is expected to treble over the next three years.

Electricity sector reform allowing private investment over the past decade is changing that.

New capacity should reach 26,000 megawatts this year, twice the capacity installed last year, largely due to investments from the likes of Tata Power and Adani Power.

In many ways, India's experience is emblematic of the challenges faced by the region. The cost of expanding and modernising energy systems runs into the trillions, but finance from traditional sources, mostly public investment, falls far short of requirements. This widening gap will need to be filled by alternative financiers such as public-private partnerships and institutional investors.

RE-EXAMINING ENERGY INVESTMENTS

According to Jo Yamagata, the Deputy Director General of the Private Sector Operations Department at the Asian Development Bank (ADB): "There is no way that governments are able to finance future energy investment in their entirety, so there is a strong need for the private sector."

To this end, governments need to address two critical factors when looking at the energy needs of the future. The first is energy policy and strategy, and government strategy needs to build a structure based on the assumption that the private sector will be in the driver's seat for future energy investment, he said.

Until now, Mr Yamagata added that "strategy was based on the assumption that governments would make up the lion's share of the investment and the private sector would simply supplement


20%
FALL-OFF IN INVESTMENT IN CLEAN ENERGY FROM IN 2012 FROM 2011, THE FIRST DROP SINCE 2004

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it. That assumption needs to be revised," he said, adding that "the private sector should be allowed to lead energy investment within a framework set by the government".

The second factor is the need to expand and develop the banking sector and capital markets.

Asian countries such as Lao PDR are putting these types of policies to the test. A developing economy that derives much of its energy needs from a mixture of firewood and expensive imported petroleum products, Lao PDR has embarked on a programme of hydro-electric schemes to meet its future energy needs.

Minister of Energy and Mines for Lao PDR Soulivong Daravong says meeting the finance needs of costly projects, such as large-scale hydro dams, has been challenging for a country that has no capital markets and little in the way of financial infrastructure.

'"Of course, we've needed private participation in all of this," says Mr Daravong, adding that the essential ingredient for this has been laying the groundwork that creates a hospitable environment for lenders.

"Despite underdevelopment, Lao PDR's legal framework has already proved acceptable to international lenders," he said. "The country has adopted a series of tax breaks and government import waivers to make the landscape more accommodating for lenders.

To date, Lao PDR has successfully negotiated with different power plants terms that represent a return on investment of 12-15 per cent and a concession period of 25-30 years".

Nevertheless, risks and challenges have emerged due to the environmental and social concerns that go hand-in-hand with large-scale hydro schemes.

"The requirements of the banking community are more and more stringent, making the projects more and more expensive," said Mr Daravong, adding that the export market is another factor that has made for a tough lending environment.

For more developed economies in the region, such as Malaysia, fine-tuning the energy mix to meet future needs is no less challenging.

In a country where fossil fuels are depleting, financing a range of new options brings fresh complexities. At present, Malaysia's energy mix consists of hydro, gas and coal and biomass units. With 26 different independent power producers (IPPs) in the country producing 16,500MW, the sector is well-developed. Despite this, the government plans to do more to encourage the uptake of renewables.

Speaking on the sidelines of the 2012 Singapore International Energy Week, Dr Emir Mavani, President and CEO of Malaysia Petroleum Resources Corporation, said: "The government has a new mechanism for looking into renewable energy, and solar will make up a major part of that. We've invested US$400 million into renewable energy and we have just announced our feed-in tariffs."

He added that while many renewable projects in Malaysia are still small-scale – between 5-6MW – the challenge of how to finance them remains.

"To do this we have to make sure our policy levers are correct," he said, adding that the mechanisms of transparency designed to reduce risk for financial institutions in renewables are equally applicable to the fossil fuel market.

"Malaysia has given third-party access to LNG importers and is looking at mechanisms for re-importing through regas plants, in which we've invested heavily in Malaysia.

"We've invested in one regas plant in Melaka," he said, adding that longer-term growth will be supported by the second and third regasification plants to be constructed in Johor and Sabah. The Johor plant alone will raise supply by another 3.8Mtpa by 2017.

"This will change the way energy producers look at energy and how they finance their own energy market."

THE FUTURE OF FINANCING

Energy financing in Asian economies already mirrors trends around the world. According to Mr Michael T Eckhart, Managing Director & Global Head of Environmental Finance at Citigroup, the world is currently 40 years into a 100-year transition to clean energy.

"From a banking perspective we don't see this as an event," he said. "We see this as the normal course of technology waves coming into the industry and this is all pulled together by public policy."

In terms of financing, there is increasingly a convergence between project financing as understood in the IPP industry (that is by negotiated contract) and project financing as understood by developing financial institutions (based on powerful investors with a strong relationship with the host government clubbing together).

"You see that, for example, in South Africa with their procurement of renewable energy," Mr Eckhart said. "It's very much a US and European style of financing with the negotiated contract under the auspices of their government, which is working with the developing financial institutions. We're seeing a merger of these two."

Basel III, the global regulatory standard on bank capital adequacy and market liquidity risk which is due to come into effect in 2013, will also affect project financing in all its forms.

"On the one hand, you have governments needing long-term capital and, on the other hand, you have banking regulators forcing the banks out of long-term lending," he said. "We can now make only a seven-year loan. We cannot make a 15-year loan to a wind farm anymore."

He said that, increasingly, as the banks move out of project financing, mainstream utilities, oil companies and energy companies will fill the gap as they adopt renewable energy as mainstream technologies in their systems and operations.

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Risks and challenges have emerged due to the environmental and social concerns that go hand-in-hand with large-scale hydro schemes

Above: A hydro power plant in Asia

"The second part of this is access to the capital markets because that's where the long-term debt financing is in the form of private and public bonds – that's where the 15- and even 40-year money is which these projects really need to level the cost of their projects," he said.

ALTERNATIVE ENERGY GOES MAINSTREAM

In 2011, more than US$280 billion was invested in clean energy around the globe, with China and the US accounting for more than US$50 billion each. According to Mr Jon Moore, Deputy Chief Executive of Bloomberg New Energy Finance, the term "alternative" is not used within the finance industry anymore.

"It's just energy now because it is mainstream," he said. "There are some very large trends taking place – one of the big ones is around solar. About 52 per cent of the increase in 2011 was solar and by far the biggest part of that was distributed solar. That's a huge growth area – in fact, 44 per cent of all power additions last year were clean energy."

Despite this, there are short-term challenges for the industry; chief among them is a 20 per cent fall-off in investment in 2012 from 2011, the first drop since 2004.

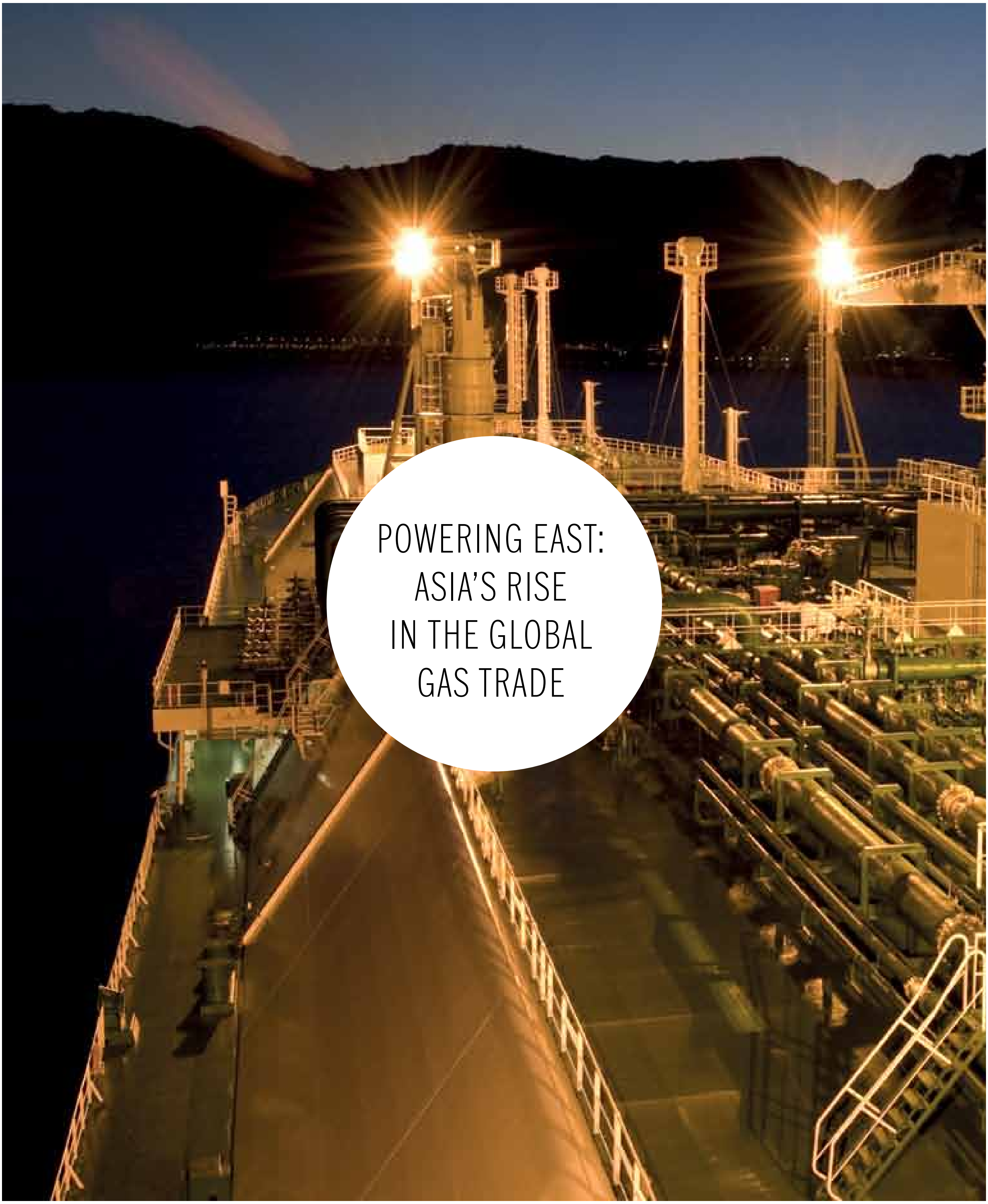
"This is interesting because if this is a growing long-term trend, why would we be hitting a downturn now particularly when the financial crisis took place a few years back? There are a handful of things that we worry about," he said. "One is around policy uncertainty, particularly in the US and the UK and in places like Italy. Policy uncertainty holds back investment.

"Another is around stock prices – clean energy stocks are pretty much as low as they have been and they're not headed north any time soon now. Again this prevents people from investing in the sector," he said.

Combined with the falling cost of materials and oversupply in the manufacturing value chain, stress and discomfort in the market have placed a strain on investment.

"In subsidies, we're now seeing the end of the stimulus packages that were put together during the financial crisis – it's now down to pure economics. Economies may be picking up in emerging markets, but not fast enough to make up the difference," he said.

For governments, the demand for energy is a constant, and attracting the private sector is vital – mandating market reforms and impartial regulation as well as promoting energy projects that look beyond political boundaries and make economic sense for the region as a whole. ■



POWERING EAST: ASIA'S RISE IN THE GLOBAL GAS TRADE

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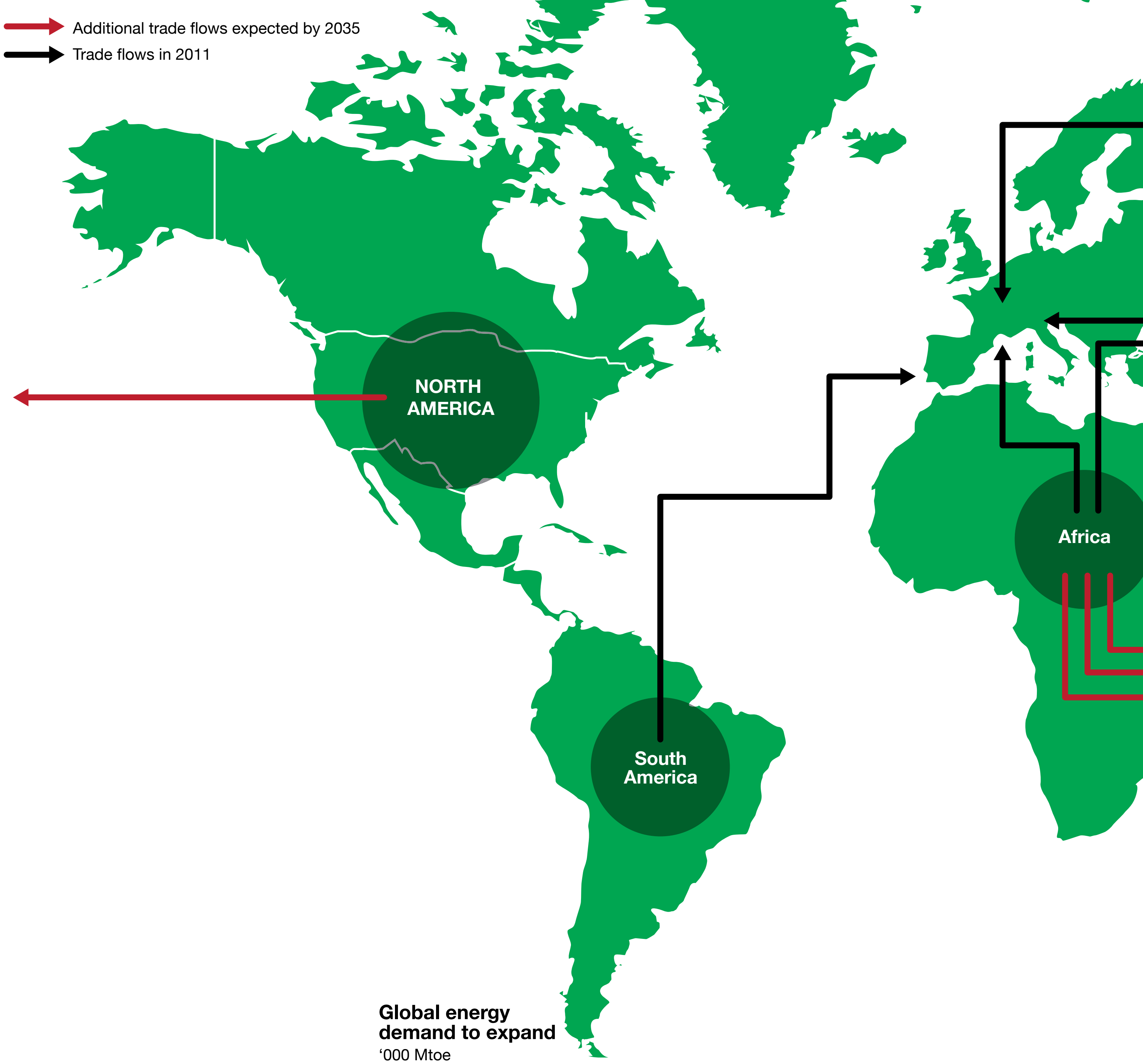
Major global gas trade flows in 2011 and 2035



Global energy demand to expand
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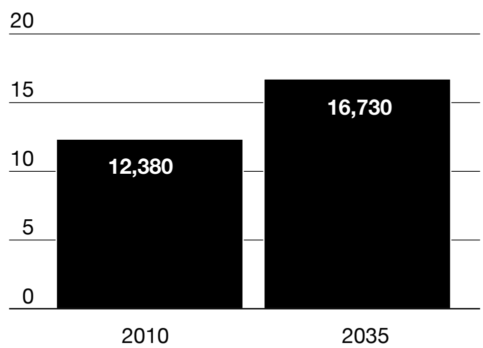
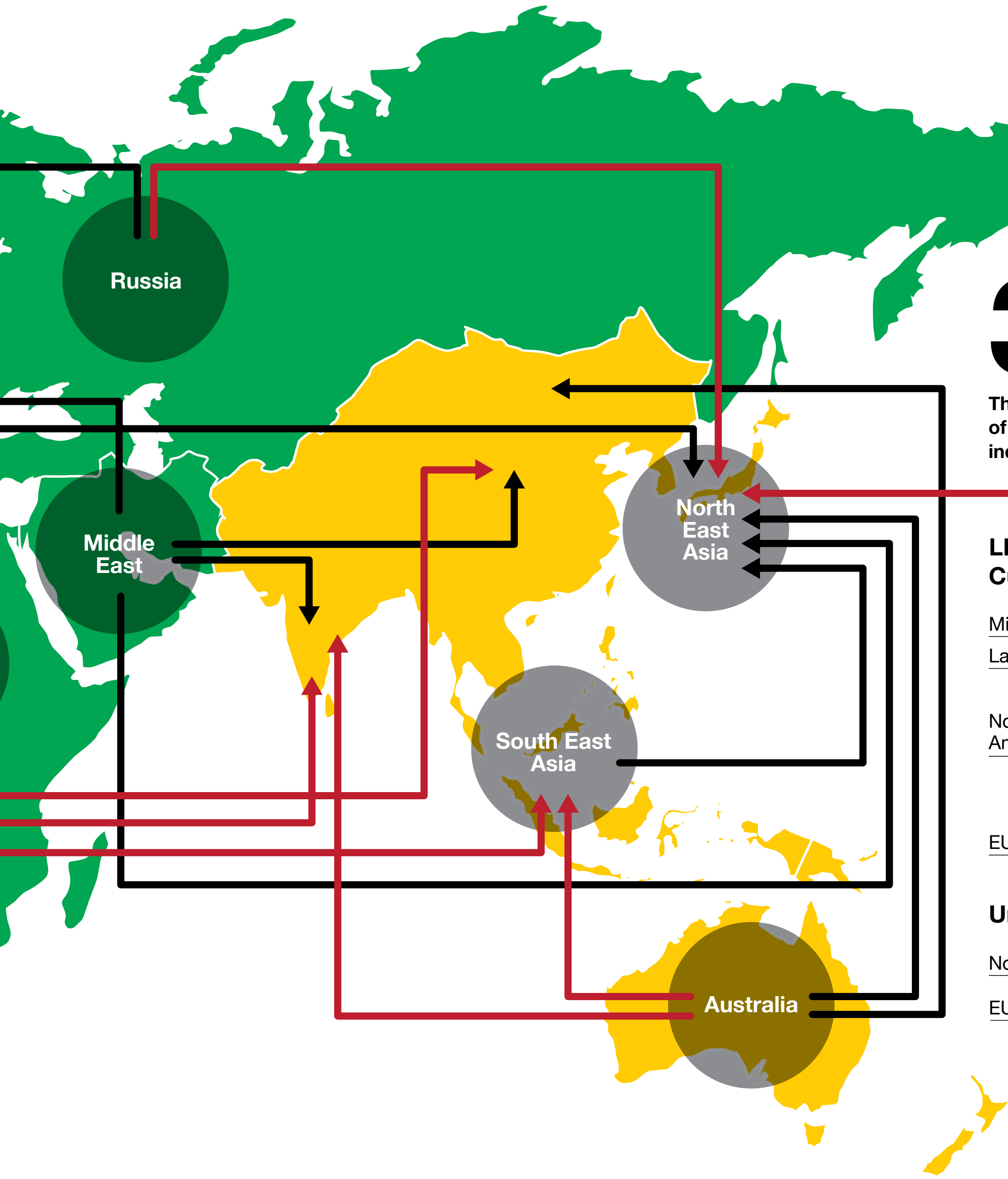


Asia's economic growth has resulted in it doubling its consumption of natural gas in the last decade, with supplies delivered via pipes and liquefied natural gas (LNG) cargoes. The International Energy Agency expects Asia to become the second-largest global natural gas market after North America by 2015. And as new and unconventional gas supplies from around the world come onstream in the near-term, new gas trade flows to Asia are set to emerge.

The map above shows a marked rise in expected gas trade flows in 2035, vis-à-vis current gas trade flows. The expected rise in gas trade flows is supported by several trends:

- The growth of global energy demand by over 30% from 2010 to 2035, driven by continued expansion and urbanisation in emerging economies.
- The surge in global natural gas demand, which is predicted to increase by 50 per cent to five trillion cubic metres in 2035.
- The region's continued economic growth and regional governmental initiatives to use cleaner sources of fuel to meet lower emission targets.

Source material for all data and graphics: World Energy Outlook 2012 © OECD/IEA 2012; Developing a Natural Gas Trading Hub in Asia © OECD/IEA 2013; BP Statistical Review 2012; BP Energy Outlook 2030; Petroleum Econ International Gas Union Natural Gas Industry Report to 2030; International Gas Union World LNG Report 2011; Grenatec Pan-Asian Energy Infrastructure Report; Global LNG Info (website); California Energy Commission (webs

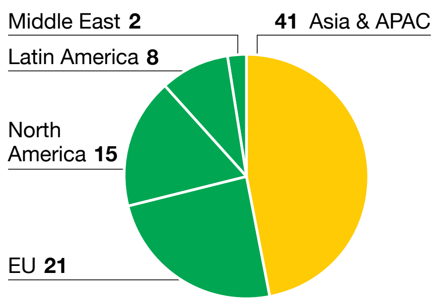


39%

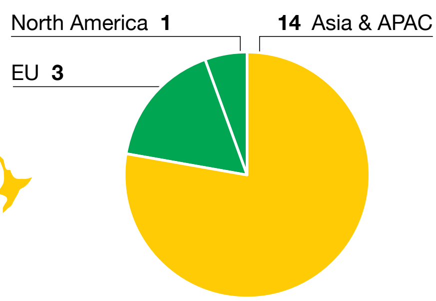
The power sector will account for 39% of gas demand growth to 2030 and the industrial sector for 38%.

LNG Import terminals

Current (as of April 2012)



Under construction (as of April 2012)

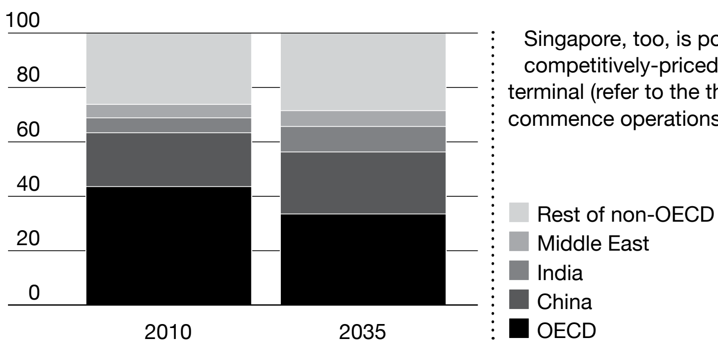


LNG is set to form a larger portion of Asia's gas supply, with new LNG production and export facilities coming online in Australia, and several Asian countries building new LNG receiving terminals to import LNG cargoes (refer to the second map).

The International Energy Agency, in its World Energy Outlook 2012 report, said it believes that the LNG trade will become more flexible and that contract terms will evolve. This development will subsequently lead to a strengthening of links between regional gas markets.

Emerging economies to drive global gas demand

Share of demand by region (%)



Singapore, too, is positioning itself to tap on competitively-priced gas via its new LNG terminal (refer to the third map), which is set to commence operations later this year.

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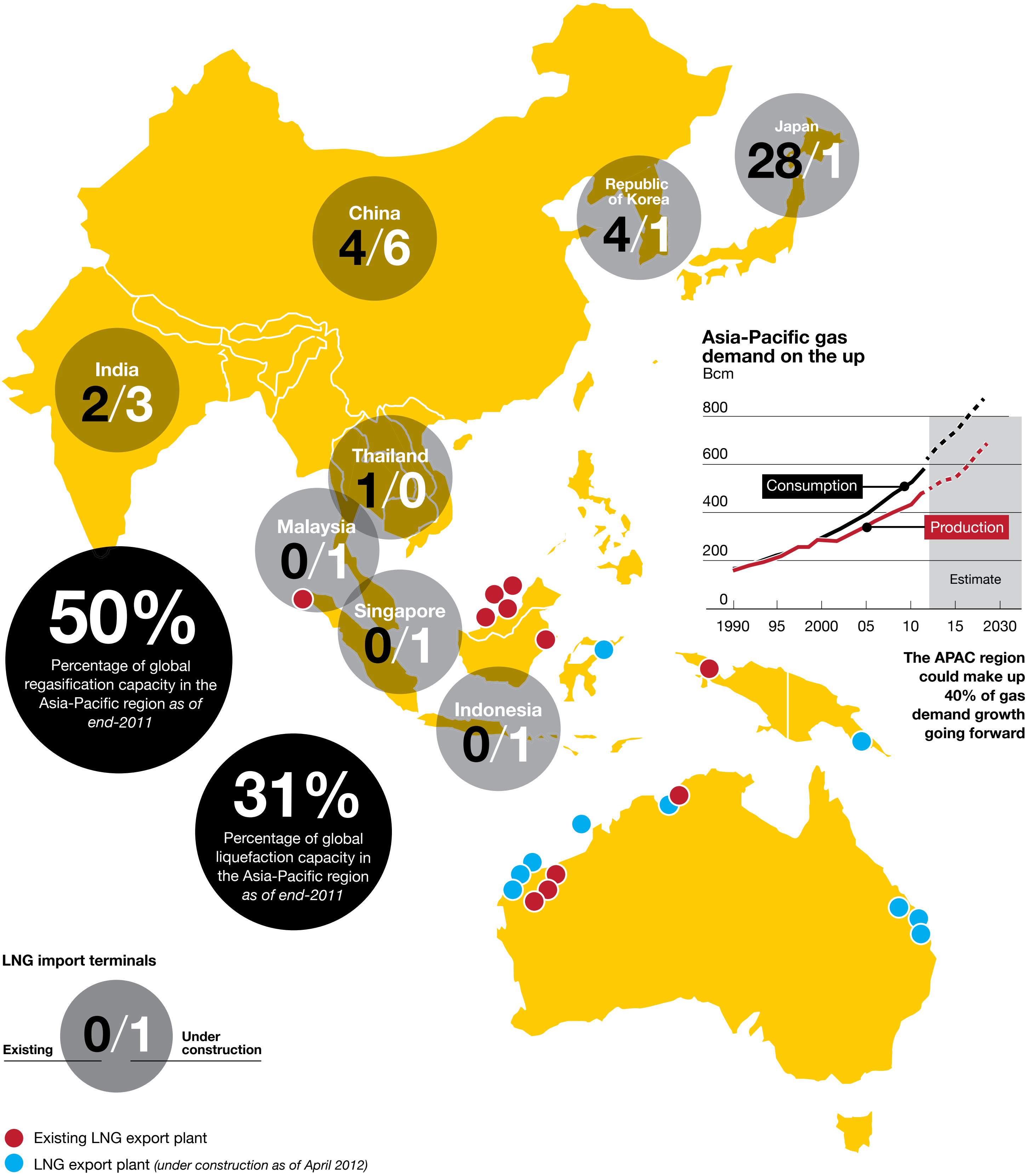
POWERING AHEAD: **A VIBRANT INTRA-REGION GAS TRADE**

The Asia-Pacific natural gas market is the fastest-growing gas market worldwide, with gas being transported via pipeline or LNG cargoes. Malaysia, Indonesia, Brunei and Australia have traditionally been the region's suppliers of LNG and piped gas – although gas imports from outside the region are increasing in line with stronger demand for LNG cargoes.

In 2011, half of the LNG consumed by Asian countries came from intra-region trade. This is expected to flourish going forward with new pipelines being built, new gas production facilities coming onstream and at least 14 new LNG import terminals under construction (as of April 2012).

52%

Increase in volume of LNG traded globally between 2006 and 2011.



POWERING SINGAPORE: **A FUTURE WITH LNG**

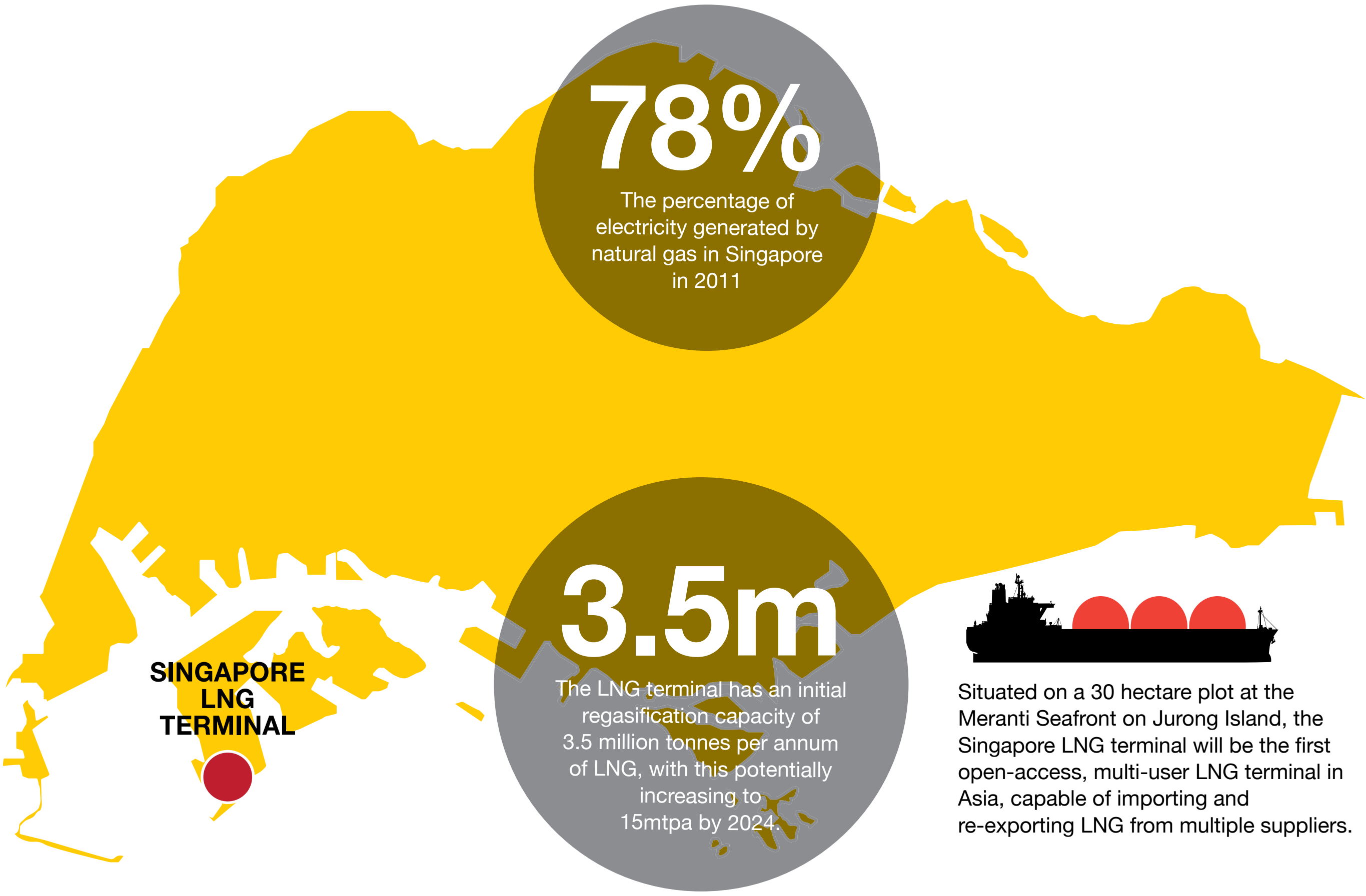
Natural gas provides close to 80% of Singapore's fuel mix for electricity generation. Singapore currently buys around seven million tonnes per year of piped gas from Indonesia and Malaysia, but has also begun to position itself to tap into the increased global gas supply.

The new Singapore LNG terminal commences operations later this year with two tanks, and will help Singapore diversify its gas supply.

The third tank is expected to be ready by the end of the year, with plans to add a fourth tank in the future, so that Singapore can access opportunities for competitively-priced gas as well as LNG-related business opportunities such as LNG trading.

In February 2013, the International Energy Agency said in a report that Singapore was best-placed to be a regional gas trading hub. Among other factors, it is geographically well-positioned, and has the requisite financial expertise and infrastructure. At least 14 LNG players now have a trading or marketing presence in the country and International Enterprise Singapore, a government agency, is keen to work with more private-sector players to develop Singapore as an LNG trading hub.

If an LNG trading hub is indeed successfully established in Asia, this could lead to diversification of Asian gas prices away from the traditional indexation to oil, potentially lowering the prices of gas here, as well as moderating the volatility of such prices due to oil price fluctuations. Such increased price competitiveness as well as security of our energy supply would lead to economy-wide benefits for Singapore.



Situated on a 30 hectare plot at the Meranti Seafront on Jurong Island, the Singapore LNG terminal will be the first open-access, multi-user LNG terminal in Asia, capable of importing and re-exporting LNG from multiple suppliers.

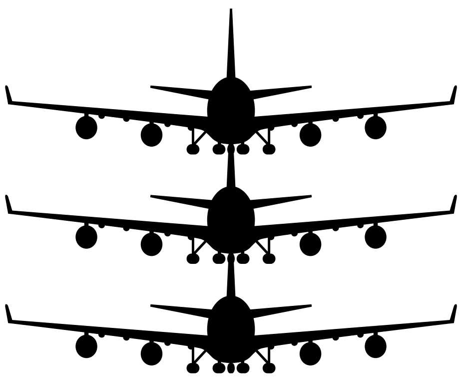
Singapore's LNG terminal

PUMPS
3 x in-tank Low Pressure pumps per LNG tank for LNG send-out
2 x LNG Reloading Pumps per LNG tank
6 x High Pressure LNG Booster Pumps for send-out at 40 bar pressure.

VAPOUR HANDLING SYSTEM
1 x Recondenser, 3 x combined Boil Off Gas/ Booster Compressors.

LNG VAPOURISERS
3 x seawater Open Rack Vapourisers and 1 x Submerged Combustion Vapouriser.

LNG STORAGE TANKS
3 x 188,000 m³
(540,000 m³ total LNG working capacity).
Plans for a fourth tank announced in 2012.



Each storage tank is 53m high, and can hold 180,000m³ of LNG – big enough to fit three Boeing 747 aircraft stacked on top of one another.

JETTY
The primary jetty is designed for LNG vessels between 120,000m³ and 265,000m³. The secondary jetty is designed for LNG vessels between 60,000m³ and 265,000m³.

UNLOADING FACILITIES
4 x 16" loading arms
(2 x liquid, 1 x vapour return, 1 x dual service).

UNLOADING RATE
12,000 m³ of LNG per hour.

RELOADING FACILITIES
Up to 12,000 m³ of LNG per hour capacity initially.

TRANSFORMING THE GLOBAL GAS MARKET

Natural gas is reshaping energy relations between countries and regions. Yet any far-reaching change in the structure of Asia's gas markets is many years off.

Natural gas is playing an increasingly important role in the world as a source of energy that can be used as an alternative to the world's rapidly depleting supplies of oil.

Liquefied natural gas (LNG) has been at the heart of this evolution. Two decades ago, LNG made up just four per cent of global gas demand, which in 1992 stood at 2.1 billion cubic metres (bcm). In 2011, global LNG trade reached 327bcm according to the IEA's Medium-Term Gas Market Report 2012, a dramatic increase from 247bcm in 2009. As demand for gas grows in Asia, it begs the question as to which new projects will successfully deliver gas at an affordable, reliable rate.

GAS SUPPLY & DEMAND DYNAMICS

LNG's global gas trade is set to increase by over two per cent per year for the next 20 years. It is expected to reach 427bcm by 2017, with over 300bcm going to Asian markets, according to the IEA's forecasts. It is crucial to note therefore that the global energy map is changing, and Asia's new global role is a primary reason for those changes.

At the Singapore International Energy Week (SIEW) held in October 2012, S. Iswaran, Minister in the Prime Minister's Office and Second Minister for Home Affairs & Trade and Industry, addressed the issue of natural gas saying: "Against the backdrop of global and individual energy trends, the role of natural gas in the race to fuel Asia is an important one. The advent of unconventional gas in the US has caused a paradigm shift in global gas markets, challenging distributors and policy-makers to revisit and even revise long-held assumptions, and to assess the impact of these developments on the Asian economies."

For the US, the potential for natural gas to replace the role of oil in the economy is particularly important because it is one of the most oil-dependent countries in the world. Natural gas is an attractive alternative because the US has the ability to produce natural gas domestically, with particularly large reserves of shale gas, which it has only recently been able to exploit due to improvements in technology.

In a relatively short time, unconventional gas has altered the North American energy landscape; it is no longer dependent on gas imports. The LNG once destined for US shores must now find new markets. As Minister Iswaran noted: "Prior to the unconventional gas revolution, the US was expected to be a large importer of natural gas. Today, the US could well become a major exporter of shale gas to the rest of the world."

While it is not really clear how much US gas will eventually be available for export and what impact it will have on the global energy market, what is increasingly apparent is that it will have knock-on effects for other gas markets around the world. "The perception of gas markets being highly decoupled and regional in nature will start to change, and the developments in the US will have significant impact in that regard," said the Minister. Already, the commoditised nature of the US gas market has allowed LNG volumes to be diverted to other markets. As a result, an impressive global connectivity has developed with "flexible" LNG seeking the highest value markets worldwide.

FUELLING THE REGION

The past three years have seen the emergence of Qatar as the leading LNG exporter, taking 30 per cent of LNG trade in 2011. Interestingly, Australia is set to overtake Qatar as the leading LNG exporter by the end of the decade. More importantly, the global LNG balance has shifted to Asia, not only to mature markets such as Japan and South Korea, but also to China, Thailand and India.

Ms Maria van der Hoeven, Executive Director of the International Energy Agency (IEA), in her keynote address at SIEW 2012 said: "Domestic supplies will be an important aspect, but for many countries, LNG will play an essential role in meeting additional demand. The good news for Asian customers is that most of it will come from the Pacific basin, particularly Australia, Papua New Guinea and Indonesia." Much of this will be within the borders of countries. However, an increasing amount will involve crossing international borders.

Hence Singapore has embarked on a project to build its own LNG import terminal so that it can access natural gas from sources all over the world.

Singapore is also well positioned to become a regional gas trading hub, given its geographical location and its current strengths as an oil trading hub. As Ms van der Hoeven noted: "Despite the volume of its gas consumption and trade, one fundamental thing is missing in this region – trading hubs, where natural gas would be priced not in relation to oil, but depending on regional supply and demand fundamentals. Singapore's foresight in this area, particularly for future LNG imports, is impressive," Ms van der Hoeven remarked, adding that "Singapore's advanced progress is a milestone for Asian gas".

With large-scale electrification being the ultimate symbol of most modern energy economies, it is not surprising that gas, because of its role in power generation, is becoming increasingly important. "The rapidly-growing LNG market of Asia represents the centre of gravity of where the LNG industry is happening – both on the demand and supply side," said Mr Duncan van Bergen, General Manager Global Gas & LNG Market Development, Shell Upstream International. "By the end of this decade, there will be up to six of the 10 ASEAN member states that will be importing LNG, so Singapore's position is crucial."

ASIA'S CENTRE OF GAS GRAVITY: SINGAPORE'S HUB

Singapore will be able to leverage its excellent existing infrastructure and its strategic position between significant LNG importers that include China, India, Japan and South Korea. The LNG terminal on Jurong Island will be a first step towards gaining energy independence as Singapore's needs are currently being met through pipeline gas from its neighbours. The LNG terminal will enable Singapore to import energy from other markets, thus diversifying gas supply sources as part of the city-state's energy security policy.

"The first phase of the energy terminal development is nearly complete: it is on track to be operational in the second quarter of this year. This will allow the terminal to handle 3.5 million tonnes per annum (mtpa) of through goods per year. A third energy storage tank targeted for completion in the fourth quarter of 2013 will increase capacity to 6mtpa," explained Minister Iswaran. The BG Group, appointed the aggregator for the first 3Mtpa of energy demand, has already achieved 90 per cent of its franchise, he said.

Minister Iswaran added: "The fourth tank will enhance our energy security by allowing further diversification of our fuel sources."

Additionally, it will also capitalise business opportunities from energy trading to bunkering. With global energy players such as Shell, BP and Gazprom already established in Singapore, a more vibrant energy industry in the city-state and Asia is expected.

Demand for gas is expected to grow in tandem with Singapore's economy in the years ahead, as the cleanest fossil fuel that can now be procured from diverse supply sources. The additional capacity will allow Singapore to respond to new opportunities in global energy markets.

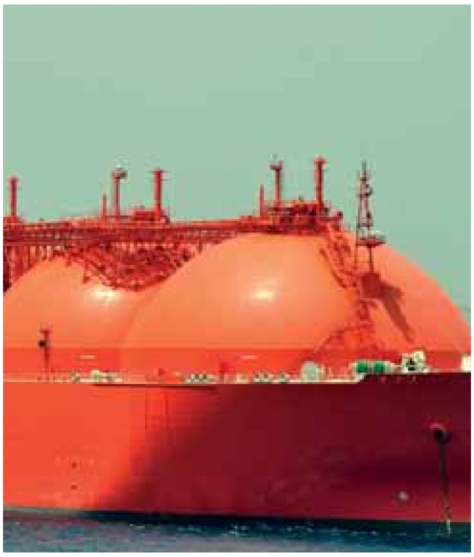
UNCONVENTIONAL GAS RESOURCES IN CHINA

Ultimately, for most nations, the strategic goal must be seen as energy security. China, for instance, is heavily dependent on foreign crude. The Chinese mainland remains tethered to coal for 70 per cent of its electricity and imports oil, which undermines the goal of domestic energy security. "To meet its demand growth, China has a fairly limited number of options," said Mr Gavin Thompson, Director of China gas research at Wood Mackenzie in Beijing. "Either it continues to attract imported gas, alongside the development of domestic resources, or it sees demand growth flatten by the end of the decade."

The IEA predicts that China will emerge as the third-largest gas user by 2013, behind the US and Russia, with its natural gas demand set to double to 273bcm in 2017 from 130bcm in 2011. Therefore, the question remains over who will supply the major increase in demand – local Asia-Pacific LNG exports or other suppliers. China would do well to favour alternatives, but whether it is able to produce its own indigenous unconventional gas remains to be seen.

Shale gas is changing the dynamics in the gas world, and with it, the assumptions that underlie many investment strategies. Chinese shale developments will certainly play an important role in fulfilling the demand for gas. China is continuing to develop its vast shale resources; fracking shale to release natural gas is one of the largest energy prospects for China, with efforts being concentrated on the Sichuan Basin.

But the government's quest to develop China's large shale gas deposits is in its earliest days, cautioned Mr Thomson. National oil companies and Beijing are moving carefully



and China is well aware that there are geological differences that make the US shale boom difficult to replicate in China. "A year ago, we were saying that we expected the build-up of shale to be conservative and incremental," said Mr Thompson. "Twelve months later, we haven't seen much progress."

If shale gas in China could trump imported LNG or gas piped from Turkmenistan on price, it will be a step towards the country's autonomous energy security. It is no surprise, then, that China's state-owned energy companies are captivated by the prospect of an onshore gas bonanza where there had never been one before.

In the next four years, PetroChina said it plans to build 220 gas wells in the same area as it built its first. It is estimated that China has the world's largest shale gas reserves, although the country has not begun serious production yet. A report commissioned last year by the US Energy Information Administration estimated that China holds 1,275 trillion cubic feet of technically-recoverable shale gas reserves compared with 860 trillion cubic feet of shale gas in the US. By 2030, China may well become a shale gas leader.

For the moment, however, there are still pieces of the jigsaw missing. Storage is a clear one, as China has very little below ground storage; about one-tenth of what it should operationally require. Pricing, too, is a complex blend of partially-deregulated prices in certain areas such as Guangdong and Guangxi, and regulated wellhead prices, liberalised LNG import prices, and a very complex relationship between gas pricing and electricity pricing.

THE FUTURE OF GAS GLOBALISATION

The obviously emerging pattern is that the gas market is rapidly globalising and evolving towards a gas-on-gas pricing model. In other commodity markets, the emergence of many different players and multiple cross-border flows has led rapidly to a globally-competitive market.

As LNG trade flows move from local, bilateral arrangements to cross-regional and multiple-party participation, a similar progression is to be expected. There are today 18 exporting countries and 25 importing countries spread worldwide, with many more aspiring to enter the market.

An increasingly liquid and vibrant LNG market is expected to emerge, helping to shift Asia increasingly towards gas-on-gas pricing. New LNG hubs around the world will likely accelerate these trends, and nowhere is this clearer than in Singapore.

This growth of LNG-focused trading capability is an early indicator of the growing market for spot and short-term LNG contracts both in Asia-Pacific and globally.

Given the increasing number of LNG players, greater financial liquidity in the global LNG markets, the development of conventional gas and growth of key gas infrastructure such as pipelines, it is only a matter of time before US Henry Hub prices and today's Asia LNG cargo prices converge.

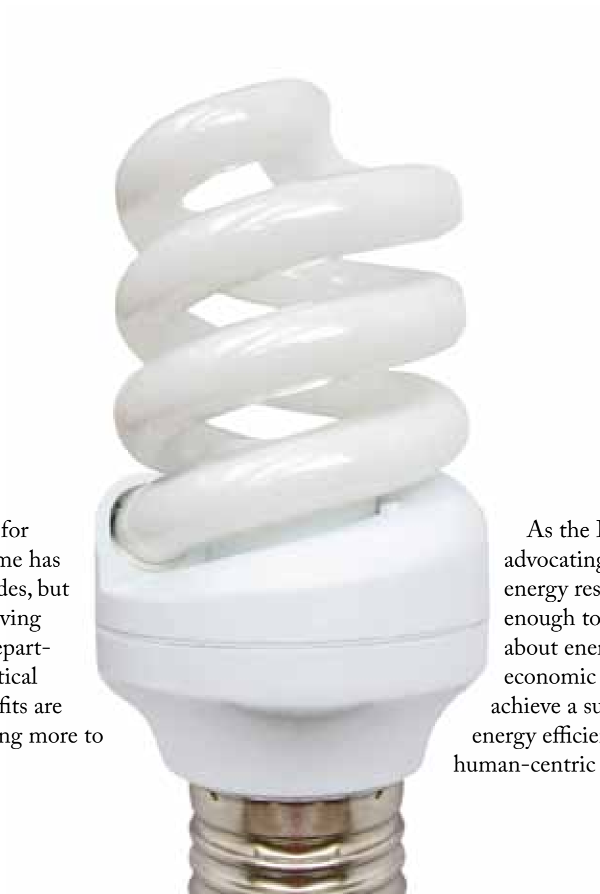
In the coming decades, the world must meet the challenge of producing more energy to cater to growing worldwide demand, while at the same time limiting and even reducing greenhouse gas emissions.

These dynamics will create unique challenges and also unprecedented opportunities for cleaner burning fuels and renewables.

LNG thus has the potential to play a key role in a carbon-constrained energy future. LNG's acceptance as a fuel for the 21st century, however, may vary across regions depending on policy concerns and the availability of alternatives. It remains to be seen the role that LNG will play in such a world. ■

Living the green dream is about managing and restraining growth in energy consumption

ENERGY EFFICIENCY: AN ATTAINABLE DREAM



Public awareness about the need for increased energy efficiency at home has been on the rise in the past three decades, but the sluggish adoption rate of power-saving technologies and habits led the US Department of Energy (DOE) to ask this critical question some years back: "If the benefits are so obvious, then why aren't people doing more to conserve energy?"

As the DOE and other public agencies advocating more efficient usage of scarce energy resources have since found, it is not enough to simply raise public awareness about energy efficiency, or to rely on only economic incentives and technologies. To achieve a sustainable change in behaviour, energy efficiency measures need to be more human-centric so that consumers can relate to

Above: An electric car recharging

these initiatives at a deeper and more emotionally-resonant level – a "why this really matters to me" revelation. Simply put, governments need to make it easier and more attractive for consumers to adopt energy-efficient practices.

AN INCREASINGLY IMPORTANT APPROACH

Higher oil prices have provided the impetus and new technology to profitably extract and use unconventional fossil fuel reserves of shale gas and oil sands, while economics has spurred governments to look at renewable sources. However, the reality remains that – at least within our current frame of reference or knowledge – any and all of these energy sources will not be able to completely address the issues we face in the foreseeable future.

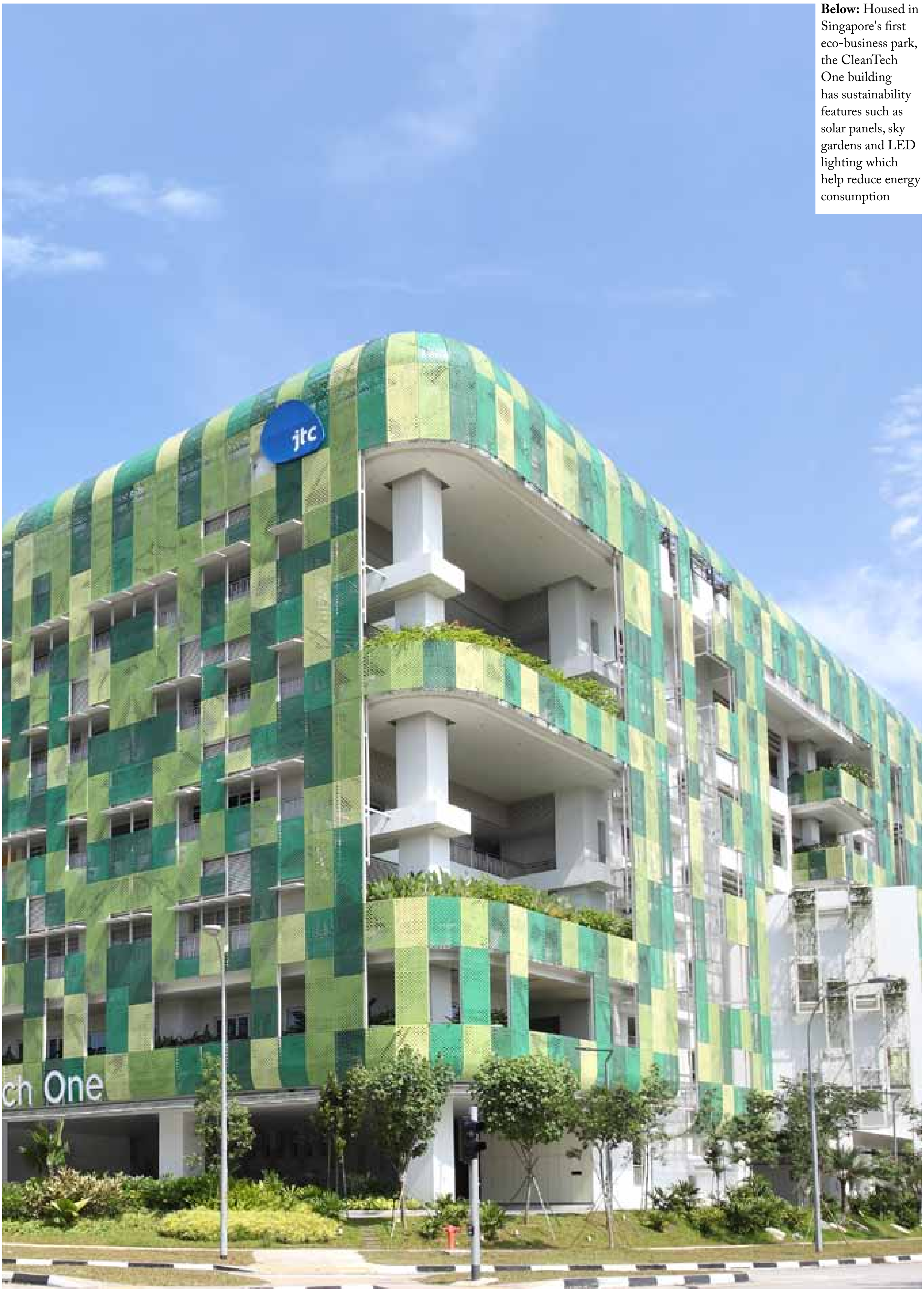
Hence, the importance of making "energy efficiency" a priority in both public policy development and action.

In Asia, the issue is particularly critical. According to the International Energy Agency (IEA), China, India and Southeast Asian countries together will constitute more than half the global energy demand growth by 2035. At the same time, some 675 million people in Asia still do not have access to electricity. On the flipside, concerns about climate change have increased pressure on countries to lower their carbon footprint.

Companies, governments and special interest groups have sought for years to power more economic activity and to meet consumer demand while reducing energy consumption and lowering carbon emissions. Thus, the need to recognise energy efficiency as the "next fuel" or the "fifth fuel"– underpinning oil, natural gas, coal, renewables and nuclear as the critical initiative needed to serve the growing needs of communities in Asia and around the world.

SHARING SUCCESSFUL EXPERIENCES

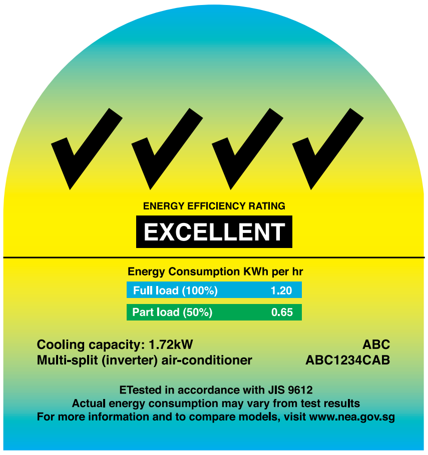
Recently, Masakazu Toyoda, Chairman and CEO of the Institute of Energy Economics, Japan (IEEJ), said: "Spiking energy costs, increasing national competition for global energy supplies, environmental issues and the increased stress of growing demand on an ageing energy infrastructure are behind the drive towards energy efficiency. And while there are significant barriers to success, a



Below: Housed in Singapore's first eco-business park, the CleanTech One building has sustainability features such as solar panels, sky gardens and LED lighting which help reduce energy consumption

Photo: © JTC Corporation

Above: Singapore's smart electricity meter



Above: An Energy Label used in Singapore

number of success stories are already unfolding around the world."

Japan, of course, has successfully targeted consumers in its energy efficiency drive. Since the "oil shocks" of 1973 and 1979, the country has improved energy efficiency by 30 per cent – through both public- and private-sector initiatives – giving the country the lowest primary energy consumption per capita GDP in the world. For instance, it has been giving "eco-points" to consumers who purchase energy-saving home appliances and who have eco-friendly installations in their home, such as double-pane windows. Consumers can then use these "eco-points" to purchase other goods and services.

Earlier in January this year, the UK announced that it would similarly incentivise homeowners to be more energy-conscious. UK Energy Secretary Ed Davey said that the nation's 26.9 million homes would be able to pay for upgrades such as loft or wall insulation through a charge added to power bills, which should then be lower because of improved efficiency.

In the developing world, the policy push towards energy efficiency has yet to translate into a series of sustained initiatives to influence consumer behaviour. However, countries like Japan are reaching out to share their experience via technology transfer and capacity-building sessions for policymakers with developing economies.

"From the perspective of my organisation, the Institute of Energy Economics, Japan (IEEJ), some of our most notable bilateral initiatives have been with Russia, India and China counterparts – because, one way or another, these countries will have critical roles to play in our shared energy future," said IEEJ's Mr Toyoda.

The ASEAN countries have also been collaborating on this front. Energy efficiency initiatives span the ASEAN Energy Management Accreditation Scheme – a training programme for auditors and energy managers to raise awareness for energy efficiency – to the ASEAN Energy Awards. Launched in 2000, the award recognises Southeast Asian organisations and businesses that have implemented innovative and successful energy efficiency practices, in a bid to spur others on to achieve the same successes in energy conservation.

Singapore's approach to energy-efficiency is multi-faceted and has included grant schemes to encourage Research and Development and the adoption of energy-efficient technologies, as well as legislation. Effective this year, the recently-enacted Energy Conservation Act mandates large energy consumers to implement energy management practices.

The government has also established the Energy Efficiency Programme Office (or E2PO), a multi-agency committee which seeks to promote and facilitate the adoption of energy efficiency measures in Singapore.

Thus far, E2PO's efforts include conducting sector-specific benchmarking exercises to showcase best practices in energy efficiency. Other efforts include organising the Energy Efficiency National Partnership to aid in capability development, and supporting pilot and test-bedding projects in energy-efficient technologies.

Speaking at the Singapore International Energy Week (SIEW) 2012, Ms Grace Fu, Singapore's Second Minister for the Environment and Water Resources, emphasised the role of consumers and the importance of providing them with "information to make informed choices on their purchases, and encourage energy-efficient behaviour".

The country's Mandatory Energy Labelling Scheme for household appliances and Mandatory Energy Performance Standards – which encourage businesses to sell only the most energy-efficient appliances – have had a significant impact. Around seven in 10 air-conditioners and nine in 10 refrigerators sold in Singapore in 2011 were models which are more energy-efficient, noted Ms Fu, who is also Minister in the Prime Minister's Office and Second Minister for Foreign Affairs.

Since then, the Singapore Government has announced that further measures to make it easier for households to choose the path of energy conservation will be put in place.

Among other things, television sets sold in Singapore from 2014 must come with labels showing how energy-efficient they are, while clothes dryers and general lighting must meet minimum performance standards. Washing machines must also meet the minimum one-tick water efficiency standards from April 2014.

Said Ms Fu when announcing these further measures: "It is important for us to first of all give our consumers the necessary information about how energy-efficient products can help them to save energy costs in the long run.

"At the same time, by regulating the type of product that is being sold, we hope we can bring in more energy-efficient products so that it will bring down the costs for consumers." ■

RENEWABLES LOOK BEYOND SUBSIDIES

Incentives can be a deciding factor for companies and businesses when considering investing in renewables

The clean energy sector faced strong headwinds in 2012. Confronted by policy changes and regulatory uncertainty in key markets such as Italy, Spain, the US and India, investments in wind farms, solar parks and other forms of green power fell by 11 per cent last year - the biggest annual fall in eight years, according to the Bloomberg New Energy Finance (BNEF) research group. Global investment slumped to US$268.7 billion last year, well below the US$302.3 billion for 2011 – a record year.

There was, however, one bright spot on the horizon: China. It invested a record US$67.7 billion in renewables, mostly in the solar sector, surging past the US to take the title as the world's biggest investor in renewable energy. To combat pollution, Beijing had previously announced that it was aiming for 15 per cent of China's generating capacity to come from non-fossil fuel sources by 2020.

With this development, China now stands at the vanguard of Asia's emerging economies where renewables promise to become a significant industry. It is a reflection of the influence that policymakers have on ensuring that the renewables sector remains significant, and sustainable.

RENEWABLES BECOME MAINSTREAM

According to the latest report from the International Renewable Energy Agency (IRENA) on an overview of 2012, wind, solar and geothermal energy now account for about half of all new power generation capacity added globally.

Solar power continues to dominate the renewable energy sector, accounting for US$142 billion of overall investment last year compared with US$78.3 billion for wind and US$19 billion for energy-smart technologies such as electric vehicles.

Sharp falls in the cost of some forms of green power equipment have extended the competitiveness of renewable energy power plants, lending support to clean energy advocates who say that countries can attempt to balance economic competitiveness with environmental goals.

"Where electricity systems are dominated by oil-fired plants, (sometimes significantly) cheaper renewable genera-

Above: One of two cooled conservatories, at the Cloud Forest. The energy used for powering the conservatory's chiller is generated by a biomass furnace that uses horticultural waste produced within Gardens by the Bay and from other parks around Singapore.

tion choices are available. For off-grid power supply, renewables are already the default economic solution," said IRENA Director-General, Mr Adnan Amin, at the Singapore International Energy Week (SIEW) last year.

The cost of renewable power is expected to decrease further on the back of technological innovation and diversified sources of production – for instance, the price of solar photovoltaic modules fell 24 per cent over the course of 2012. But as barriers to renewables remain - such as the highly-regulated nature of the power sector where large-scale power generation is the norm – policymakers will have to signal their continued commitment to renewables.

At SIEW last year, Malaysia's Minister of Energy, Green Technology and Water, Dato' Sri Peter Chin Fah Kui, noted that Malaysia was "committed to including renewable energy sources into our fuel mix, not as our base load but rather as peak [load]".

Indonesia's Secretary of Directorate General New Renewable Energy and Energy Conservation, Dr Djadjang Sukarna, said at SIEW that renewable sources will provide Indonesia with as much as 25 per cent of its electricity by 2025, up from around seven per cent today. Dr Djadjang said the government was considering feed-in tariffs (FiTs) and other measures to attract investments into the sector.

In this regard, the US has provided a signal lesson on what to avoid. Renewable energy investment sank by almost a third to US$44.2 billion in 2012 amid fears that important wind power tax credits would lapse at the end of the year. While the tax credits still passed into law, the uncertainty had already drained investor confidence.

TRADE-OFF A TOUGH CHOICE

However, emerging economies are still faced with tough choices between renewables and cheaper fossil fuel alternatives. It has become an issue of cheap electricity versus sustainable electricity, as they endeavour to keep electricity costs low for the population and for the national budget.

Mr Tsoi Mun Heng, the Director of the Energy Innovation Challenge Directorate at Singapore's National Research Foundation, said this is a reality that all stakeholders face. So while energy security and coping with climate change are key drivers for technology innovations, cost remains a core issue. Speaking at SIEW 2012, he said that in the mid-term, it is unlikely Asian markets will accept higher energy prices for environmental sustainability.

So far, different countries have taken different approaches depending on what is most cost-effective for them. India has used auctions to avoid paying excessive renewable energy subsidies, with project developers awarded capacity based on the discount at which they are willing to sell power. This means less capital investment from the government. In Germany or Japan, government funding has resulted in renewable projects getting off the ground at a much quicker pace.

> *Sharp falls in the cost of some forms of green power equipment have extended the competitiveness of renewable energy power plants, lending support to clean energy advocates who say that countries can attempt to balance economic competitiveness with environmental goals*

Other countries such as the Philippines and Malaysia also want to stimulate deployment of renewable energy but have financial caps in place.

The International Energy Agency (IEA), in a report on deploying renewable energy technology last year, suggests that policymakers emulate the best practices of other countries in adopting incentives to boost renewables, while engaging new financing sources. These could range from pension funds to insurance funds, private investors, co-operatives, wealthy companies that want to expand into "green" options, and even recent inventions like "crowd funding", it said.

Mr Masakazu Toyoda, Chairman & CEO of the Institute of Energy Economics of Japan, also believes that Asian countries can focus on specific types of clean energy that are most relevant to the region's energy needs, as a means of targeted spending on renewables. He cited three examples at SIEW 2012: smart grid technologies for matching of electricity demand and supply, stabilising technologies for unstable solar and wind energies, and heat-utilising and energy-visualising technologies for energy savings.

CRUCIAL POLICY CHOICES

Beyond verbal commitment, BNEF's Mr Milo Sjardin believes that actionable policy has the power to impact the renewable sector to the tune of tens of billions of dollars.

Japan, for example, posted a 75 per cent rise in investment to US$16.3 billion, as the government undertook a fresh focus on renewable energy after the 2011 Fukushima nuclear disaster. In India, by contrast, green investment fell 44 per cent after wind incentives expired and there were fewer approvals for solar projects. In Singapore, the government employs test-bed initiatives to allow businesses to market their products from the laboratory and experimental stage.

"The question is when can policy take a backseat to renewable energy deployment?" Mr Sjardin asked. "We've gradually seen that happen."

While outright financial support of the renewable sector is helpful, subsidies should not be a mainstay of the sector, said clean energy advocates. Mr Sjardin noted that currently in Germany the residential feed-in tariff is lower than the residential power price.

"So the power price should be sufficient to stimulate further PV deployment on rooftops and not necessarily the actual feed-in tariff itself," he added.

"Feed-in tariff government support in countries such as China is still very important. But over the next five to 10 years, that should gradually decrease because cost reductions that have taken place in the renewable energy sector will, and have already made renewable energy more cost-competitive with other sources of energy.

"Countries need to get into that sustainable growth pattern which ensures that you don't need continuous government support," said Mr Sjardin. ■

JOINING THE DOTS OF THE WATER-ENERGY-FOOD NEXUS

The interrelated problems of energy, water and food require not just nexus thinking but nexus action too

Population growth projections are among the world's most sobering statistics. With the global population growing more than 80 million a year, it is estimated that by 2030, the planet will need to provide 30 per cent more water, 40 per cent more energy and 50 per cent more food.

New technologies, business models and methodologies will be vital as those currently living "off-grid" in developing countries begin to share in rising levels of prosperity, transforming small towns into second- and third-tier cities of more than two to three million people.

Too often, water, food and energy have been handled as separate, silo issues – a mistake highlighted by the biofuels panic of 2008 and 2011, when demand for grain to produce bio-diesel caused a spike in world food prices.

Today, analysts and policymakers have a greater understanding of the close links between water and power generation and their impact on food production. Agriculture currently accounts for 90 per cent of freshwater consumption worldwide, but it is also essential throughout the lifecycle of power generation, from fuel extraction to production. Power, in turn, is required to pump groundwater for irrigation and to process water in desalination plants and recycled water operations.

One is dependent on the other, and the demand for all three will continue to grow. The nexus is the realisation that a solution for one problem must equally consider the other two if the solution is to be sustainable.

Add to this climate change and the need to cap CO_2 emissions – a factor that will have significant effect on both agriculture and water availability – and the next few decades will be critical.


W A T E
R E N E
R G Y F
O O D

Extracting groundwater in China requires massive amounts of energy, which has contributed to rising emissions in the country. Research has found that 0.5 per cent of China's total emissions are due solely from pumping groundwater for irrigation

CREEPING CONCERNS

The experiences of emerging economies have provided a valuable litmus on the strain that development has placed on our water, food and energy sources.

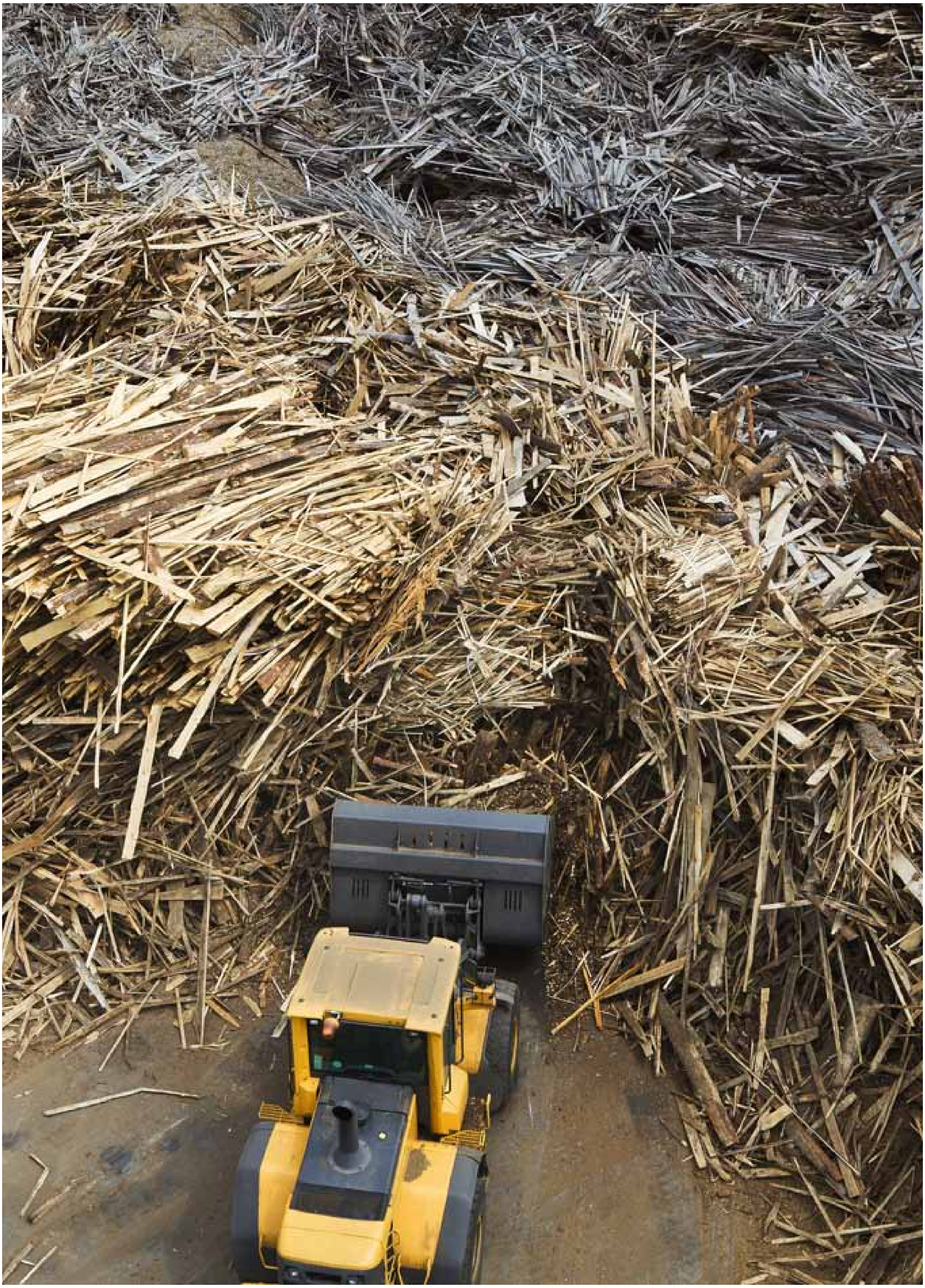
The University of East Anglia's (UEA) Water Security Research Centre, in its research on China, pointed out that China's carbon emissions are set to expand in the years to come on the back of rising industrialisation. Already, China has climate change woes such as desertification, caused in part by excessive irrigation for crops. China siphons water out of the ground at a rate of 20 cubic kilometres per year, faster than nature can replenish it. And it is not alone in this. According to estimates published last year in the journal Water Resources Research, the United States pumps water at a rate of 30 cubic kilometres greater than it can be replaced, while India is at 190 cubic kilometres.

Extracting groundwater in China requires massive amounts of energy, which has contributed to rising emissions in the country. Research by a group of six research centres and universities, including the UEA Water Security Research Centre, the Centre for Chinese Agricultural Policy and Cranfield University, found that 0.5 per cent of China's total emissions were due solely from pumping groundwater for irrigation last year.

In December 2012, US National Intelligence Council noted in a report titled *Global Trends 2030: Alternative Worlds* that climate change, rising urbanisation and increasingly middle-class lifestyles would lead to a potential food and water crisis in China. The report pointed to huge water demand resulting in crop shortages in 2030, adding that "water may become a more significant source of contention than energy or minerals out to 2030".

China aside, the report said that other developing nations would also have to pursue new technologies to try to avert a food and water crisis. These technologies, such as high-tech irrigation and precision agriculture, would be aimed at expanding crop yields and conserving water.

Some businesses are already preparing for such a future. Royal Dutch Shell is looking at "potential solutions" to better utilise food waste and conserve energy and water use in the production of food, said Ms Ruth Cairnie, Shell's Executive Vice-President of Strategy and Planning.



Businesses are starting to pay attention to the water-food-energy nexus as well, with many looking at it through the lens of a looming water shortage

Noting that it takes as much as 1,500 litres of water to produce a kilogramme of beef, she said: "As population growth drives increases in food demand and prosperity drives a significant shift in diets, (this) will lead to more energy and water use in the production of food."

SECURING SOLUTIONS

China is dealing with its challenges through detailed five-year plans that set targets for reducing energy intensity and relying more on renewable sources of energy. It has also introduced other goals for energy efficiency and emissions, food production and water use, including how much water goes into growing a particular crop.

In Malaysia, adopting solutions that also provide food, water and energy security has been a tough balancing act, but one that the government hopes to move towards under its 10th energy plan covering the period 2011 to 2015.

"Security for energy, security for food and security for water - we hear these every year," said Dato' Sri Peter Chin Fah Kui, Minister of Energy, Green Technology and Water, Malaysia. "I'm not going to say that we have ready solutions. All I can say is that if we apply the solution in a business-as-usual manner, then I am sad to say the future will be quite bleak."

He said engaging civil society, non-governmental organisations and businesses will be key to finding a path through the complex set of countervailing factors that make up the water-food-energy nexus.

"There is no one-size-fits-all solution. There is no one cure for what we are suffering. We need to find our own solutions," Dato' Sri Peter Chin said. "Adopting green technologies provides us with a lot of solutions. If we practise it in a sustainable manner, if we really put our efforts into renewable energy, there is hope we can replace fossil fuels one day."

Creating the right environment for investment in green technologies has been one of the key drivers of the Malaysian government's initiatives. Feed-in tariffs (FiTs) introduced last year have favoured small producers – up to 5MW – of renewable energy. Like successful policies elsewhere, the Malaysian proposal includes all renewables, differentiates tariffs by technology, and derives the tariffs based on the cost of generation.

"At the moment, these are just rudimentary steps. Nevertheless, there is volition on the part of the government to go on with these green economy practices," said Dato' Sri Peter Chin, adding that Malaysia is also attempting to reduce its carbon emission by 40 per cent based on 2005 carbon intensity values.

"I agree we need to embark on certain practices, but there are other low-hanging fruit that we can pick, for example, energy efficiency," he said. "In Malaysia, we have taken an initiative to ban the use of incandescent bulbs."

WATER AS THE KEY FACTOR

Businesses are starting to pay attention to the water-food-energy nexus as well, with many looking at it through the lens of a looming water shortage. They are seeking ways to mitigate their impact on the nexus, through more sustainable development and growth.

Notwithstanding the fact that the bulk of water is used for agriculture, Ms Cairnie estimated that if you take into account the industrial water use that goes into producing food, the total industrial consumption of water sits closer to 20 per cent. Energy production is going to have to pay more attention to the stresses it is putting on water and that's especially the case in power generation, she noted.

Shell is also looking at its own operations where it believes "water intensity is going to become ever more of an issue". Said Ms Cairnie: " We have examples around the world – from tight gas operations in Canada to treating produced water in Oman, to recycling refinery water in Geelong, Australia – where we are investing in water treatment plants so that water can be recycled."

In Geelong, Shell has embarked on a programme of co-investment, working with the local water authority and government to build a plant that not only recycles refinery water but treats wastewater from the local neighbourhood.

Said Ms Cairnie: "It's getting this linkage between public and private – doing something bigger than simply limiting it to our own operations."

THE FUTURE IS NOW

At the 2012 Singapore International Energy Week, Ms Cairnie said the world, after an extended period of relatively cheap and plentiful resources, has already entered an era of volatility economically, politically and socially. This situation would continue for decades.

She based her comments on Shell's *Signals and Signposts* report, published in 2011, which took into account the global financial crisis. These environmental and resource issues, she contended, will make industrial and social transformation inevitable.

"If we look forward, we can expect nine billion people by the middle of the century," said Ms Cairnie. "We can expect three out of four people to live in cities; enormous growth taken up by the fast-growing cities in the East. It's equivalent to building a new Singapore every month for the next 40 years."

Meeting the basic demands of these new cities will be the 21st century's greatest challenge, she noted. ■

WORKING IN ENERGY – RECRUITS REQUIRED

The energy industry is so critical to our everyday lives that it offers a vast array of career choices

If you are looking for work, chances are you might find it in the energy sector. In Singapore, more than 15,000 people are employed in the energy market – in the oil and gas, petrochemical, power utilities and clean energy sectors. In addition, future capacity expansion in the power sector, due to new generation plants and the commissioning of Liquefied Natural Gas (LNG) operations, will lead to greater demand for manpower in the sector.

Recently, the US said that the growth in its energy sector was one of many factors contributing to a healthy national jobs report. No doubt this was welcome news in an otherwise flagging economy. According to the US jobs report, unconventional oil and gas production has created over one million jobs, with 800,000 more expected by 2015.

The energy industry involves many political, economic, environmental, technological factors that interact with one another to influence marketplace trends. Their long supply chains also spur the creation of jobs in associated and supporting industries for skilled and well-paid workforces, which will lead to multiplier effects in job creation for other supporting industries.

There is a wide variety of professions available in the energy industry – both traditional and renewable. Both sectors offer the opportunity for different individuals with different types of training. At the same time, the challenge to find the right professional niche remains.

Jobs in the clean energy sector are also increasing as renewables take root. Simultaneously, the rise of new and unconventional energy supplies has had a multiplier effect on supporting industries - the boom in unconventional oil and natural gas extraction, for example, has led to a demand for construction workers, engineers, truck drivers, and a host of related occupations.

In India, the new and renewable energy sector is estimated to have created over 50,000 direct jobs in the last three years. The job creation has taken place in off-grid and other areas of the sector, according to the Ministry of New and Renewable Energy.

In some mature markets, supply of manpower cannot keep up with demand. Across the globe, utilities companies have started to work on a solution to the dilemma of an ageing workforce, while the pipeline to supply the necessary skill sets is running on empty. The human capital required to keep our lights on is now a diminishing asset.

Singapore's power sector, which is made up of the electricity and gas sectors, is a case in point. It is a key driver of the economy but faces an ageing workforce and challenges in attracting and retaining young Singaporeans. The median age of the technical workforce in the power sector is 48 years, compared with the national median of 42. Over 40 per cent of the technical workforce is expected to retire in the next 10 to 15 years.

At the same time, there are challenges in attracting young Singaporeans because of misperceptions concerning the work environment and career opportunities within the sector.

Coupled with future capacity expansion in the sector and the commissioning of LNG operations in Singapore, the power sector is expected to require 2,400 professionals over the next 10 years, with technicians and technical officers making up the bulk of the manpower requirements for the sector.

Countries and companies alike are addressing their future manpower needs in different ways. In the US, utilities companies are working with colleges, polytechnics and universities to train a new generation of workers. Others are transforming their workplaces into modern and digitised high-tech businesses to attract recruits.

Singapore took a nation-wide approach to the problem. It established a taskforce to look into the issue. Its recommendations, said Singapore's Second Minister for Home Affairs & Trade and Industry, S Iswaran, were aimed at attracting, retaining and developing manpower in the power sector as well as changing misperceptions about these jobs.

Said Minister Iswaran, who is also Minister in the Prime Minister's Office: "In particular, rebranding the sector would help correct the misperceptions and raise awareness of the career opportunities available within the sector, particularly among young Singaporeans, who will have an important part to play in shaping 'Singapore's energy future'.

"While the sector offers many interesting and stable jobs in areas such as plant design, operations and maintenance, grid transmission design and regulation, business development and energy efficiency management, many of our youth may not be aware of these opportunities … it is important for players within the sector to engage the youth and inform them of these exciting opportunities." ■

We welcome reader feedback on the perspectives presented in this publication. We would also be happy to receive your views on how SIEW can be a platform for discussions on the broadening horizons in the global energy landscape. Please reach out to us at **ema_siew@ema.gov.sg** *or visit* **www.siew.sg** for more information on SIEW 2013.

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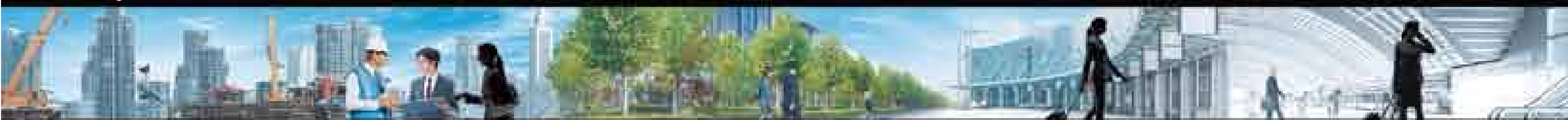

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