Oil magazine

DECEMBER 2013

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Number 24

4.00 EUROS

Oil magazine no. 24/2013 - Targeted mailshot

Oil magazine

Eni quarterly
Year VI - N. 24
December 2013
Authorization from
the Court of Rome
No. 19/2008 dated 01/21/2008

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Via Mondadori, 15 - 37131 Verona
In the U.S.: Fry Communications Inc.
Mechanicsburg, PA
In China: Reference Standard Limited - Beijing
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Sent to press on
December 11, 2013

Selena Burgo Paper - Naural uncoated wood-free paper, 100% recycled, chlorine and acid free.

Publisher **eni spa**
Chairman:
Giuseppe Recchi
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Carlo Cesare Gatto, Alessandro Lorenzi, Paolo Marchioni, Roberto Petri, Alessandro Profumo, Mario Resca, Francesco Taranto

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Difficult forecasts

by GIANNI DI GIOVANNI

Only a few years ago, some sections of the scientific world wrestled with the idea that we might be running out of oil — an idea, if truth be told, that was hotly contested. Yet everyone was talking about "peak oil," the moment when oil production capacity would reach its zenith, before entering an inexorable decline. That moment was imminent and set to have a massive, unquantifiable impact on human life.

Not so fast. Only a few years after peak oil hit its rhetorical peak, a new theory has emerged; one that happens to suggest the opposite conclusion. Today's big —and equally contentious—question among energy experts is not "peak supply" but "peak demand," whereby global societies of the future (the very near future) need less and less oil to live and to do business, triggering a sharp decline in demand for oil products.

Peak demand, they say, results from recent technological developments, which, on the one hand, enable massive savings on oil consumption (even now, new U.S.-built cars are twice as efficient as those of just a few years ago), and, on the other, bring ever increasing quantities of alternative energy products to market (gas, above all, and recently discovered shale gas in particular).

More cautious exponents of this school of thought reckon on peak demand will arrive around 2025, while others bring that date forward to 2020 or even earlier. Whatever timetable one accepts, it's clear that such a development would have wide-ranging global repercussions for economics, trade, technology, and geopolitics. It promises an entirely different cast of winners (and losers) than "peak oil," and it presents an equally difficult strategic challenge to those charged with protecting the future military and economic security of nations.

The effects of introducing alternative energies—including economic adjustment, changing lifestyles and demographic transformations—would be felt on a global scale. Essentially, it would be a step towards the end of the "Oil Age". In part, this is because there are no more wells to drill, but also because mankind has moved on, echoing Sheikh Yamani's aphorism, quoted by Paul Betts in this issue, that the Stone Age was by no means caused by a lack of stones.

This outcome is by no means certain, but in line with Oil's coverage of "peak oil" several years ago, it does warrant more in-depth examination. So, without taking a stance on what remains an open question—yet bearing in mind the often-fleeting nature of theories on energy, as peak oil taught us—we consulted some highly qualified experts and asked them to share their thoughts on the subject. The result is an array of opinions which, without claiming to be exhaustive, can certainly help us shed light on an issue that encapsulates many of today's biggest questions about the international energy scenario, whichever side of the fence you are sitting on. We leave it to you, our readers, to make up your own minds. ■

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Interview/Mozambique's Minister of Mineral Resources, Esperança Bias

The Africa of growth

Africa as a whole is destined for a prosperous future, especially if revenues from recent mining activities are put towards improving the living standards of all citizens

by CHARLOTTE BOLASK

Women in the energy world are still something of a rarity, especially when it comes to the top institutional and corporate jobs. It therefore comes as a pleasant surprise that there is a woman at the head of a crucial government department like the Ministry of Natural Resources in Mozambique – a country that aspires to turn the sector into a key driver of domestic growth. The work of Esperança Bias, who has been in the role since February 2005, is typical of the government's desire to use the economic profits from its natural gas and coal reserves to improve the living standards of the population. After all, as Bias herself points out several times during our meeting, a country's stability depends above all on civil and cultural growth.

Mozambique is considered a new leading country on the African continent. Its reserves of natural gas are among the richest both in sub-Saharan Africa and in the world. What does it mean for you to be at the center of the international energy scenario?

It means that we have greater responsibility. Our main aim today is to make sure that all those resources, and the greater economic opportunities they engender, will benefit not only the Mozambican people but also the region. It means that in our development plan, we need to think about how to use →

Mozambique in numbers

Area: 799,380 km²
Capital: Maputo
Population: 24,096,669
Average population age: 16.8 years (men 16.2/women 17.5)
Language: Portuguese (official), Makhuwa, Tsonga, Sena, other Mozambican languages
Natural resources: coal, titanium, natural gas, tantalum, lead
Government: Republic

MAIN ECONOMIC INDICATORS
GDP (purchasing power parity): $26.7 billion (2012 estimate)
GDP (official exchange rate): $14.6 billion (2012 estimate)
GDP growth rate: 7.5 percent (2012 estimate)
Unemployment rate: 17 percent (2007)
Public debt: 34.6 percent of GDP (2012 estimate)
Inflation: 2.1 percent

Oil
Consumption: 18 million barrels per day (mb/d)
Exports: 3,076 mb/d
Imports: 17 mb/d

Gas
Reserves: 75 billion cubic meters as at December 31
Production: 3.36 billion cubic meters
Consumption: 0.15 billion cubic meters
Exports: 3.20 billion cubic meters

Source: CIA World Factbook 2012; Eni World Oil and Gas Review 2012

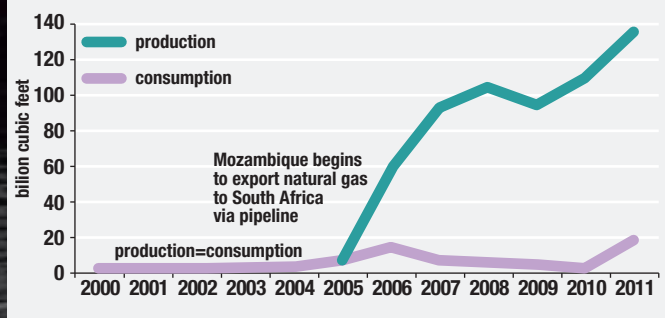
REGIONAL HDI COMPARISON

	2000	2005	2011	2000-2011 Growth in average
Malawi	0.343	0.351	0.400	1.41
Swaziland	0.492	0.493	0.522	0.54
Tanzania	0.364	0.420	0.466	2.27
Zambia	0.371	0.394	0.430	1.37
Mozambique	0.245	0.285	0.322	2.49

Source: UNDP (United Nations Development Programme)

The Human Development Index (HDI) is a composite measure for assessing long-term progress in health, access to knowledge and a decent standard of living. Between 1990 and 2011, Mozambique's HDI value increased from 0.200 to 0.322 (+61%).

GAS PRODUCTION AND CONSUMPTION



Source: U.S. Energy Information Administration

Mozambique's natural gas output matched domestic consumption between 2000 and 2005, until new reserves were found and the country started to export its resources to South Africa thanks to the construction of new gas pipelines.

the resources that we are discovering, domestically and in terms of filling the gaps of our neighbor countries and even the world itself.

Since the initial discovery of one of the largest gas fields in the world less than two years ago, Mozambique has continued to announce new discoveries, month after month. How are you managing this process? How are other countries reacting to this new wealth, in terms of participation and investments in exploration blocks and infrastructures?

The recent discoveries have brought new and stimulating challenges for our country, in terms of a future of progress and greater economic stability. We lack infrastructure right now, but I believe that when we monetize all the resources that we are discovering we will be able to fund a development program for new infrastructures, such as roads, telecommunications, schools and health facilities. So there is good reason to say that these resources are coming at the right time, because now more than ever we are capable of putting them all together to help develop Mozambique.

The natural gas in your country has also aroused East Asian interest. Might we see a new link between Africa and Asia in future?

Mozambique is a friend of all countries in Asia, Europe and America. For the purposes of this sector, Asia is definitely an interesting market and we have every intention of continu-

ESPERANÇA BIAS
Esperança Bias has been the Minister for Mineral Resources in Mozambique since February 2005. Previously, she was the Deputy Minister of Mineral Resources (from 2000).
Minister Bias is providing strong leadership in Mozambique on minerals policy, particularly through her commitment to establish a national policy to regulate the social investments of mining companies, to develop a strategy and policy of mineral resources, and to secure the social responsibility of mining companies. The policy aims to maximize community benefits of mining, mandate investment in schools and other infrastructure, and resolve concerns around resettlement.

ing to work together. Asia is a continent that offers good prices and it is our nearest market, so why not make the most of the opportunity? But if other countries or continents express an interest in Mozambican gas, the door is always open.

As well as gas, Mozambique can also offer another important resource – coal. What are your future plans for the sector?

We are drawing up the coal master plan alongside the gas master plan. These instruments will give us a clear vision of how to proceed with exploration and how we can use the resources we have available.
The current paradox in Mozambique is that we are energy producers, but less than 10 percent of the population has electricity. We need to expand our capacity to supply electricity, not only for Mozambican people, but for the entire region. With all these resources, we have the opportunity to start a process of industrialization in our country: we have coal, we have iron ore and we have natural gas. At the same time, we can improve other sectors such as agriculture through fertilizer plants. And we also have iron ore processing plants. If we combine all these elements, plus the abundant supply of water, we can say that Mozambique has the potential to become an industrialized country in the near future.

Not just Mozambique, but all of Africa, is seeing steady growth. According to International Monetary Fund (IMF) forecasts, over the next five years, ten out of the 20 fastest growing economies will be in sub-Saharan Africa, two in northern parts of the continent and none in western Africa. What does the future hold for these countries?

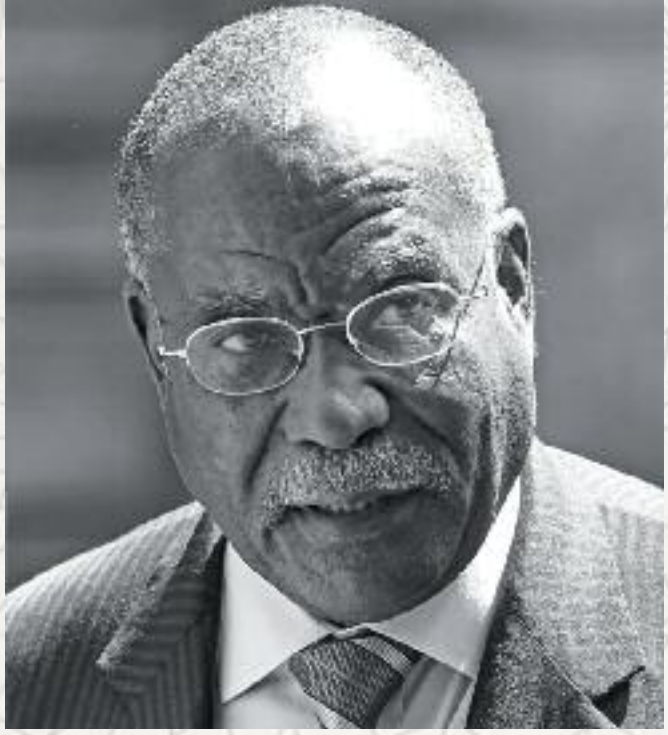
Africa as a continent has a lot of opportunities in different areas, from agriculture and livestock to mining. I do believe that if we use this opportunity, all together, to open doors for investment – and if we have good legislation – we will succeed and we will continue to grow in a sustainable way.

There are still very few women in the energy sector. With a view to future growth, in Africa and for Africa, do you think women can play a greater role?

I really hope that happens, including in other areas of the economy and society, in this country and across Africa. But we have to continue to struggle, not only to be in positions of power but simply because we are women. We need to demonstrate that we have the capacity to occupy the roles we now have. I also think that with good education the next generations of women can do better than today. I see no differences between male and female visions of power, particularly in Mozambique. We are all working together for a national vision – not a male or female one. There is only one vision: a future of progress and well-being for our entire country.

ABO About Oil

On www.abo.net, read other articles on the same topic by Daniel Atzori, Antonio Galdo, Moisés Naím.



JOSÉ MARIA BOTELHO DE VASCONCELOS
José Maria Botelho de Vasconcelos is Angola's Minister of Petroleum. He has several decades of experience in the oil sector and in selling oil and derivatives, which has seen him work in Belgium, France and Great Britain. He was appointed Minister of Petroleum for the first time in 1999, remaining in the role until 2002. Between 1999 and 2000, Vasconcelos also served as chairman of the Committee of Energy Ministers of the Southern Africa Development Community (SADC). In 2002, he took on the role of Minister of Energy and Water in Angola. In October 2008, Vasconcelos was again appointed Minister of Petroleum and in 2009 held the rotating presidency of OPEC.

Exclusive/Angola's Minister of Petroleum Josè Maria Botelho de Vasconcelos

Beyond oil

Angola, Africa's second biggest oil producer, continues to fund exploration projects, but its goal is to diversify its economy and thereby bring an end to dependence on oil revenues

by ANTÔNIA DAS PALMAS

Angola is Africa's second biggest oil producer, with an output of 1.75 million barrels a day. In the last 10 years, since the end of the country's seven-year civil war in 2002, it has experienced massive economic growth, reaching peaks of 20 percent, largely thanks to oil, which until just a few years ago accounted for half of GDP. Now, Angola is trying to free itself from this dependence on oil revenues, which has left it vulnerable to fluctuations in oil prices. In 2009, oil prices dropped as a result of the economic crisis, blowing a hole in the country's finances. If the theory of peak demand proved accurate, Angola would be one of the world's worst hit countries. *Oil* discussed the issue with Josè Maria Botelho de Vasconcelos, Angola's Oil Minister, who also spoke about the country's energy future and its economy in general.

What do you think about the theory of peak oil demand?

I think it is a theory like many others. Over the years many theories have been developed about the amount of oil on the earth. They used to say that there would be no more oil in 30 or 50 years, but as we have seen, there is still more oil. Moreover, global consumption has continued to rise, up to about 90 million barrels a day. These theories are based on new sources of alternative energy. The point is that alternative energy can only replace oil up to a certain point, particularly when you think about transport.

Why so?

Because even if we look further into the future, the infrastructures to support these kinds of energy will never be as cost effective as the ones built over the last few decades for oil. We know that energy prices have a huge influence on the economy and very often energy types are not switched because the cost is high–it costs more. Even if these kinds of energies are developed, they will be really expensive. So I think oil is still a valid alternative. These are all just theories; the world is always changing, as we know. Still, I think oil will have a really important role in the coming decades.

In 2009, Angola felt the effects of the global economic crisis because of the drop in the price of oil. If that happens again, will the country be ready?

Yes, of course. What we are doing is diversifying the economy to avoid it being dependent on the oil business. In recent years the government has taken major steps in this direction and we can see the results in the proportion of GDP accounted for by oil. Until 5, 10 years ago, oil generated about 60 percent of GDP. Now we are at between 40 and 43 percent and the intention is to reduce this percentage even further to ensure that the other sectors of the economy have a greater presence, which will protect the progress the country has made up to this point. We do not want our economy to depend on oil, diamonds or natural resources.

Oil is still very important for the country at this time. What are the results of the explorations and discoveries of recent years?

In the last 20 years, significant discoveries have been made in Angola that have transformed us, in terms of production, into an emerging country. In the 1990s, we were producing 800,000 barrels per day, but now we are producing 1.75 million, partly thanks to offshore discoveries, which account for about 98 percent of the total in Angola. Beyond that, current production has to be tailored to future prospects. That is why explorations have to continue at full speed to increase current production, until we reach the goal of producing 2 million barrels per day in 2015.

Have onshore explorations started as well?

In terms of onshore, we have a number of camps in Cabinda and in the province of Zaire [both in the north of the country, at the border with the Democratic Republic of Congo – ed.] that are operational, but during the war it was not possible to move ahead with exploration in the interior, even though we knew that there were resources that had never been looked at. In the last 10 years of peace, we have worked hard to clear these areas of mines and now the conditions are starting to be right for oil activities to be developed onshore as well. We selected 15 blocks in the Kwanza basin and the lower Congo, and we are thinking about starting the process to sell licenses at the start of next year.

Aside from these 15 blocks, will others be put up for auction?

LUANDA. A view of the waterfront. In Angola a reconstruction process is underway and all economic sectors have felt the effects of this transformation: roads, railways, houses and infrastructures for the distribution of energy have been built.

Our strategy is to put blocks up for auction every two years. The last auction was held in 2011, and we have started the process to do another one in 2013, but we will only be able to start operations in early 2014 – in the first quarter of the following year. We are trying to reduce the time everything takes, so as to minimize the delay.

Have the current onshore explorations yielded any results?

We have found some basins like the one in Kassange, towards the provinces of Malange and Lunda, in the northeast of the country. Then there is the Etoxa basin, near the border with Namibia, which is an extension of those basins. Sonangol is working on it.

What are your expectations from the explorations? Are you optimistic?

Yes, because we have a few indications that give us reason to be hopeful. In the Kwanza basin, for example, oil activities started in the 1950s and, at the time, technologies were used that did not permit complete oil extraction. Now, based on preliminary data, we can say that there is still oil in that basin. However, we will continue to explore because the objective is to consolidate knowledge of our onshore reserves so we can work out our oil potential.

In recent years Sonangol has acquired a range of interests in various foreign companies, not only in Europe but also in Asia. What are the group's future plans?

The major change for the group is that it will evolve into a real holding company, an operational company that has business and business development at its heart. That is the main way forward: Sonangol will be able to develop its activities both internally and externally, in a symbiosis that keeps energy – the company's core business – at its center.

Sonangol also works with Eni.

Angola is an open country and we can say that considering Eni's strategy in Angola, our relations with this company are satisfying and positive. We have developed mutually beneficial relationships with all our partners and surely Eni is one of them. After years in which Eni was a partner aiming to become an operator, finally this aspiration was realized with Block 15/06.

As well as oil, Angola is producing gas with the "Angola LNG" project.

Five cargoes of gas have been dispatched and we expect to export about eight cargoes before the year is out. Then the installation will be shut down for routine maintenance for about 50 days, before being started up again. After that we hope to start more regular production.

Do you think Angola LNG production can increase?

According to the plan and the installed capacity, production could reach 5.2 million tons of natural gas per year. The objective is to ensure that production is stable, but we need to take into consideration that this is a pioneering project because we are producing associated natural gas in association with oil, which has its own special characteristics that have resulted in the plant suffering a few delays. An example is the incident with the probe that was supposed to install the gas pipeline across the river; that problem obviously set back construction of the pipeline. All these factors must be taken into consideration, but our objective is to make sure that the installation runs at full capacity.

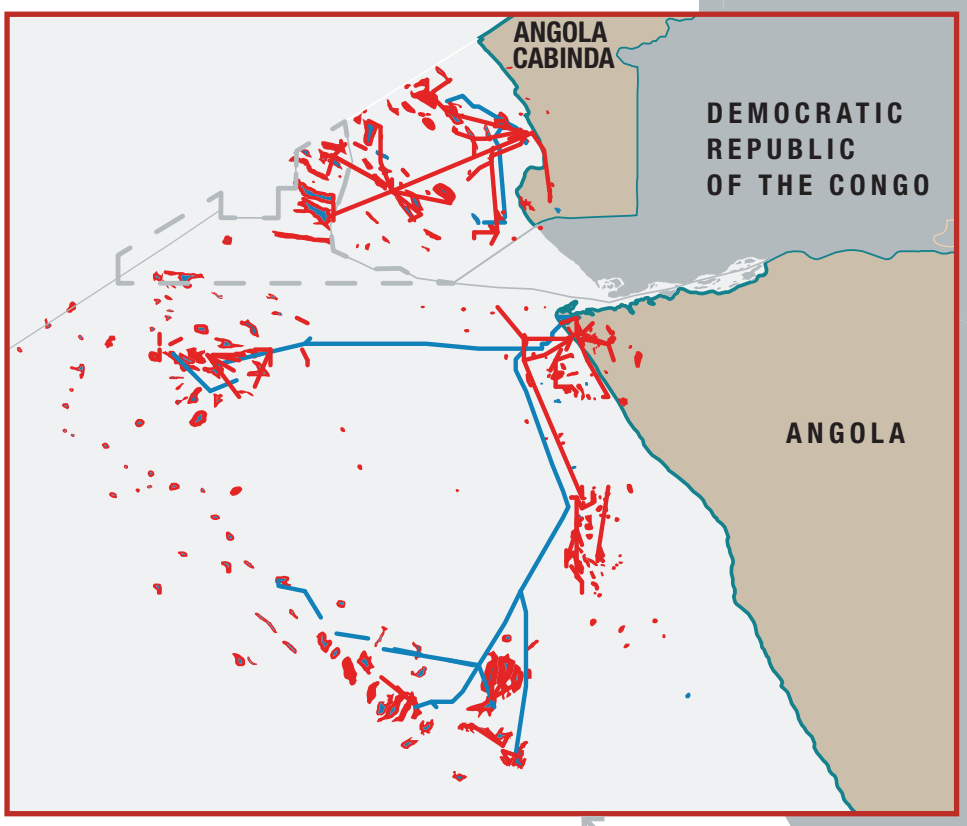
The government's is also planning to build a refinery in Lobito city. What stage is that project at?

Works have begun and at the moment we are building the infrastructure. According to the timeline for the works, the refinery could be finished in 2017.

How much has already been invested and how much do you predict you will invest in future?

The forecast for building the infrastructure is a little over $1 billion. However Sonangol is still looking over the process and doing studies of all kinds: from financial analysis to engineering studies and designing the refinery's structure. The project is being developed as we speak.

Angola has seen a great deal of growth in recent years. How much has your role changed, in the region and on the world stage?



Angola in numbers

Area: 1,246,700 km²
Capital: Luanda
Population: 18,565,269
Average population age: 17.7 years (men: 17.5 / women: 17.9)
Language: Portuguese (official), Bantu and other African languages
Natural resources: oil, diamonds, iron ore, phosphates, copper, feldspars, gold, bauxite, uranium
Government: republic; presidential, multi-party system

MAIN ECONOMIC INDICATORS
GDP (purchasing power parity): $130.4 billion (2012 estimate)
GDP (official exchange rate): $118.7 billion (2012 estimate)
GDP growth rate: 8.4 percent (2012 estimate)
Public debt: 16.2 percent of GDP (2012 estimate)
Inflation: 10.3 percent

Oil
Production: 1,854 mb/g
Reserves: 10,470 million barrels, as at December 31, 2012
Consumption: 127 mbd
Imports: 80 mbd
Exports: 1,709 mbd

Gas
Production: 0.73 billion cubic meters
Reserves: 275 billion cubic meters, as at December 31, 2012
Consumption: 0.73 billion cubic meters

Source: CIA World Factbook 2013; Eni World Oil and Gas Review 2013

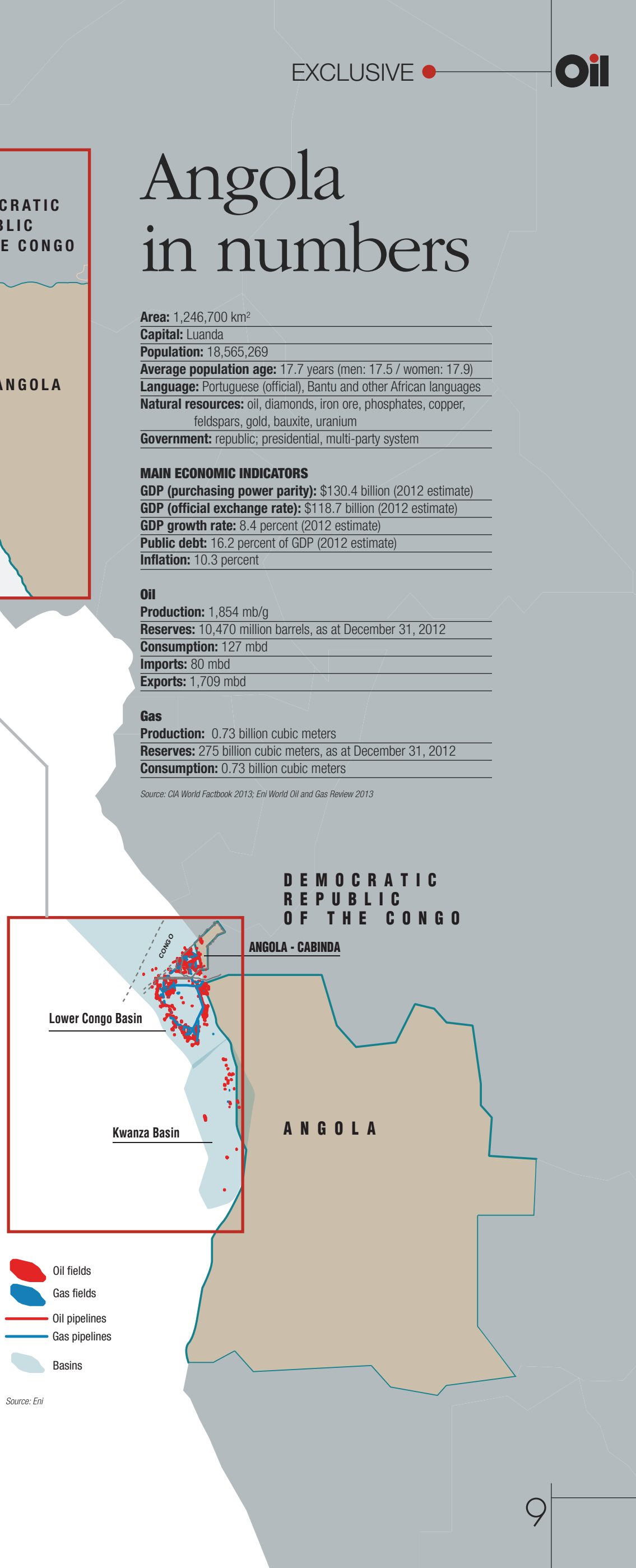
Angola is a country that has gone through various metamorphoses. The most important victory was peace in 2002 and everyone can plainly see that the country has been completely transformed since that date. There is a process of reconstruction in progress and all economic sectors have felt this transformation: road and rail transport, airports, and we have also built dams, homes and infrastructure for distributing energy. We are also seeing changes in the financial and banking sector. There is a sense of dynamism and internal transformation in fact. However these are just starting points. We have to consider that are still significant levels of poverty in the country. The objective is to create the conditions to reduce poverty and cut out the inequalities between the various regions. The government has already identified these problems and has designed programs and projects that go in this direction. We have already achieved some goals: until two months ago, Angola was one of the world's least developed countries and from next year will be classed among medium-developed countries. This is the result of the efforts that the government is making in all sectors of the economy and shows that our country can achieve high targets and be a leader in terms of development in Africa.

Other than poverty, what are the challenges that Angola will have to face?

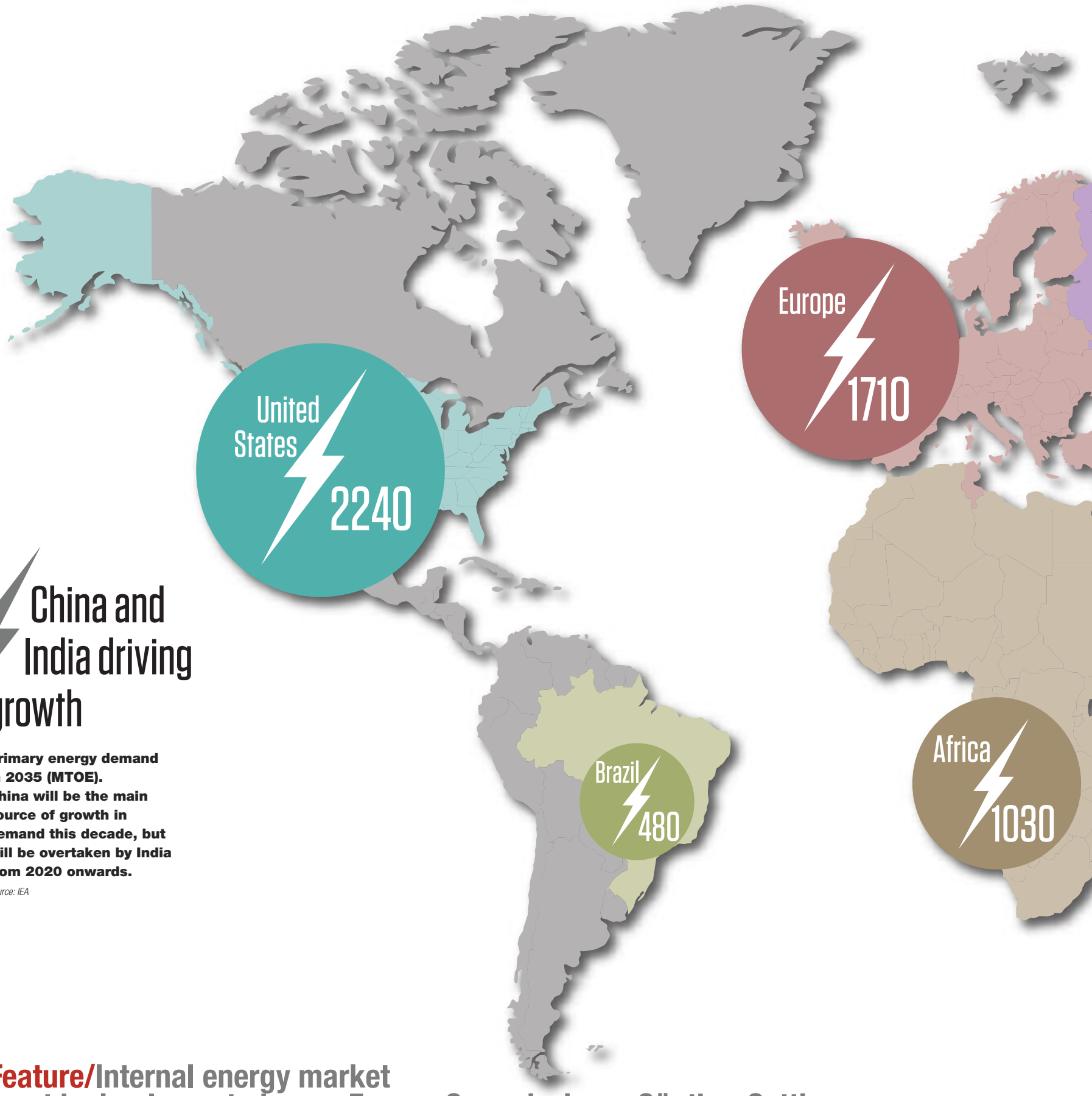
There are other sectors in which the country can improve– education for example. We need to create the conditions for our teachers to be able to train the workforce that our country needs in order to develop. We must create a chain like the one that exists in more developed countries, to ensure that the country's goals can be achieved. We have to improve health conditions, training staff in the highest levels of public health. The health infrastructure is starting to appear; now we also need qualified personnel.

What do you think the future holds for the country?

Current generations will have to work to pass the baton to the new generation, while holding fast to the goal of ongoing development in the country. That is the ambition that all Angolans have at this moment.



Source: Eni



China and India driving growth

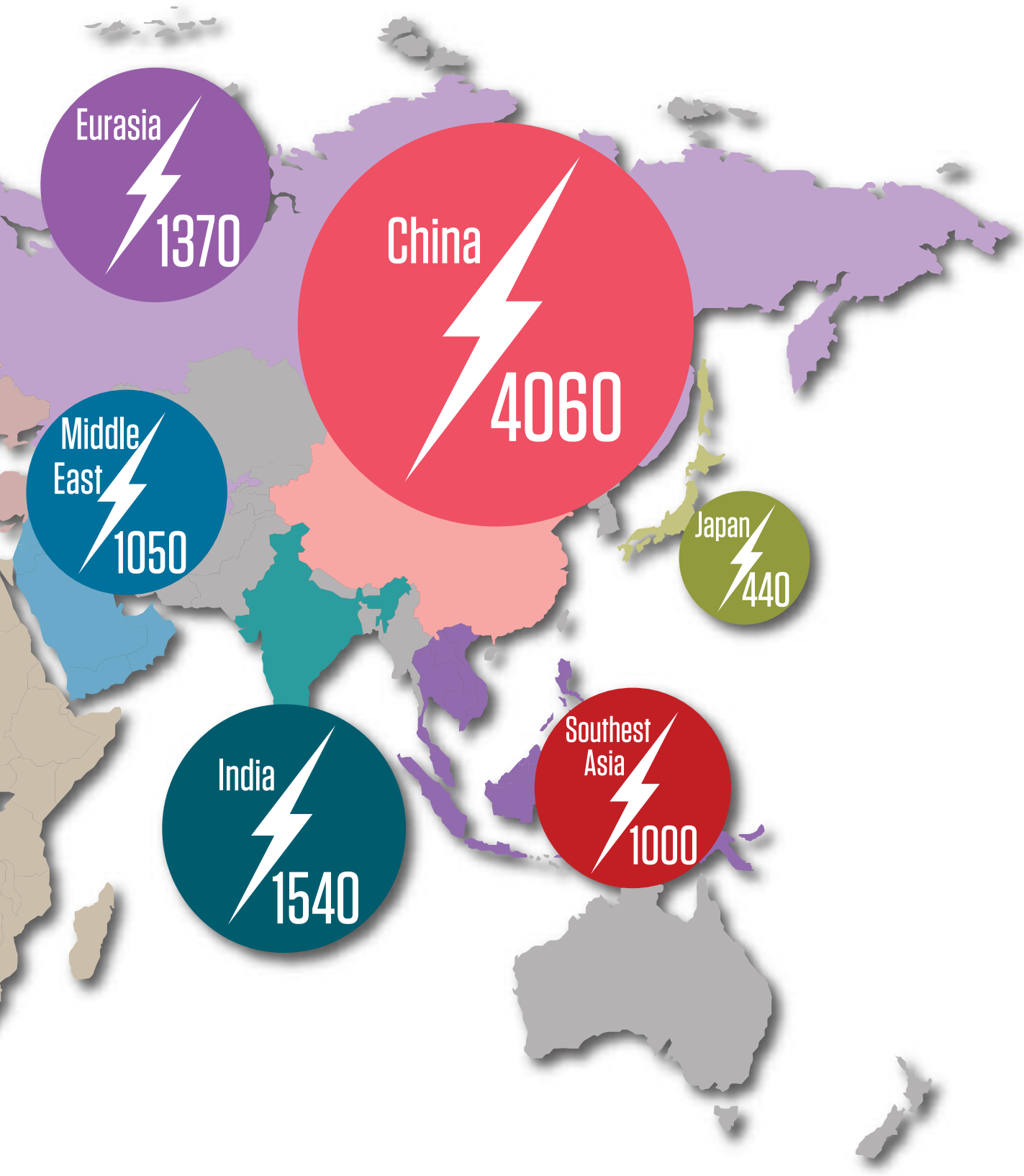
Primary energy demand in 2035 (MTOE). China will be the main source of growth in demand this decade, but will be overtaken by India from 2020 onwards.

Source: IEA

Feature/Internal energy market must be implemented, says Energy Commissioner Günther Oettinger

Security, competitiveness and decarbonization

In the long term, these goals are not mutually exclusive, but the transition needs to be managed carefully. If successful, E.U. industries and economies will benefit from a reliable and low-cost energy system



GÜNTHER OETTINGER
Günther Oettinger is the European Commissioner for Energy in the Barroso II Commission, having taken up the role in 2010. He was a member of the State Parliament in Baden-Württemberg, Germany, from 1984 to 2010 and from 2005 served as its Minister President. From 1991 to 2005, he was also leader of the Christian Democratic Union (CDU) parliamentary party and also chaired its federal committee for media policies.

by SERENA VAN DYNE

Europe's dependence on imported hydrocarbons threatens its energy security. One of the most vexing issues currently facing the European Commission, it is likely to become even more challenging over time.

Europe's Commissioner for Energy, Günther Oettinger, put it succinctly: "As demand increases in other parts of the world, competition for resources will tighten and the E.U. may face new challenges in sourcing its energy supply." Oil discussed this – and other questions – with Oettinger, who underlined the importance of diversifying sources of supply, promoting new interconnections within the European energy market and learning how to manage domestic demand more effectively.

Energy security is one of the main challenges that Europe will have to face in the coming years. Is it ready?

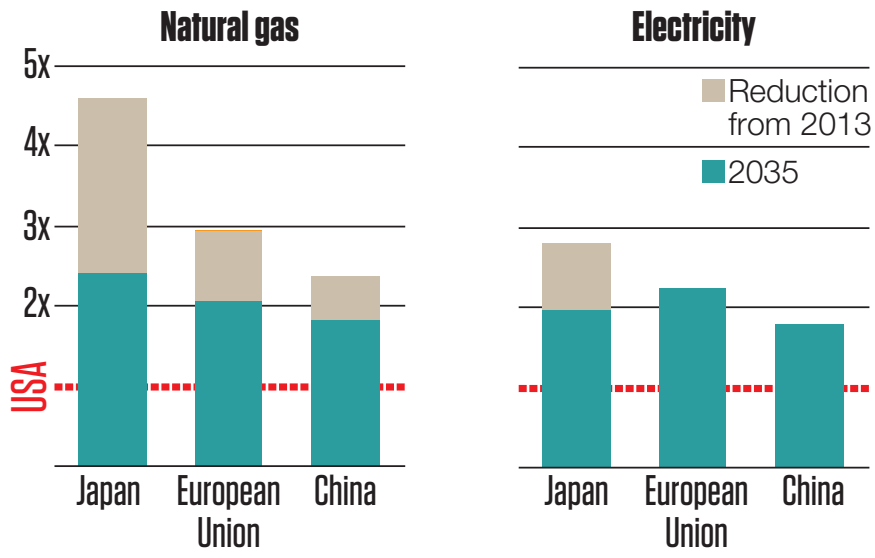
Europe's high dependence on fossil fuel imports, and rising demand for energy elsewhere, clearly pose challenges. In addition to this, comes our dependency on gas imports.

To increase energy security in the field of gas, we are diversifying our supply routes, both within the Internal Energy Market, and in terms of our external energy corridors. New gas pipelines such as the Trans-Adriatic Pipeline and Tanap will allow us to get gas directly from Azerbaidjan and other coun- →

Who has the energy to compete?

The gap between what European, Chinese and Japanese companies pay for electricity and gas, and what their U.S. counterparts pay, is set to hold firm over the next 20 years.

Source: IEA



DEPENDENCE AND ALTERNATIVE SOURCES

To reduce its dependence on fuel imports, the E.U. has committed to getting 20 percent of its energy from renewable sources by 2020. Member states such as Germany and Sweden have already invested heavily in wind and solar power.

tries in the Caspian region. This is the very first time in history that we have received gas directly from this region. In case of gas transit disruptions, such as those experienced in the 2009 Russia-Ukraine gas dispute, we will be much better equipped than in the past.

Many member states are also looking to increase their options through the use of shale gas and renewables. The latter, in particular, comes with a new challenge for security of supply, in the form of fluctuating generation that depends on weather conditions. The EU is helping to integrate alternative energy sources such as wind and solar into our energy networks on a large scale through the deployment of Smart Grids, for which large investments in transmission and distribution grids will be required.

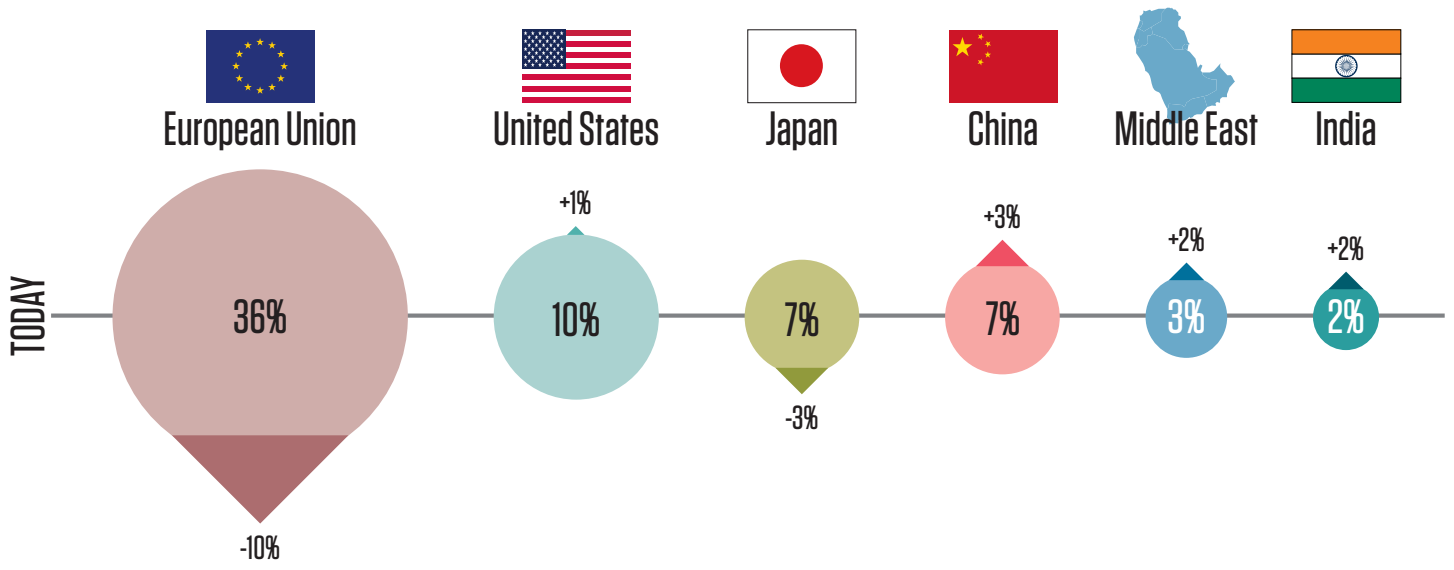
What policies are needed to reduce Europe's dependence on oil and gas imports?

First, energy dependence on fuel imports can be reduced through the increased use of alternative energy sources, and the EU is committed to getting 20 percent of its energy from renewable sources by 2020. Member states such as Germany and Sweden have already invested heavily in wind and solar power. Unconventional gas production may also provide us with opportunities to increase indigenous production.

Winners and losers

The United States and emerging economies will enjoy a growing share of the market in exports of energy-intensive goods, while the E.U. and Japan will see a sharp decline.

Source: IEA



> It is important to promote new interconnections in the European energy market. Increased cross-border energy exchanges will foster interdependence between E.U. member states, as well as lower prices, thereby reducing our need for costly energy imports

Second, new interconnections within the European energy market are important. Increased cross-border energy exchanges will foster interdependence between Member States, as well as lower prices, thereby reducing our need for costly energy imports.

Finally, we cannot effectively reduce our dependence on oil and gas imports if we do not better manage our demand for it. Energy efficiency is at the core of our work, and we promote this, for example, through legislation on the energy efficiency of buildings, and on the design and the labeling of electrical products.

Another factor that makes Europe less competitive is the very high price of gas compared to the prices we are seeing in the United States – thanks in part to the shale revolution – and in Asia. How can we overcome this difference?

Our companies are indeed paying several times more than their American counterparts. It is a massive challenge for our industry to stay competitive. We have to make sure that relatively high energy prices do not chase away energy intensive companies that provide much needed jobs, skills and wealth in the European economy. Solutions in the near term depend →

NEW ENERGY CORRIDORS

Athens, February 13, 2013. Former Greek Foreign Minister Dimitris Avramopoulos (C), former Italian Economic Development Minister Corrado Passera (L) and former Albanian Deputy Prime Minister Edmond Haxhinasto after signing an agreement that seals their support for a natural gas pipeline project to cross their territories. The intergovernmental agreement is a condition to build the Trans-Adriatic Pipeline (TAP), a project to link Azerbaijan's giant Shah Deniz II field to western Europe.

on the successful implementation of the internal energy market, more efficient pricing through gas-to-gas competition and policies to increase energy efficiency.
Looking towards the longer term, we need to develop new and more efficient energy technologies. Horizon 2020 is a research and innovation programme with a funding of at least €70 billion - by far the EU's largest to date - and a substantial proportion of this will help EU industry develop the technologies to be competitive in a low carbon economy.
The European Commission is looking at the whole question of energy prices in Europe, and why they are so high. Next February the European Council will discuss whether further actions need to be taken in this regard.

Hydrocarbon demand is falling in Europe and in Organization for Economic Co-operation and Development (OECD) countries in general. Meanwhile emerging countries are seeing growth, which is expected to intensify in the coming years. What scenarios do this this new global equilibrium point towards?

The balance in global oil and gas demand is changing rapidly. We are seeing demand rising fast in developing countries, while needs in the EU will probably come down as a result of our energy policies. Nevertheless, even with our low-carbon policies, the EU will continue to be a major oil and gas consumer and importer beyond 2030. There is a promising future for natural gas in our decarbonization plans, particularly if Carbon Capture and Storage (CCS) can be successfully applied. But all hydrocarbon industries need to diversify in the future.
As demand increases in other parts of the world, competition for resources will tighten and the EU may face new challenges in sourcing its energy supply. To be prepared, we therefore need to further develop our infrastructure, and build strong partnerships with key energy suppliers. The EU also needs to speak with one voice, and engage others by continuing to lead international dialogues on climate change and energy efficiency.

Europe has made a commitment to cut CO_2 emissions drastically. What does the Roadmap to 2050 have in store in this area? How will the re-emergence of coal have an impact on this goal?

The re-emergence of coal in Europe is indeed a challenge to our carbon reduction objectives. But the Roadmap 2050 also clearly says that the CO_2 goals can be achieved under different scenarios, even if the fossil fuels will continue to be an integral part of the EU's energy mix in the decades to come. It needs then to be combined with CCS. 3 out of 5 EU's decarbonization scenarios contain fossil fuels with CCS a part of the energy mix in 2050.

Will the E.U. be able to cut greenhouse gas emissions by 80 percent by 2050 but still remain competitive?

The EU cannot do this alone, but only in the context of a robust international climate agreement.
We have no choice but to decouple economic growth from increased fossil fuel consumption. In the long-term, the goals of cutting emissions and having competitive industries are not mutually exclusive, but clearly there is a need for a carefully managed transition towards decarbonization, and this a key rationale underpinning our 2020 and 2030 strategies. If we can achieve the rightfully ambitious targets we have set, EU industries and economies will undoubtedly benefit from a reliable and low-cost energy system, and ultimately the EU will be more competitive.

What progress has been made in terms of achieving the objectives for 2020 and what are your views for what needs to be done in 2030?

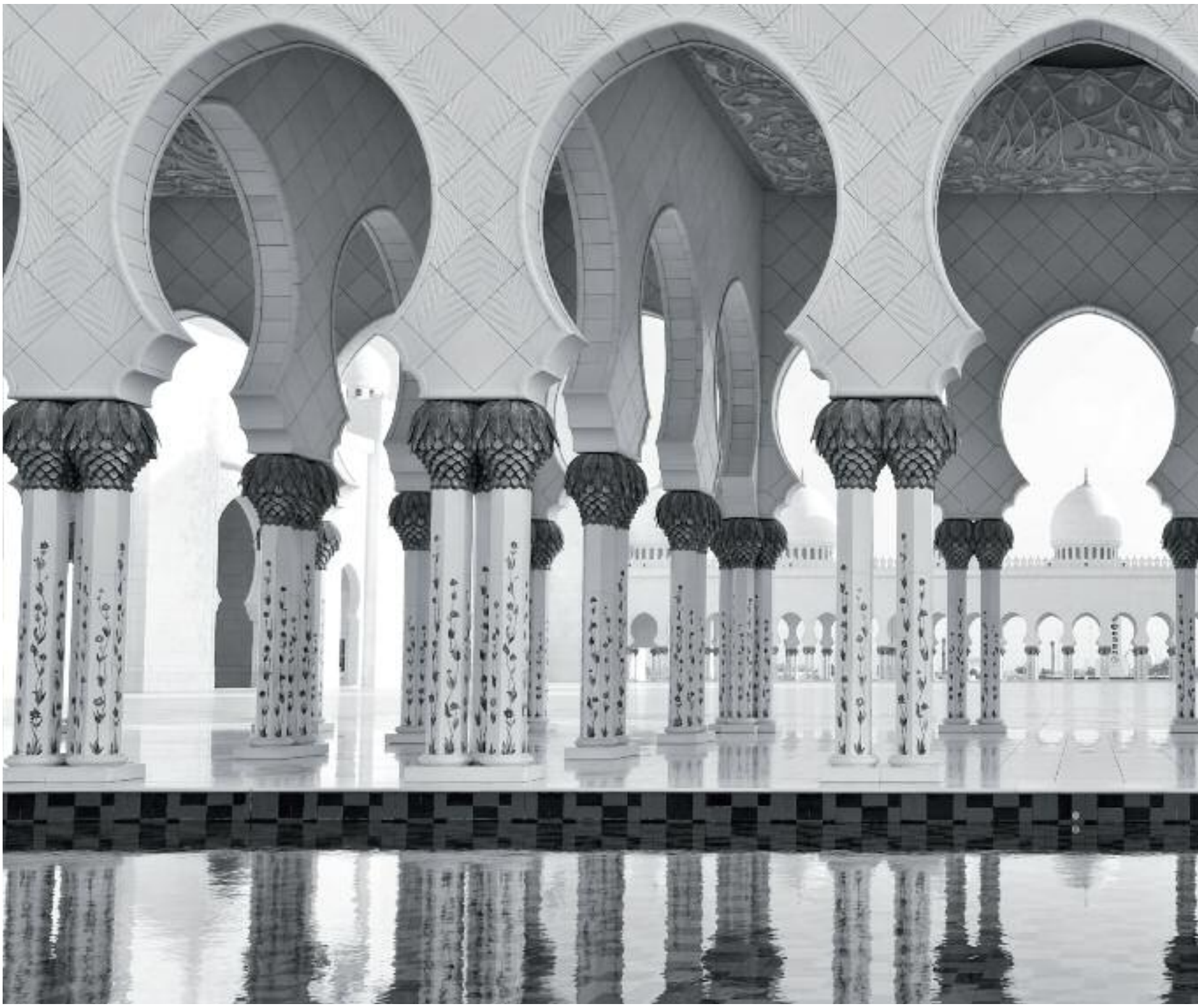
For the 2020 targets, projections suggest that the greenhouse gas reduction target of 20 percent compared to 1990 levels will be achieved by the EU level as a whole. However, a number of member states still have a lot of work to do in order to achieve their national targets. While all member states have committed to detailed action plans to achieve the 20 percent renewable energy consumption target, the economic crisis and various barriers to renewable energy development have hampered progress, and many member states will require further measures.
Energy efficiency remains our biggest challenge, and more needs to be done in this area, even after the full implementation of the Energy Efficiency Directive. The EU is also making good progress towards the completion of the internal energy market and diversification of energy supply.
With 2030 in mind, EU energy policy must ensure progress towards three objectives: competitiveness, security of supply and environmental sustainability. Higher shares of renewables and a more energy efficient economy will contribute to all these objectives, but we cannot ensure a competitive and secure energy system solely through these means. The 2030 framework must be defined in a way that safeguards affordability of energy and competitiveness of our industry, while at the same time make sure that we are on track to meet long term climate objectives.

Opinion/According to Matar Hamed Al Neyadi, Undersecretary for Energy of the United Arab Emirates, innovation is the way forward

Diversification is key

The United Arab Emirates is poised to launch an energy development plan involving an increase in both nuclear and renewable power generation. The country is investing $25 billion over the next five years on exploring new gas fields

MATAR HAMED AL NEYADI
Matar Hamed Al Neyadi has been the Undersecretary of the United Arab Emirates Energy Ministry since January 2012. Since 1998, Al Neyadi has acted as a legal advisor for the UAE's armed forces and the Permanent Committee for Borders, representing his country in numerous committees and legal conferences within the Gulf Cooperation Council, in the Arab world and internationally. Al Neyadi has also served as Secretary-general of the Border Affairs Council.



The prevailing idea that the Arab peninsula goes hand-in-hand with oil extraction may well be set for a change. The UAE's latest programs to develop its energy sources are marked by a far greater degree of diversification.
Naturally, we took this as our starting point when we interviewed the country's Undersecretary for Energy, Matar Hamed Al Neyadi, at the World Energy Congress in South Korea.

by JOHN ST. JEAN

Diversification is the buzz word in the world of energy nowadays. How is the U.A.E. facing this new and pressing challenge?

Diversifying our energy mix is the first pillar of our energy policy. Our country is following a path of innovation in the energy sector. To meet immediate demand, we are using more natural gas to generate electricity, because of its clean and efficient burning properties.
We will spend $25 billion over the next five years on exploring new gas fields using the latest technology to develop non-associated gas at onshore old oilfields. We are sealing long-term arrangements with Qatar to import gas via the Dolphin Energy pipeline, which will help the U.A.E. to meet around 30 percent of its local demand for natural gas.

What is the right mix of energy sources for your country?

We are mainly working on three elements: natural gas, nuclear energy and renewables. We are not using any diesel or biodiesel to generate electricity, because in our opinion this is not really economical and, moreover, it is bad for the environment.

How are you going to expand your liquefied natural gas (LNG) activities?

Our first LNG plant is in Dubai. It has been in operation since 2010, with a total capacity of 4.5 million tons per year. That one is a floating terminal. We are working towards constructing a second LNG terminal on the eastern coast of the U.A.E., with a capacity of 9 million tons per year. As I said before, in our country we consider gas to be a fundamental energy source: it is efficient, economical and environmentally friendly.

Does the plan to diversify your energy sources

Reserves: 97,800 million barrels, as at December 31, 2012
Production: 3,539 thousand barrels per day

Reserves: 6,090 billion cubic meters, as at December 31, 2012
Production: 51.51 billion cubic meters

Source: Eni World Oil and Gas Review 2013

A new nuclear path
The United Arab Emirates expects, by 2020, to produce 25 percent of its own energy from nuclear power plants. Four plants with an overall capacity of 5,600 megawatts are currently being built

The "renewable" Emirates
Under the scope of the Global Carbon Agenda the government of the United Arab Emirates planned to reduce CO_2 emissions by 30 percent by 2030.
In the same period, government plans expect renewable energy to cover approximately 7 percent of overall energy production with a forecast capacity of more than 35,000 megawatts

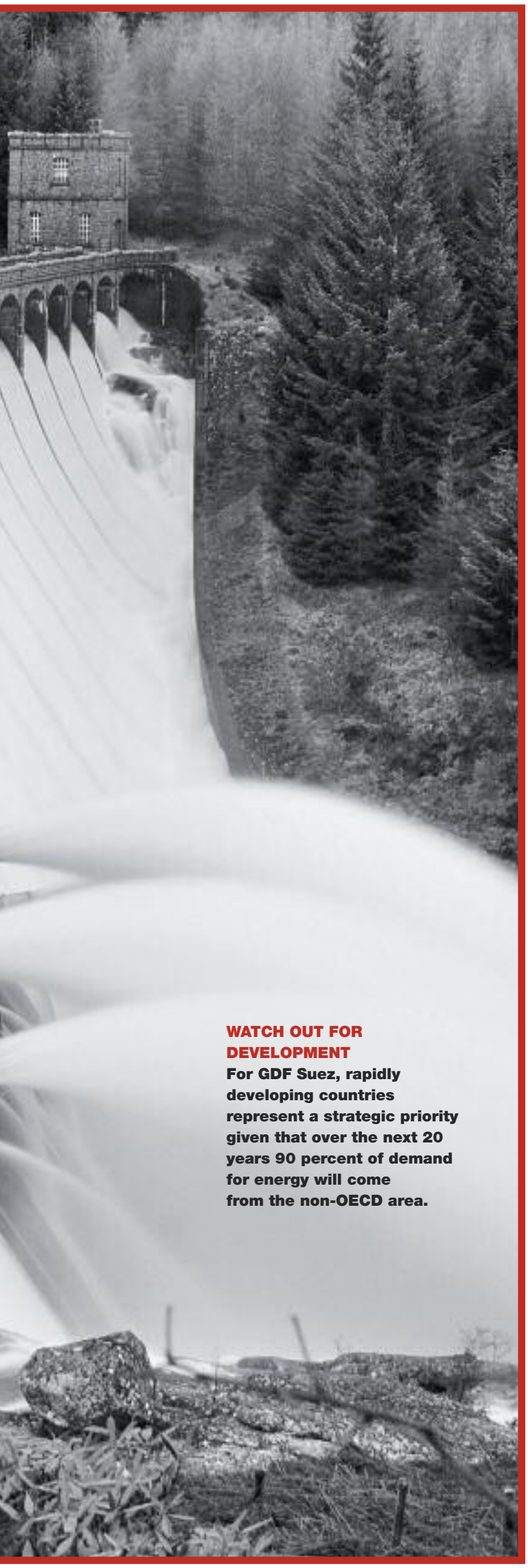
Source: Ministry of Energy of the United Arab Emirates

also involve developing the nuclear sector?
In terms of nuclear power, in December 2009 we awarded a $20 billion contract to the Korea Electric Power Corporation to construct four nuclear reactors.
They will be completed by 2020 and will cover about 25 percent of the U.A.E.'s demand for electricity. At the same time, however, the U.A.E. was the first country in the Middle East to announce renewable energy targets, which will see 2.5 GW of new renewable energy capacity by 2030. We expect these targets to be met with solar and waste-to-energy resources. As a major first step, Masdar commissioned Shams 1 in March this year – the largest concentrated solar power plant in the world.

The sustainability of energy sources is a very sensitive topic in your country. How do you intend to pursue greater respect for the environment?
We are committed to increasing the environmental sustainability of energy sources, while also trying to provide greater access to electricity for the entire population of the United Arab Emirates.
The U.A.E. has the region's first mandatory green building codes, which will bring down energy and water consumption by more than 33 percent in new buildings. More and more appliances will soon fall under the regulation. We are also running a large number of pilot schemes in order to develop additional policies in the next few years. These include monitoring water and energy consumption through wireless smart meters, consumption testing and time-of-day based electricity pricing to offer lower rates for less electricity usage, and the establishment of state-funded energy service companies.

The term "transition" is at the heart of current debate in the energy industry. What does this concept mean for your country?
This is a term that is being used mainly in Europe; it is not used in our part of the world. We prefer to talk about the challenges facing our country, because they are unique and different from one country to another. It all depends on climate and location.
To overcome these challenges, I think it is really important to use dialogue and to learn from each other's experience. This helps each country to face any kind of challenge, both in terms of generation and consumption.

GÉRARD MESTRALLET
Gérard Mestrallet is Chairman and CEO of GDF SUEZ. He joined Compagnie Financière de SUEZ in 1984 as a project manager. In 1986, he was appointed Executive Vice-President for industrial affairs. In 1991, Mr. Mestrallet was appointed Executive Director and Chairman of the Management Committee of Société Générale de Belgique. In 1995, he became Chairman and Chief Executive Officer of Compagnie de SUEZ, then, in 1997, Chairman of the Management Board of SUEZ Lyonnaise des Eaux. On May 4, 2001, Gérard Mestrallet was appointed Chairman and CEO of SUEZ, and later Chairman and CEO of GDF SUEZ following the merger between SUEZ and Gaz de France on July 22, 2008. He is also President of the Association Paris EUROPLACE, Member of the International Council of the Mayor of Shanghai and Chongqing, and Director of Tongji University (Shanghai).



WATCH OUT FOR DEVELOPMENT
For GDF Suez, rapidly developing countries represent a strategic priority given that over the next 20 years 90 percent of demand for energy will come from the non-OECD area.

Point of view/Gas will play a major role according to Gérard Mestrallet

An eye toward the development

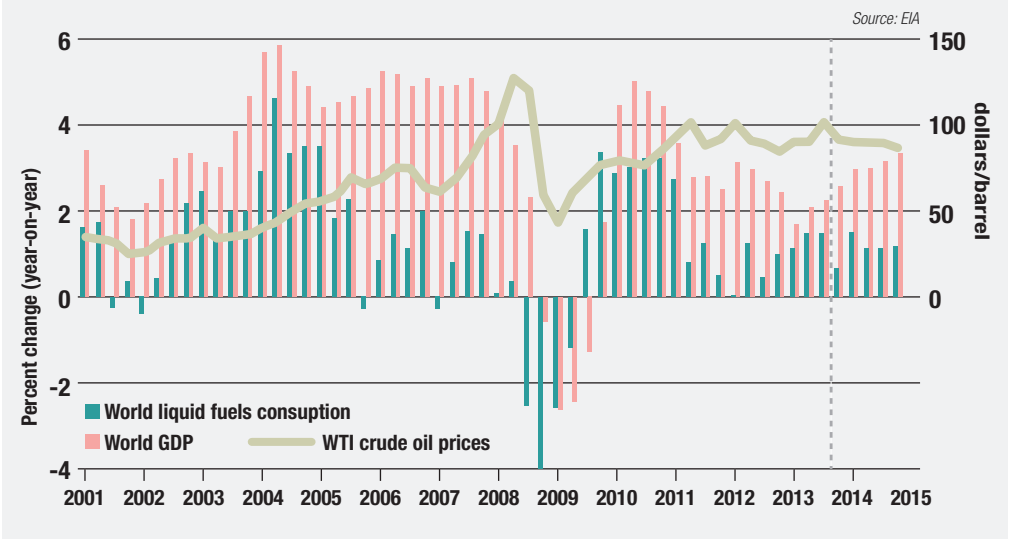
The demand for energy may be near its peak in the "mature" economies, while for the first time, emerging countries' demand exceeds that of OECD members. Looking forward, GDF Suez's CEO and Chairman sees renewables as the next strategic target

by GRANT SUMMER

The recent World Energy Congress (WEC) in Korea emphasized the importance of rebalancing the world's energy mix. Right now, fossil sources still retain their dominant position. At the same time a greater number of analysts are saying that the next few decades could see global oil demand start to fall as a result of a series of factors, including the spread of alternative fuels such as gas and the crackdown on consumption in major consumer countries like China. In order to better understand the role of European operators in this new framework, we asked for a forecast from Gerard Mestrallet, CEO of GDF Suez, one of the most important global players in the energy sector.

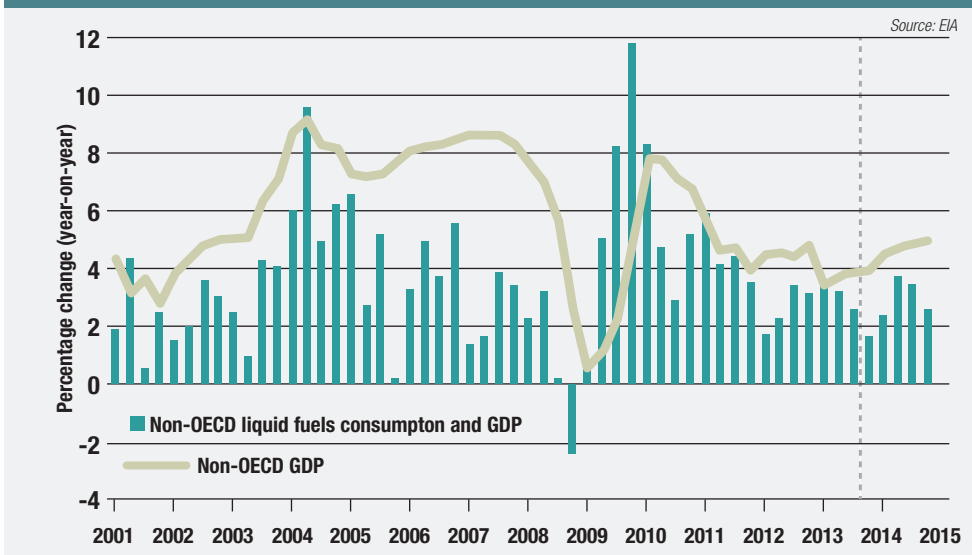
If oil demand did fall, which energy sources do you think would stand to make the biggest gains?
We share the IEA's view that foresees a relative decline of oil in the world energy mix; however, in absolute value, it should continue to rise. Our anticipation is that gas will play a growing share in energy mix, thanks to growing energy needs of emerging countries, to significantly enhanced reserves and to growing environmental concerns.
Overall emerging countries are facing growing energy needs to fuel the growth of their rising economies. Energy demand is particularly critical in China, which accounts for one fifth of the world global energy consumption and which experiences a racing urbanization and industrialization. As a consequence, China's 12th 5-year plan identifies gas as a key contributor to address this energy challenge, together with energy efficiency and renewable energies.

LIQUID FUELS CONSUMPTION AND WORLD GDP



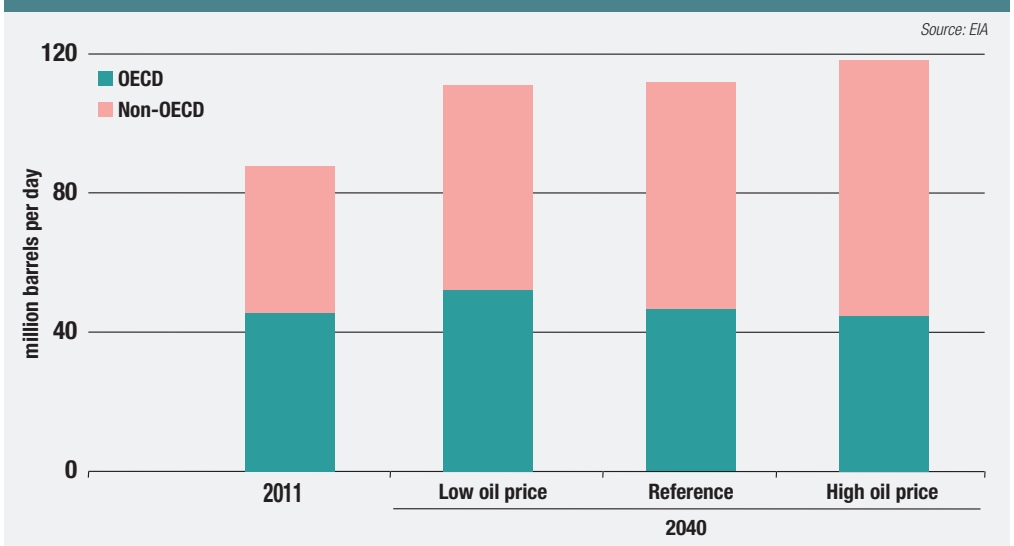
The graph shows the parallel relationship between consumption of liquid fuels and world Gross Domestic Product (GDP) performance between 2001 and 2013, with projected figures to 2015. This is also valid for the line that marks the cost per barrel of oil.

LIQUID FUELS CONSUMPTION AND NON-OECD GDP



The trend in consumption of liquid fuels for countries that do not belong to the Organization for Economic Cooperation and Development (OECD) has, between 2001 and 2013, constantly followed the fluctuations of global GDP.

OIL DEMAND AND PRICE OF OECD - NOT OECD



In 2013, for the first time and led by China, demand for oil in countries not belonging to the OECD exceeded that of wealthier nations, increasing by at least 50 percent over the last 10 years and reaching 44.5 million barrels per day in April 2013, compared with 44.3 million barrels per day for OECD countries. This trend is expected to continue in the future.

The United States is moving towards energy independence thanks to increasingly intensive shale gas and shale oil development, while demand for new energy among the Asian "Giants" grows ever higher. Where does Europe stand between these two?

We know how much the US/American landscape has been changed by the intensive development of unconventional gas and oil. The USA has become the world's leading natural gas producer and will soon be an LNG exporter.
This is remodeling the entire American energy sector with a shift to natural gas in the power sector but also in the transportation sector such as for heavy trucks and for rail. Moreover, the phenomenon has affected the entire economy, by boosting America's global competitiveness. At the same time, technological progress is helping to reduce the environmental impact of exploitation in terms of less pollution and a smaller land footprint.
In Asia, energy consumption goes hand-in-hand with fast economic growth. In the next twenty years, 90 percent of global energy demand will come from non-OECD countries. To meet that increasing demand, all types of energy sources are needed: coal, renewable, and of course natural gas.
I would like to underline that our strategy at GDF SUEZ, as the referent energy company of the emerging countries, is totally in line with this vision: fast-growing countries are our number one strategic priority. We want to develop solutions that correspond with their local resources and needs.
Europe is faced with a quite different situation. Energy demand has been declining in Europe since 2008 after a 60-year growth trend because of the crisis, but also thanks to the impact of energy efficient measures. Indeed, this region has been a trailblazer in terms of energy efficiency. GDF SUEZ, as a leading player of the energy transition in Europe, takes the ongoing revolution into account by adjusting its thermal generation portfolio to the market shift and by further focusing on the development of its energy efficiency activities and of its renewable generation portfolio in Europe.

Is diversification – including in terms of renewable sources – the way forward for major energy companies, or is this scenario still some way off?

According to an AIE forecast, 60 percent of the incremental renewable energy demand between 2010 and 2030 will come from non-OECD countries. At GDF SUEZ, we have been early believers in a balanced energy mix in terms of both geography and technology. More than 80 percent of our generation capacity has low CO_2 emissions, with up to 15 percent in renewable. We are convinced, however, that different countries must also take into account the availability of their domestic resources to define their energy mix. This has lead us, for instance, to a mix relying mainly on hydropower in Brazil, while on gas in GCC, both regions in which GDF SUEZ holds leading positions.

Can we expect Europe's big companies to adopt a more synergistic strategy in future, bearing in mind the United States' progress on the unconventional market?

I believe that major European utilities are heavily involved in proposing solutions to address strategic issues. The recent outcry of the Magritte club, (12 CEOS of major European Energy companies among which ENI and GDF SUEZ), in which is a fine illustration of how European energy companies can team up not only to launch a common alarm but also to submit adapted solutions regardless of their diverging interests.

The theory/According to Citi, the trend could reverse within the decade

Peak demand is near

Increasing fuel efficiency standards and the replacement of oil with natural gas in the transport sector will result in a potential fall in demand of 10 million barrels per day by 2025, eroding practically all potential growth in oil demand

by EDWARD L. MORSE

At the turn of the century, a wave of Malthusian pessimism pervaded the oil sector: demand from China and other emerging markets for oil was exploding with the prospect of a couple of billion people buying cars and consuming gasoline and diesel fuel while oil supply appeared to be peaking. And no matter how high prices had to climb, the thought was that there was no deterrent to greater demand growth.

But increasingly it appears that both sides of that Malthusian equation were wrong. The shale revolution is pointing to decades, if not centuries, of adequate oil supply – it's abundant on the planet and technology is bringing it within reach at prices that are below today's $100 per barrel or higher levels. What's more, when it comes to demand there are limits on a crowded planet to how many cars →

and trucks and diesel trains can be deployed. On top of that, the shale gas revolution and the discovery of deep gas resources are dropping the price of natural gas to levels that make it competitive with oil. For the first time in a century, oil's monopoly in the transportation sector is seriously jeopardized.

The International Energy Agency has significantly downgraded prospects for oil demand growth in its latest *World Energy Outlook 2013*. The IEA is projecting that under its "new policies" scenario, oil demand should rise from 87.4-million b/d in 2012 to 101.4-mm b/d in 2035, or by a mere 14-million b/d over the next twenty-two years. That represents a substantial drop in the relationship between economic growth and oil demand growth over the previous two decades. Most of the growth – 12-mm b/d of the total 14-mm b/d increase – is expected in the transportation sector, where oil's role has reigned supreme.

It may be the case that the IEA's brave move in dropping the likely growth rate of oil demand is too conservative. Indeed, recent trends point to a peaking of oil demand long before then, perhaps as early as the end of the current decade, or by 2020-2025.

FUEL EFFICIENCY AND THE RISE OF GAS

One of the prime movers of the decline in oil demand has been steady gains in fuel efficiency, which has already resulted in a peaking of passenger vehicle transportation fuel demand in all of the OECD, including the United States. The average fleet fuel efficiency in the United States will rise from 23.5-miles per gallon today to 40-m/g in 2025. Even adding in growth in the vehicle fleet from 250 to 305-million vehicles and assuming a modest penetration of hybrid and electric cars would drop US gasoline demand from over 9-mm b/d today to about 5-mm b/d then. Add in a 30 percent penetration of electric vehicles and gasoline consumption would fall by more than 50 percent.

On a global basis we have taken the Citi automobile equity research team's estimate of a 2.5 percent annual improvement in fuel economy for new cars and trucks globally, and we also take their conservative estimate of total fleet turnover of 20 years. By 2020 this increased fuel efficiency globally would reduce projected global oil demand of 3.8-m b/d versus business as usual.

Fuel efficiency growth is being buttressed by other global trends. In the OECD the aging of populations and other demographic trends result in significantly lower automobile ownership as well as significantly less driving. Older drivers simply drive less than those under 35 and car use and ownership are reduced in retirement years. Overcrowding is also at work, which is one of the many reasons that outlook for Chinese demand growth has been lowered by the IEA.

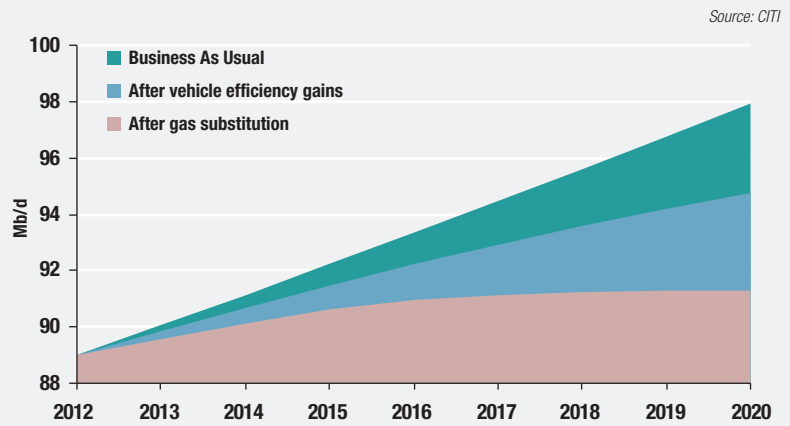
But far and away the most important factor in the peaking of oil demand is growth in natural gas as a transportation fuel, ending the more than century-long monopoly of oil in the transportation fuel market.

Several factors are at work in natural gas's accelerating substitution for gasoline and diesel in transportation. The most important of these is the de-linking of oil and natural gas prices resulting from the shale gas revolution that began in the US and is already showing signs of spreading to Argentina, China, Colombia, Mexico, Russia, and even Saudi Arabia. With natural gas prices in the US currently under $4 per MMBTU and potentially rising to $5-6/MMBTU, the arbitrage toward natural gas and away from oil is overwhelming. At present in the US gasoline and diesel are trading at around $18/MMBTU on an equivalent basis. In Europe the costs for liquid fuels are multiplied by

THE SHIFT TO A LOW EMISSIONS ECONOMY

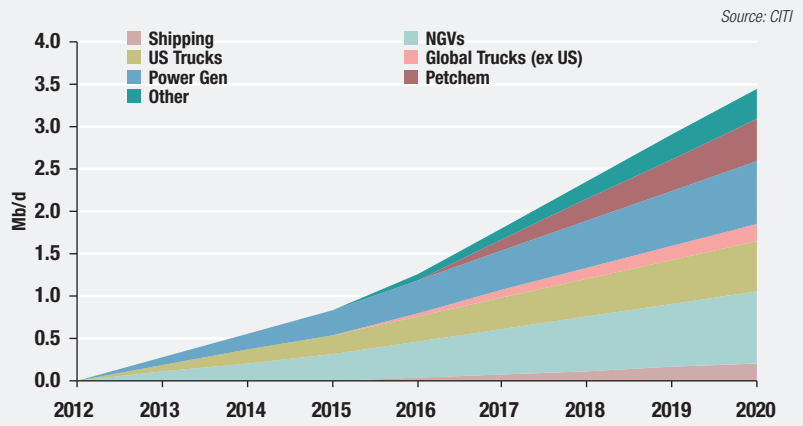
The commitment, at global level, to reduce carbon emissions, caused by transport fuels will be one of the factors that will result in a fall in the demand for oil.

GLOBAL OIL DEMAND (2020)



The improvement in efficiency of vehicle fuels, at world level, will reduce global demand for oil by 3.8 million barrels/day compared with the business scenario as usual.

NATURAL GAS SUBSTITUTION FOR OIL



The gradual replacement of oil with natural gas in the sectors under consideration will lead to a fall in global demand of 3.5 million barrels per day by 2020.

virtue of taxes imposed at the retail level.

ENVIRONMENTAL MATTERS AND ENERGY SECURITY

But other factors are at work as well. These other factors include both environmental elements designed to reduce the emissions footprint of oil-based transport fuels and also energy security issues. For example in China, attention has moved to use of methanol made by abundant national coal supplies as opposed to oil from insecure imports. Additionally, China is at the forefront of developing distribution of LNG for use in heavy-duty trucks and seeking ways to exploit its abundant shale gas resources to further developments of natural gas fuel use in vehicles.

Citi Research's study, "Energy 2020: Trucks, Trains and Automobiles", carries out a detailed analysis of how natural gas can penetrate three different markets – on road vehicles, international marine, and rail, with projections not just to 2020 but to 2040. The study uses extremely conservative assumptions on market penetration, without counting on government policy intervention.

At present some 50-million b/d of oil consumption is in transportation, and at a minimum the report concludes that by 2025 some 2.5-million b/d of oil demand could be eroded by natural gas. That would involve a mere 17-BCF/d of natural gas use. The inroads could easily be double that, given the price incentives alone. Most of the projected penetration of natural gas is in the area of on-road transportation. At present there are some 16 million natural gas powered vehicles in the world (an insignificant number with the vehicle fleet currently growing globally by about 85-million vehicles per annum). Most of these are in Asia with total natural gas consumption of about 5.6-BCF/d fueling the fleet. A near trebling of this use to 14.9-BCF/d would displace 2.3-m b/d of oil use, the bulk of it would be in Asia (1.2-mm b/d) followed by North American (800-k b/d), South America (200-k b/d), and Europe (100-k b/d).

On-land rail use is also seeing an arbitrage in favor of LNG use. And the global bunkers market is also being challenged at present due to environmental regulations eliminating discharge in or near ports and these add to the numbers.

TWO EXAMPLES OF CONVERSION

The major difficulty confronted in projecting natural gas use forward is the speed with which conversion takes place after a minimum volume of a fleet is converted to natural gas. There are two critical examples of fleet conversions in recent history. The first is the conversion of coal powered rail locomotives to diesel between 1935 and 1965; this took place in the US (where it was driven by economics) as well as in Europe and Japan (where it was driven by post-World War II reconstruction). It took ten years for diesel to reach 10 percent of total use, but in the following 10 years fleet conversion rose from 10 percent to 80 percent. The second case was the conversion of the US trucking fleet from gasoline to diesel. Again, an S-curve approach prevailed and it took 10 years to grow from around 25 percent of the fleet to 70 percent of the fleet.

With these historical examples in mind we constructed another case that might be more realistic than our very conservative base case and this in case, which we also think is conservative, we think a minimum of 3.2-million b/d of gasoline and diesel can be lost to natural gas by 2025, but after then conversion would accelerate for the following decade.

Adding together the fuel efficiency standards and the conversion of transportation fuel use to natural gas, we see a potential decline against business as usual of as much as 10-million b/d by 2025, eroding practically all of the potential growth in oil demand in the world. It is on this basis that we believe that peak oil demand might very well be close at hand.

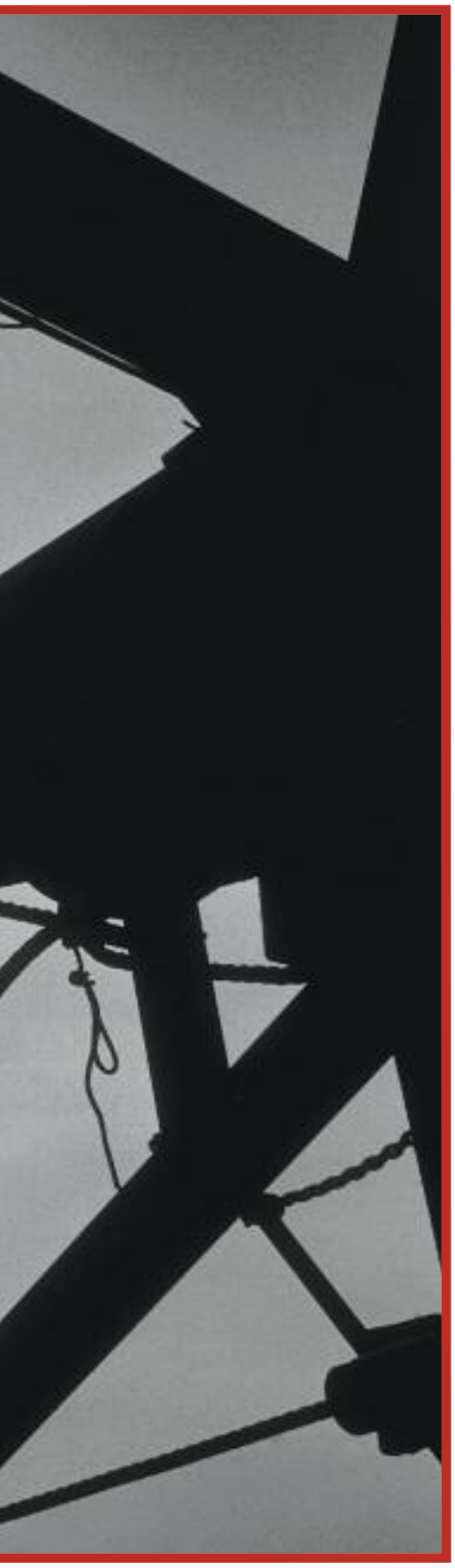
*The themes in this article are based on two Citi reports: "Global Oil Demand Growth—The End is Nigh" (26 March 2013), and "Energy 2020: Trucks, Trains & Automobiles: Start Your Natural Gas Engines" (June 2013).

Edward L. Morse is Managing Director and Global Head of Commodities Research at Citigroup. He is a contributor to journals such as the *Financial Times*, the *New York Times*, the *Washington Post* and *Foreign Affairs*. He worked in the U.S. government at the State Department.

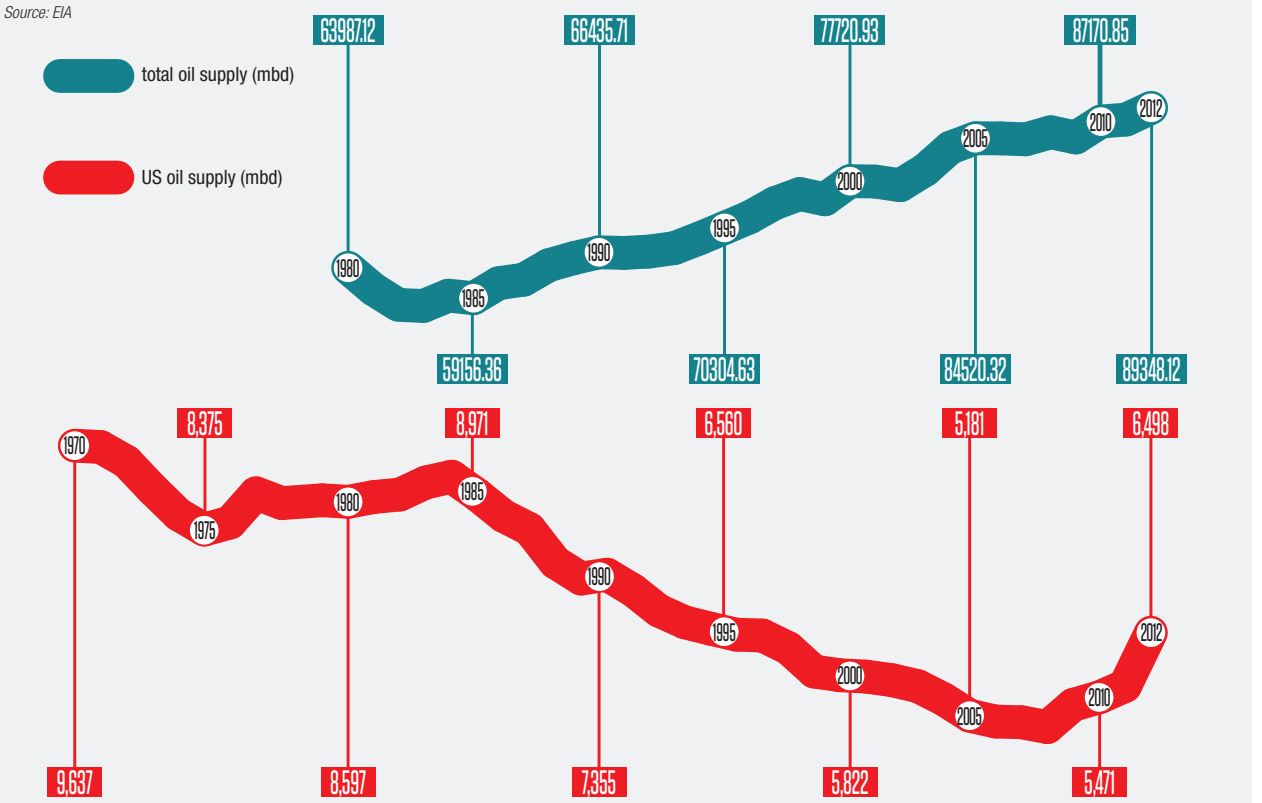
Debate/Peak oil vs. peak demand

Two sides of the same

If oil prices keep increasing, economic growth could fail. If they fall too much before the transition to renewables, then the subsequent decline in production will occur sooner than later with an inevitable decline in consumption



UNITED STATES AND GLOBAL OIL PRODUCTION



The green curve shows global oil production between 1980 and 2012, the red curve shows United States production since 1970. When U.S. oil production hit a peak in 1970 and began to decline – temporarily at least – it seemed that Hubbert's theory was being proved right.

coin

by PAUL BETTS

There is a well-worn aphorism, first attributed years ago to the then Saudi Oil Minister Zaki Yamani, that has been kicking around the oil industry for decades: "The stone age didn't end because we ran out of stones." In other words, the oil age would not end because the world ran out of oil but rather because it would move on to more economically efficient technologies and alternate resources.

A whole string of other pundits and experts have since used this aphorism, among them Al Gore, Bjorn Lomborg, Steven Chu and Ron Bailey, to counter one of the most recurrent and long running intellectual theories associated with the oil and gas industry: the concept of so-called Peak Oil. The issue, especially in the US, has assumed the shrill tones of religious fanaticism, with hard core prophets of Peak Oil warning that the "end was near" and that humanity would be thrown into mayhem not to say war, starvation and economic recession when the oil supplies that helped create the modern world stop growing and irreversibly declined.

HUBBERT'S THEORY

Daniel Yergin, a Pulitzer Prize winning author and chairman of Cambridge Energy Research Associates, has traced the origins of this doom and gloom scenario all the way back to the 1880s, finding that it has made comebacks at various times of economic and geopolitical stress ever since. The idea owes its origin and inspiration to the famous US geologist Marion King Hubbert, who noted some arcane aspects of geology related to US oil reserves and then applied them globally. Hubbert unveiled his theory–immortalised as "Hubbert's Peak"–in 1956 and declared US oil production would hit its peak somewhere between 1965 and 1970 and subsequently steadily decline.

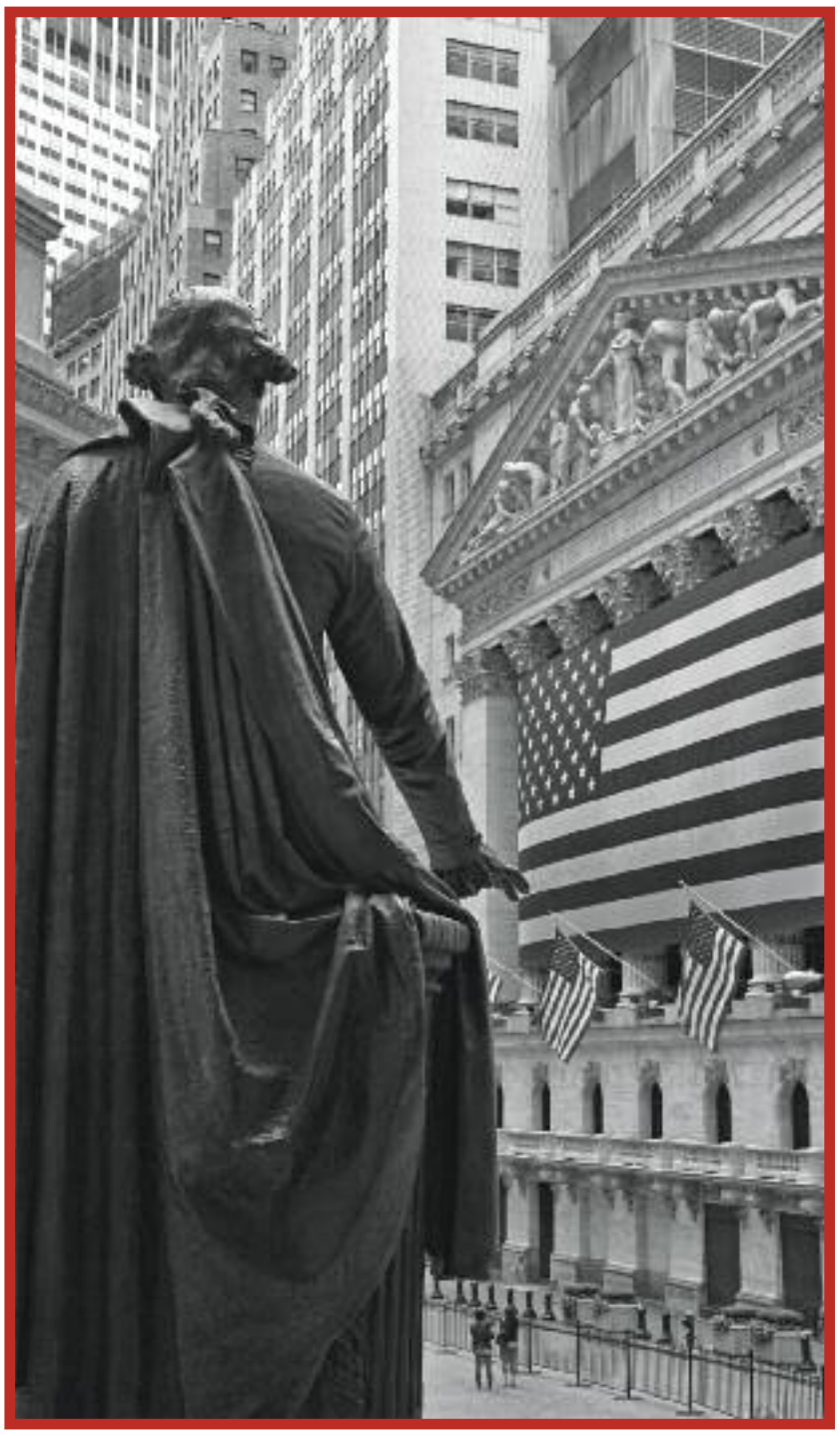
US oil production did hit a peak in 1970 and began to decline – temporarily at least – and the world was indeed shaken by the 1973 oil embargo. Hubbert seemed to be right. But as Yergin points out, Hubbert's theory insisted that price did not matter and that the basic economic laws of supply and demand did not apply to the finite physical amount of oil in the earth. Yet it seemed obvious to others that if supply diminishes faster than demand, prices will rise (as they have) and induce more supply or alternatives (as they have also done). Hubbert's disciples now seem to have been wrong on the geology too. They did not anticipate the revolutionary impact of combining directional drilling and hydraulic fracturing to release vast amounts of hydrocarbons - natural gas, crude oil, and natural gas liquids – from Devonian shale formations.

Of course, it's possible that technological advancements and the law of supply and demand have only delayed the inevitable, and oil Peakers continue to insist that the supply peak will inevitably arrive at some time or other (the latest prediction is of a significant risk of a peak by 2020). But a new challenge to their case has arisen, offering a compelling and utopian message that the world is fast reaching a point of peak oil *demand* rather than supply with demand and consumption peaking before the decline of supply and production. Paraphrasing Peak Oil doomsters, "Global Oil Demand Growth – The End Is Nigh" is the ironic title of a (add year) report by Citi bank energy analysts that has sparked the latest controversy and led to a string of reports, articles and heated exchanges on the internet aether.

IS THE END NIGH?

The new theory argues the push to substitute gas for oil–accelerated by the US shale revolution–and improvements in fuel economy, not to mention the ramp-up in US ethane-based petrochemical capacity, alternate energy sources such as nuclear, wind and solar power, and a decline or at least a flattening of oil consumption in the older industrialised countries will all contribute to reduce the world's thirst for oil, with demand →

WALL STREET. If oil prices should suffer an excessive fall, production from unconventional sources would come to a halt. If, on the other hand, they were to increase out of all proportion, this would cause irreparable damage to the global economy.



peaking at around 92mbd in a few years from the current level of around 89mbd. Although this forecast of peaking demand at 92mbd goes against the conventional wisdom that demand for oil will keep growing (BP forecasts that it will grow to around 104mbd by 2030), even if consumption keeps increasing, there will be plenty of oil around to satisfy this demand as a result of the new technologies being used to extract crude from difficult sources such as the tar sands of Alberta to the shale formations in North Dakota. The International Energy Agency forecasts in its latest report that "US shale will help meet most of the world's new oil needs in the next five years, even if demand rises from a pick-up in the global economy." So even without adding to the equation the possible decline in demand, concern about a looming global hydrocarbon shortage is increasingly being replaced by focus on the implications of a potential global hydrocarbon surplus.

> The oil age will not end because the world runs out of oil, but rather because it will move on to more economically efficient technologies and alternate resources

Does this therefore imply that we can all sit back and relax and sleep tight at night in the knowledge that there is no genuine shortage of oil and fossil fuels? If and when such a shortage appears at some point in the distant future–after all oil resources by definition are finite–is it likely that other better alternatives will have replaced oil to cater for the bulk of the world's energy needs making the transition from oil to alternatives virtually automatic? The old stone age aphorism will then have held true.

Peak demand is an appealing theory, but in fact it offers little reason for complacency, for it is, is in fact, just another way of defining peak oil. The economic logic is straightforward. Falling production of conventional so-called "cheap" oil and increasing reliance on oil extracted from expensive new sources such as tar sands, tight oil, and deepwater wells not to mention Arctic drilling have led prices rise to as much as $110 per barrel to make it viable. In turn, high prices are driving demand down. If prices drop too much as a result of falling demand, production from these new sources will dry up, but if they go too high they will crush the global economy.

In any event, Peak oil has never been about the world running out of oil. It refers to the production rate of oil. In the case of conventional oil production, most industry analysts concur that the peak occurred in 2004/2005 and that oil output has been on a bumpy plateau ever since. Since 2005, global oil production has fluctuated from a low of 82mbd in 2005 and 2009 to a high of 87mbd in 2012. In the same way, world demand has also fluctuated up, flat or down and, according to Dr Robert Hirsch a leading industry expert, it will almost certainly have little impact on the date of the onset of decline in world oil production.

THE HIRSCH REPORT

Dr Hirsch was responsible for producing an influential study for the US Department of Energy in 2005 entitled "Peaking of world oil production: impacts, mitigation and risk management" which has since been dubbed the Hirsch Report. Hirsch examined three scenarios: one where no steps are taken to offset a peak until the peak occurs; one where steps to mitigate a crisis are taken 10 years before the peak; and one where mitigation is put into practice 20 years before the peak. The report concluded that mitigation – or taking steps to both expand supply through the introduction of alternative liquid fuels as well as decrease demand by increasing fuel efficiency – 20 years before peak would help the world make a smooth transition to other fuels, minimising the economic and sociopolitical consequences when the peak in oil production occurs.

Hirsch acknowledges today that he, like a number of other advocates of peak oil, could be overly pessimistic in estimating a rapid decline in world oil production. But he is firm in his conviction that world oil production decline is inevitable. In a presentation earlier this year at a Peak Oil conference in Qatar attended by Gulf producing states increasingly concerned by this issue, Hirsch argued that a small change in world oil production would have minimal impact on overall behaviour. The difference a million barrels per day production increase or decrease might have over a three year period on the date of the onset of world oil production decline would be a matter of weeks. The implication is that a few million barrels of US tight oil would have a minimal impact on the onset of world oil decline.

Declining oil production can also occur in any given year for several reasons unrelated to peak production. These include OPEC production decisions, unplanned field stoppages, geopolitical events, changes in oil industry investment strategies, and

above all prices. The outgoing chief executive of Shell, Peter Voser, for example recently said that his biggest regret was Shell's $24bn bet in unconventional oil and gas in North America. In the Caspian, the flagship Kashagan field has now been nicknamed "Kash-all-gone" as costs have tripled to $46bn taking the shine off the Caspian for many western international oil companies.

THE TIMING

It is also arguable whether global consumption of oil will decline any day soon. Demand will continue to be dictated by global economic growth, especially in the emerging regions which are offsetting flat or lower demand in the mature OECD area. The world is moving towards greater fuel efficiency but this too will take much longer than the most optimistic pundits suggest given the scale, cost and time it takes to convert the existing fleets of older cars and vans.

The IEA notes a combination of sustained high prices and energy policies aimed at greater end use efficiency and diversification in energy supplies might actually mean that peak oil demand ultimately occurs before the resource base is anything like exhausted. But one should also not forget that there is a basic difference between reserves and production. An abundance of reserves is all very well. The world, however, does not live on reserves. It lives on production which is the rate of reserves drawdown and this is somewhat dependent on oil prices, which will have to remain high to allow production from the deep offshore and from tight shale rocks to compensate for the decline in conventional oil that has already happened. If oil prices keep moving up, they will eventually strangle economic growth. If they fall too much before the eventual transition to a renewable energy future is made, the peak and subsequent decline in production will occur sooner than later and inevitably induce a decline in consumption. Peak oil production and demand are all one and the same problem.

An abundance of reserves is all very well. The world, however, does not live on reserves but on production, which is the rate of reserves drawdown, depending on oil prices

Paul Betts has worked for the *Financial Times* for the last 36 years, including 28 years as the paper's foreign correspondent in Rome, Paris, New York and Milan. He is currently based in London.

Will shale gas have a role in foreign policy?

Rising instability in some oil-producing countries could mean unprecedented challenges for Washington. The future may see conflict over shale gas's environmental impact or disruption of the existing political order

by MOISÉS NAÍM

What do the fall of the Shah of Iran, the collapse of the Soviet Union, the Internet, China's economic ascent, Europe's crash and the U.S. energy boom have in common?

No one saw them coming. All these events changed the world and no government, company or expert anticipated them or their many—and momentous—consequences.

With this sobering observation in mind, the only prudent prediction about the consequences of the United States' energy boom is that they are going to be as enormous and as surprising. Nonetheless, some repercussions of the U.S. energy resurgence are already evident.

Even if it never becomes a net exporter, the fact that the U.S., which is the world's largest oil consumer (and until a few years ago, it's top importer) is poised to become increasingly self-sufficient will create both new foreign policy options to its government as well as new sources of geopolitical instability.

WILL SHALE GAS EXTRACTED FROM THE U.S. MIDWEST CHANGE THE MIDDLE EAST?

The Middle East will be one of the first regions directly affected by America's new energy situation. While Saudi Arabia and other Middle East producers will continue to be important players in the global energy market, their dominance, enjoyed for most of the past century, will no longer be the central feature of this market. The implications of this trend are enormous, ranging from the military to the commercial and perhaps even the social. As the supply of oil and gas coming from a variety of sources increases, prices will face downward pressures. Middle East producers are thus likely to face dwindling export revenues, which will

IT'S UP TO OIL
United States diplomacy will be strongly influenced by the boom in production of hydrocarbons that the country is experiencing. The photo shows the President of the United States Barack Obama and the Secretary of State John Kerry, during a recent visit to Boston.

naturally constrain what they can do at home and abroad. Fiscal adjustment and other belt-tightening measures that have never been needed will become necessary. And, as we have seen everywhere else, governments forced to impose fiscal adjustment inevitably face popular discontent. Domestic political instability among Middle East oil exporters can in turn trigger changes in their foreign policies, which may in turn trigger changes in U.S. policy. It is unclear, for example, what belt-adjusting measures will do to the financial support that Arab oil exporters give to militant groups and allies in Pakistan, Afghanistan, Malaysia and other countries with large Muslim populations. Or the consequences for their behavior towards regional rivals like Iran, a country poised to launch a major expansion of its own oil production if international sanctions are lifted.

As the geopolitics of energy change, so will the web of international alliances of oil-producing countries in the Middle East. For example, it's distinctly possible that they may seek closer alliances with Russia and distance themselves from traditional allies like the United States. And a United States that is no longer critically dependent on energy imports from the Middle East will be able to recalibrate its role as the provider of the military umbrella that ensures the safe passage in the sea lanes through which middle eastern oil reaches global markets. Ensuring that the Suez Canal or the Strait of Ormuz are open and safe to pass will continue to be an American priority, although not as much as it was at the height of U.S. dependence on Middle Eastern oil. Analyst Nikolas K. Gvosdev argues that America's newfound energy capacity means that "a robust U.S. military presence abroad will no longer be seen as essential for prosperity at home… the Carter Doctrine and the Reagan Corollary, which commit the United States to defend the countries of the Persian Gulf against outside aggression and internal subversion because this region and its energy resources are deemed invaluable to U.S. interests, [could] go the way of other now-irrelevant U.S. foreign policy doctrines."

The consequences of the shale gas revolution on the Middle East are as varied and enormous as they are hard to anticipate with precision.

TOWARDS A NORTH AMERICAN ENERGY BLOCK?

Energy resources in North America are already massive and growing. The U.S., Canada and Mexico have about 1.8 trillion barrels of probable, recoverable oil reserves and 346 trillion cubic feet of proven gas reserves. Texas shale gas deposits are now known to extend into Mexico, which holds the world's fourth largest reserves of shale gas. All this will naturally boost that country's role as an energy player. These resources are complemented with significant coal reserves and a growing non-renewable energy inventory that is making North America essentially self-sufficient in energy.

The International Energy Agency, IEA, calls such gains "revolutionary." According to their 2013 Medium Term Oil Market report, "The North American hydrocarbon revolution continues to dominate the supply outlook…. North American oil production will increase almost by 4 million barrels per day during the period 2013-2018, more than half of the increase predicted for non-OPEC countries." In parallel, oil imports into North America will diminish from about 6 million barrels per day in 2012 to some 3.5 million barrels per day in 2018, while intra-continental oil and gas movements will intensify.

All this points to the consolidation of a self-contained North American Energy Block. This will have major geopolitical impact just by virtue of the block's decreasing dependence on hydrocarbons imports. If the region becomes a net hydrocarbons exporter, the impact would be much greater.

These changes are bound to spark major revisions of the foreign policy of the United States. A prime candidate for such a revision is Mexico. U.S. policy towards its southern neighbor has always been driven by two key issues: immigration and drugs, and, to a lesser degree, trade (as a result of NAFTA, the free trade agreement between the U.S., Canada and Mexico). Moreover, Mexico's planned reforms of its outdated energy policy suggest that the country can regain the energy luster it has gradually lost in the last several decades. This, combined with the changes in the energy outlook of the U.S. and Canada, will create a very dynamic "energy zone" that gives Mexico a renewed importance in the calculations of U.S. foreign policy makers.

MORE ENERGY SECURITY FOR EUROPE

The cornerstone of the U.S. foreign policy regarding European energy security has been the promotion of gas pipelines from the Caspian and Central Asia regions to Europe, such as TANAP, TAP and Nabucco, in an effort to minimize European dependence on Russian gas. These efforts have been positive but, in the best of cases, expensive, time consuming and plagued by thorny political complications. Recently the U.S. 113th Congress has introduced bills aimed at facilitating access to U.S. liquefied natural gas (LNG) to all members of the North Atlantic Treaty Organization (NATO). The U.S. hope is that this move will give Europe a greater degree of energy security by undermining Russia's energy choke on several European nations. In any case, the decrease in oil imports by the U.S. is already freeing significant volumes of hydrocarbons that are giving Europe more options than had only a few years ago.

ACCESS TO TECHNOLOGY AND THE U.S. DEALINGS WITH CHINA

Shale gas accounts for almost 40 percent of total natural gas production in the U.S. In China, which lacks leading edge technology, shale gas production represents less than 1 percent. But China holds the largest resources of shale gas in the planet, with estimated reserves of about 1,115 trillion cubic feet, almost twice as large as U.S. reserves. Speeding up the development of these resources is obviously a priority for China. Al- →

Global consequences

Ernest Moniz, U.S. Secretary of Energy

We are seeing the consolidation of a NORTH AMERICAN ENERGY BLOCK comprising the United States, Canada and Mexico, which will become less and less dependent on hydrocarbons imports

Nicolás Maduro, President of Venezuela

Technology in shale gas development and non-renewable sources of energy can be instrumental in strengthening U.S. PRESENCE IN LATIN AMERICA

Abdullah bin Abdul Aziz, King of Saudi Arabia

One of the regions more directly affected by a new energy situation in the United States is the MIDDLE EAST, WHICH COULD FACE military, commercial and social CONSEQUENCES

Vladimir Putin, President of the Russian Federation

The decrease in U.S. oil imports is freeing significant volumes of hydrocarbons, which could MINIMIZE EUROPEAN DEPENDENCE ON RUSSIAN GAS

Xi Jinping, President of China

Access to U.S.-owned shale gas technology is bound to be A LEVER THAT WASHINGTON WILL USE in its interactions WITH BEIJING

though American shale gas technology is not controlled by the government and Chinese energy producers can buy it directly from its private owners, the U.S. government is unlikely to be a passive observer of this technology transfer process. Access to U.S.-owned shale gas technology is bound to be a lever that Washington will use in its multiple interactions with Beijing.

IS SHALE GAS THE FINAL NAIL IN OPEC'S COFFIN?

The important cut in U.S. oil imports from OPEC countries will erode the geopolitical clout of the organization. OPEC oil that no longer goes to the U.S. would have to be marketed elsewhere, most likely in the spot market. The International Energy Agency estimates that global oil production capacity will grow to 102 million barrels a day by 2017, a volume well above demand forecasts of 95.7 million barrels a day. Such an excess production will tend to weaken oil prices in the medium term.

The cartel's ability to affect prices had already been dwindling, as had its power to impose production discipline on its members—especially those whose economic needs make them hungry for additional oil revenues. For years, OPEC has not been high on the list of America's diplomatic priorities. U.S. shale gas is likely to push OPEC even further down that list.

PROTESTS IN PRODUCER COUNTRIES?

Oil producing countries with large populations or poorly managed national finances are especially vulnerable to declining oil prices and loss of markets. Some of these countries, such as Iran, Iraq, Libya and Venezuela, require oil prices to be over $100 per barrel to satisfy their financial needs. If prices fell below that level, they could experience significant political and social unrest. It's quite possible that America's. increasing energy self-sufficiency could trigger dangerous instability in these countries; the United States ignores this possibility at its own peril.

A MORE ASSERTIVE U.S. ROLE IN LATIN AMERICA

Years of deemphasizing diplomatic efforts toward Latin America have weakened U.S. presence in that region, a void that in some countries has been filled by populist, strident-anti-American leaders and by an unprecedented presence of China. U.S. technology in shale gas development and non-renewable sources of energy can be instrumental in strengthening U.S. presence in countries such as Argentina, where significant shale gas resources exist, and in Central American and Caribbean nations that lack hydrocarbons resources. This has the potential to erode Venezuela's (and, through it, Cuba's) influence in those countries.

CONCLUSION

The U.S. energy boom will not only impact domestic political and economic conditions but will also change America's foreign policy. In some of the areas, discussed here, the policy shift will be quite dramatic.While most of the impact is likely to be positive for the United States, the risks of increasing instability in some oil producing countries will also present unprecedented challenges to Washington.

Moreover, as shale gas exploration and production reach the substantial levels now predicted, it seems almost inevitable that conflicts related to its environmental impact or to its disruption of existing political equilibria will arise. It is impossible to anticipate the exact nature, location and timing of these conflicts. But what is safe to assume is that the shale gas revolution will spark surprising changes in the domestic politics and the international relations of many countries.

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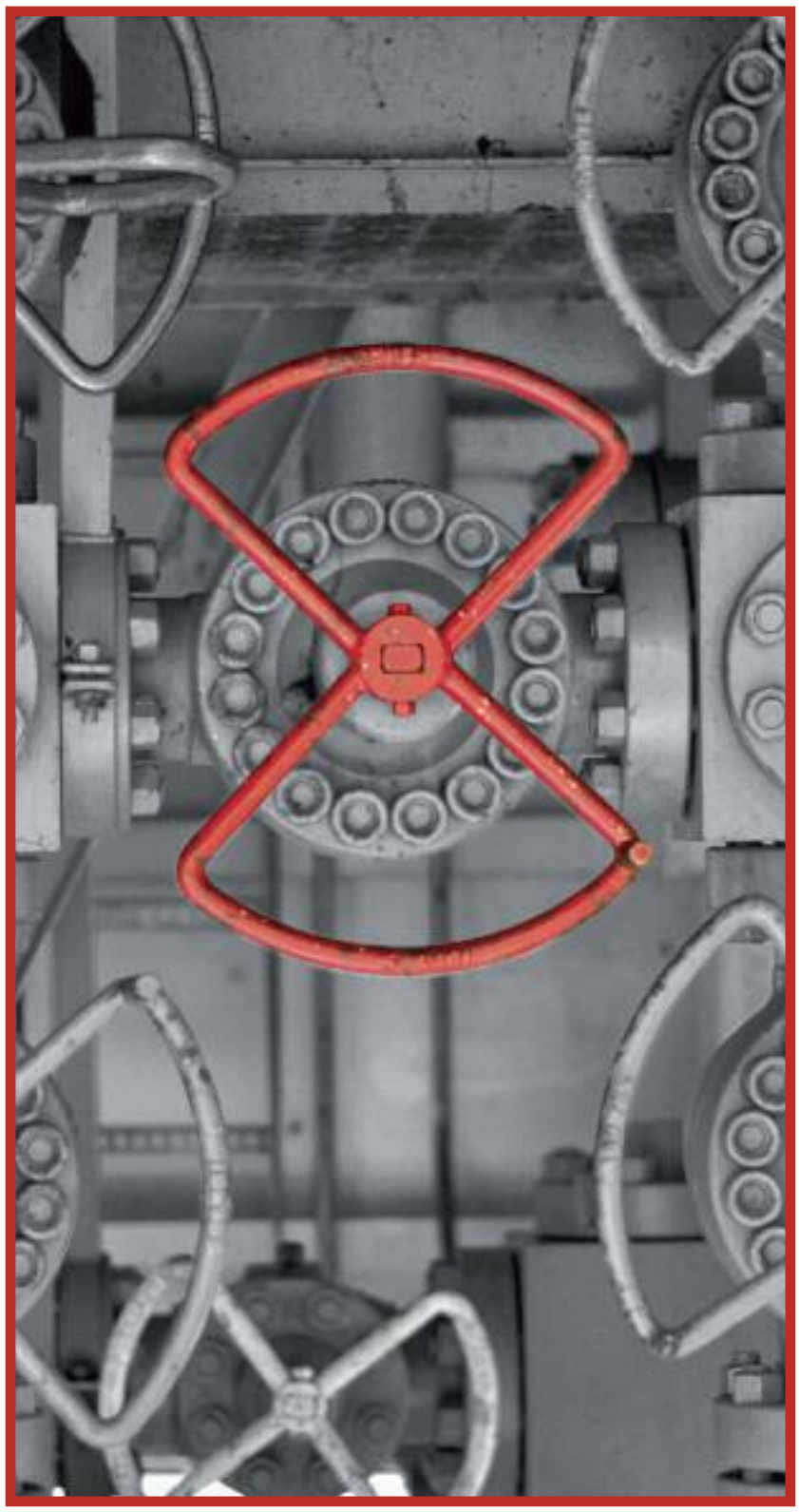
Moisés Naím is a member of the editorial board of OIL. He is a Senior Associate at the Carnegie Endowment in Washington DC, and recently published *The End of Power: From Boardrooms to Battlefields and Churches to States why Being in Charge isn't What it Used to Be* (Basic Books; 2013).

Analysis/The views of Adam Sieminski, Administrator of the EIA

Prices and technology will be key

The next big advance is going to be determining, ahead of time, which parts of a horizontal well are likely to produce the most oil or the most gas. The EIA expects energy use to rise by 56 percent by 2040



by MOLLY MOORE

Oil demand is determined by a number of variables whose future paths are difficult to predict. Prices and technology are the key factors, but population growth, economic performance and consumer behavior are also essential elements in any theory of energy consumption (and production) trends. That is why Adam Sieminsky, Administrator of the United States Energy Information Administration (EIA), the White House's main energy analyst, is ready to dismiss any theories on peak oil demand or supply out of hand. Just 30 years ago, nobody could have predicted the unconventional resource revolution, which has transformed the global energy landscape. Looking forward, it's difficult to predict whether we'll see a similar degree of technological innovation, even if hydrocarbon prices stay relatively high.

Do you subscribe to the theory of peak oil demand?

Did I ever subscribe to the theory of peak oil supply? And the answer to that is no. And let me just explain that a little bit, then we'll talk about demand. Peak oil supply was based on three critical assumptions. The first one was that you know what the resource base is. And then the second and third were that prices don't matter and technology doesn't matter. And I was a firm believer in – prices do matter, technology does matter and that the resource base is dependent on prices and technology. And peak oil supply people will tell you, "No, it's not." They know exactly how much oil is in the ground.

I think what we've learned with shale oil and gas, shale gas and tight oil, is that we're still learning how much is in the ground. So, now, so do I subscribe to peak demand? So, what drives demand? And do prices and technology matter to demand? Absolutely. And what else drives demand and population and the economy and behavior? So, I might subscribe to that theory if I knew what it was. If you want to simplify it and you want to say, "Well, the theory of peak oil demand is that we will run out of demand before we run out of supply." Tell me what this theory is.

Well, that's the controversy, isn't it? There are some who say, "Well, okay, we're going to reach a point where either we run out of oil," or "We reach a point where, no, we're not going to ever reach the point where it runs out, our demand will run out first."

Right, I think probably in the popular literature it's that we're going to run out of demand before we run out of supply. In some very simple sense, you might say "Well, of course. We ran out of demand for horseshoes before we ran out of supply."

What do you see as the most dramatic changes and trends in energy production in the coming decades?

On energy production, the most important thing that's happened in the recent past is the ability to produce both gas and oil from continuous resources. It's really source rock. And 30 years ago, nobody thought that that would ever be possible, 20 years ago George Mitchell thought maybe he could do a little bit of it, 10 years ago it started to look really interesting, and 5 years ago it did get interesting in a big way.

And where do you see it going?

In our Annual Energy Outlook we're saying that by 2040, half of the natural gas produced in the U.S.–and there'll be more produced in 2040 than now–is going to be coming from shale. On the oil side, what we said in the 2013 Annual Energy Outlook was that production of all oil that's being driven by shale at the margin–tight oil–would go up early in the next decade and then it would start to come back down and would taper down and level off.

ADAM SIEMINSKI
Adam Sieminski is Administrator of the U.S. Energy Information Administration (EIA), which is responsible for collecting, analyzing and disseminating independent energy information to promote sound policy-making, efficient markets and public understanding of energy and its interaction with the economy and the environment. Sieminski was named agency head in 2012. He previously served as senior director for energy and environment on the staff of the National Security Council, chief energy economist for Deutsche Bank and served as president of the National Association of Petroleum Investment Analysts.

Our forecasts in the 2013 Annual Energy Outlook are already behind the short-term energy outlook by a lot. The 2014 Annual Energy Outlook is going to have a lot more oil production in it. Why? Well because it's already been added to the short-term energy outlook.

And why has it surged?

Well it's surging because–and now we're back to prices and technology–oil prices have stayed very high, and the technology continues to improve, and the combination of prices and technology and the application of that technology has dramatically grown oil output beyond what we thought was possible. So we published the Annual Energy Outlook in December of 2013, the reference case that was based on data that was really coming to us in the spring of 2012. And by the first quarter 2013, we already had surpassed what we thought could happen in the short run, and so we adjusted our short term numbers upward.

And looking at what the industry is doing and including our drilling productivity report, we can see first-hand what's going on and the answer–similar to natural gas–there are decline curves. But if you drill enough new wells and if both the productivity of the wells and the productivity of the rigs is continuing to improve, you more than offset the declines, and production can rise, and production's still rising.

And is the production limitless?

Well, very few things are limitless. We do know that oil molecules are bigger than natural gas molecules, and squeezing oil molecules through the fractures and the resource base is harder for oil than it is for gas. Right now, in the U.S., it looks like the oil-prone areas are not as prolific as the natural gas-prone areas, but we're still learning. And it looks to me, the learning curve on oil is 5 years behind the learning curve on natural gas. So, is the learning curve for oil going to improve? Will the industry figure out ways to deal with the molecular size issue, making bigger fractures? It's possible that they could do that, in which case, the numbers could continue to improve.

So what's the next tight oil? What's the next big, huge technological advance or discovery?

Well, I think that this is one that has both cost and environmental implications that are very positive. I suspect that the next big advance is going to be determining ahead of time which parts of a horizontal well are likely to produce the most oil or the most gas. And then rather than fracturing the entire horizontal portion of the wellbore, which is what industry is doing now. If you were to say–make up some numbers–if there were 10 stages across a mile-long lateral, so that would be 500 feet, let's just say, in a stage. It may be that half of those stages are producing 90 percent of the oil or the gas. So it would be really quite interesting if the industry could identify through seismic and other measuring technology, which of those stages to frack. Then you'd only frack 5 of them instead of 10. You'd leave the other 5 unfracked, and that would mean you'd be using less water, less chemicals. The truck's there 10 times, you only need them there 5 times. And your costs have gone down, and the amount of flow back water has been cut in half, and the amount of chemicals you're using has been cut in half, and the amount of production relative to the cost of getting at it has been dramatically improved. That's what I think's going to happen next.

And what do you think are going to be the most dramatic changes in the coming years in energy consumption and demand

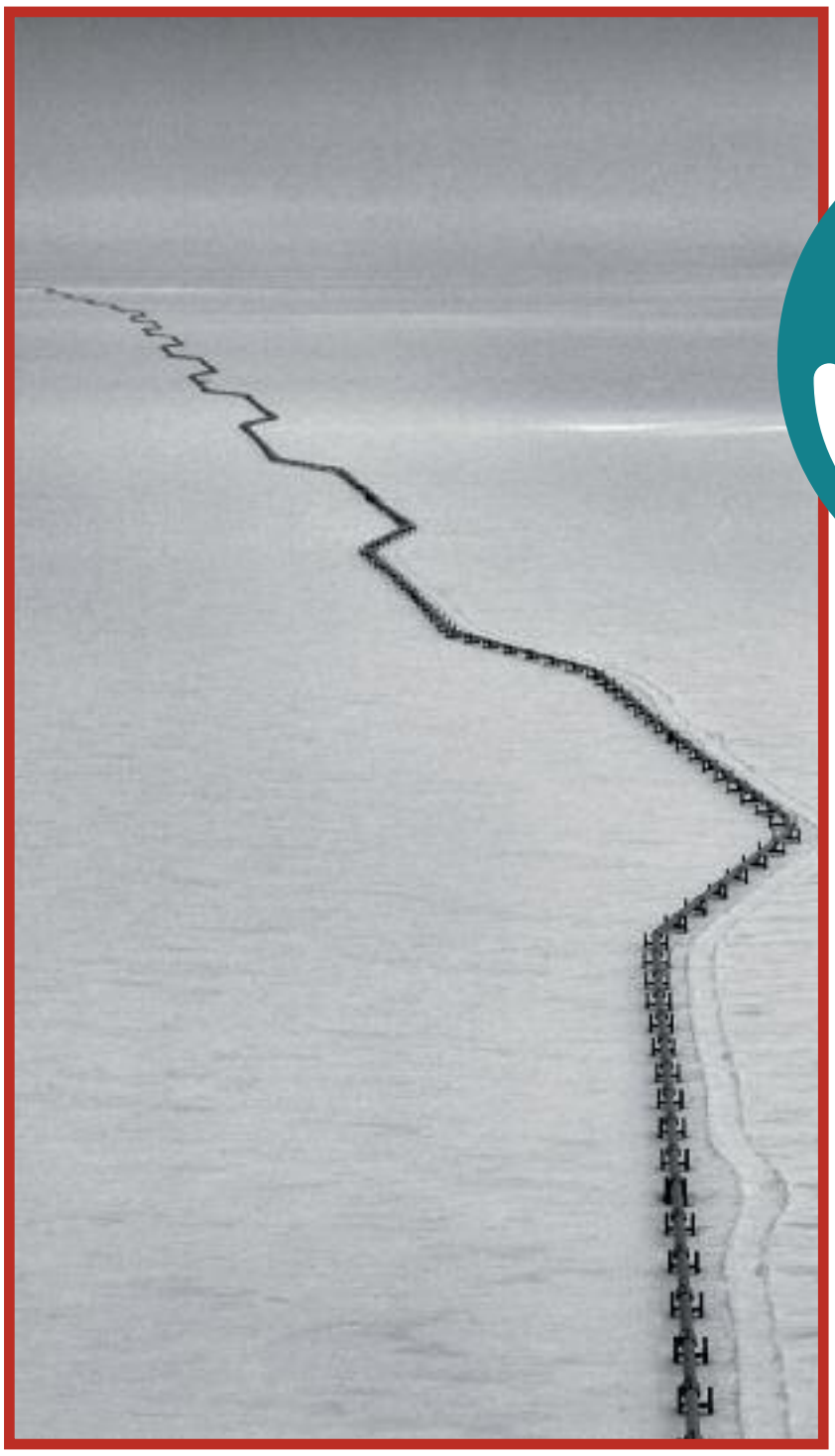
By 2040, half of U.S.-produced natural gas will be shale gas

from the consumer side of the market?

The biggest change is the one we're seeing already occurring, and that is that demand growth for energy in general is coming in the developing countries, not the developed world. So it's not the OECD countries where energy demand is growing. In fact, the odds are pretty good that energy demand in the developed world is going to be at best flat, probably going down as population isn't growing nearly as fast, or might even be shrinking in some of those countries, and technology of consumption like auto fuel efficiency standards is kicking in, and population growth and economic growth is still driving demand growth in places like Asia and the Middle East. In the Middle East, many energy fuels are being subsidized, oil certainly is, so the per capita consumption is rising, and the population is rising, and that adds to a lot of growth.

What do you think that does to the overall global balance? Is the growth there so much higher that it's going to outweigh the diminution in use in the developing world?

Well, in our International Energy Outlook, which we published this summer, we still have overall energy demand rising out to 2040, and the number is: GDP is rising globally at 3.6 percent per year, energy use under that economic assumption is up by 56 percent between 2010 and 2040, and of that 56 percent, about half of it is in 2 countries - just China and India. So with energy up 56 percent, then obviously the growth is offsetting efficiency gains produced in the OECD.



The United States will become a net exporter of natural gas around 2020

And what do you see in terms of energy production in places like China and India? Can the efforts in tight oil here translate?

Well China has a lot of resources. China has oil production, but in the last decade, China's imports of oil exceeded its production of oil. They're producing–call it roughly 4 million barrels a day. But they're now consuming 11 million barrels a day, and demand for oil in China is still continuing to go up, so the demand in general in Asia is rising significantly faster than production is rising.

There's a little bit of that actually happening in the Middle East, that the percentage growth in demand is surpassing the percentage growth in supply growth in the Middle East. EIA has not come to this conclusion, but there are a few people who've actually sat around with a certain set of assumptions. Saudi growth in energy consumption and petroleum has been so strong that what they have left over to export could potentially shrink.

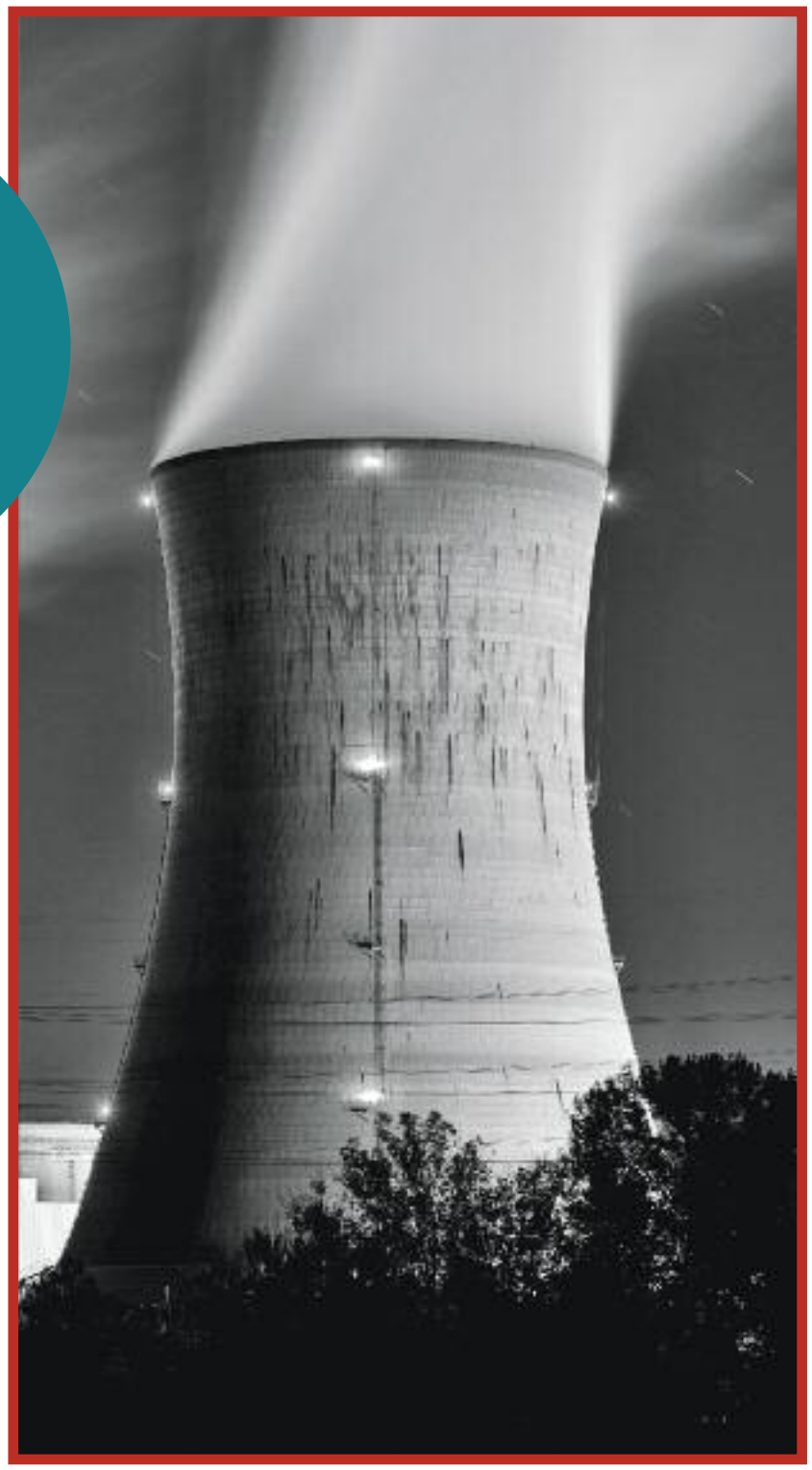
So how do you see that changing geopolitics?

Well, growth in oil production in the U.S. is already having an impact on geopolitics. The U.S. is now producing more than we're importing for oil. And, in fact, EIA has written, that's an internal cross for us, and if you just look at it externally, we are also now importing less oil than China is importing, so China's net imports for oil are now higher than U.S. oil imports. It's another cross that's interesting to look at in terms of its implications. The U.S. is already a net exporter of coal. We will be, in the EIA's projections, a net exporter of natural gas sometime around 2020. We are a net exporter of petroleum products like gasoline and diesel and so on. The only thing that we're not a net exporter of right now is crude oil. 2020 – that's still 6 years away for being a net exporter of natural gas, but the trends are in place in terms of LNG export facilities that are already under construction. So could we be a net exporter of oil in general? Or could the U.S. generate enough crude oil production growth to offset it? That depends on a combination of things. You can't do that calculation just on the production side alone, you have to look at what's happening on the demand side. What's the demand for petroleum products, and where is that going to come from? But in one of our side cases, which we call the no- or low-imports case, the U.S. potentially could become a net exporter of petroleum in general sometime after 2030. What would be required would be extended policies on demand, so the improvements in auto fuel efficiency have to continue. You need substitution of natural gas for gasoline and diesel fuel, particularly for diesel fuel in the long-haul trucking fleet and the diesel electric locomotive fleet. So you substitute LNG in there and that means you have less demand for diesel. You put that case together, so continuing auto fuel efficiency, substitution of LNG into traditional diesel fuel markets, you put some gains for natural gas into the heating oil markets in the Northeast, using Marcellus natural gas, for example. Combine all of that with a high-resource case for finding more shale oil and shale gas, and the U.S. could potentially be a net exporter of oil sometime after 2030.

Do wind and solar play any role?

Both in the U.S. and globally, yes. Renewable energy and nuclear power globally–that's looking at this thing across the world–are the fastest-growing energy sources. So they're →

Renewable energies and nuclear power are growing at a rate of about 2.5 percent worldwide



each going up by about 2.5 percent per year globally. In the U.S., renewables, including solar and wind, are also, I think, the fastest-growing of any of the individual fuels. Natural gas comes in pretty well, both globally and in the U.S. One of the interesting things is, on an international basis, coal is growing faster than petroleum consumption all the way out to roughly 2030 before it starts to slow down. The reason for that is coal use for electricity generation in China and India is expected to continue to rise pretty strongly.

Ten years ago would you have believed you'd be seeing the U.S. becoming a net exporter?

No, not in a million years would I have thought that the U.S. could potentially be a net exporter of oil. The U.S. has always been an exporter, we export to Canada, and we export to Mexico. But would we be a net exporter? This leads back to one of the interesting aspects of this whole phenomenon. A lot of the thinking about geopolitics and energy policy goes back to the 1970s and 1980s when the framework was: demand only goes up and supply only goes down. So, supply is harder and harder to find and demand just rises without ever pausing. And that framework, at least in the U.S., has been turned on its head. So now what we're getting in the U.S. is supply looks very robust, and demand is beginning to taper off.

Is the greatest contributor to that overall, technology? Just technologies you wouldn't have imagined 5 or 10 years ago?

I think on the production side, it's the technology of drilling and seismic technology and production technology has just been dramatically, dramatically improved. On the demand side, it's a combination of competing forces, let's say. On the one hand, improving efficiency in consumption. Among the most notable is the auto fuel efficiency gains. I think that you can also say that things like combustion efficiency for natural gas home heating has dramatically improved. But on the other side, you have urbanization, especially in the developing world. Urbanization in China and India and Latin America has produced rising incomes and the need for and desire of a huge portion of the world's population for energy, for lighting. There are still more than a billion people in the world who don't have electricity. They're going to get electricity, that's going to happen. Where's that electricity going to come from? How's it going to be supplied? How can it be done economically? How can it be done from an environmentally sound standpoint? How can it be done for those countries without compromising their own national security issues? It's something that's going to occupy policymakers for a good period of time.

So that urbanization and population growth is going to continue and we have demand for energy rising all the way through 2040. If you just look at what the UN has been saying, population continues to go up into 2050, -60, -70. It's not until the end of this century that most of the population models begin to show flattening and maybe decline.

Where does that leave the countries like India and China? Because here they are trying to catch up to where the U.S. was a few decades ago, but the populations are exponentially so much bigger than they were in the U.S., that even if they use a lot of the technology, are you looking at a huge imbalance out for the next 40 or 50 years?

You hardly ever get imbalances. You don't get shortages. You get changes in prices, and then changes in prices drive changes in behavior. The changes in behavior are that if gasoline prices go up, people prefer smaller cars, or more efficient cars. And refiners and producers look for ways to make more gasoline to balance it out. The other thing that – EIA does not forecast changes or abrupt improvements in technology, we don't forecast breakthroughs – but if you had a breakthrough in battery technology, you'd have a lot more electric vehicles. If you had a breakthrough in drilling technology, we might be able to lower the cost of drilling and get more fuel. If we had a breakthrough in how to capture carbon dioxide from using energy and sequester it, (he needs to finish sentence here). The Secretary of Energy recently attended
a big meeting that was held on what progress was being made on carbon capture and sequestration. There is some progress being made.

Southern Company has got a plant that they're working on that takes lignite, low-BTU coal, and turns it into natural gas and hydrogen that goes into turbines to make electricity. Something like 60 percent of the CO_2 is captured, and they're going to pipeline that to an oil field in the area and use that for enhanced oil recovery. So far it's been very expensive, but

Chinese output is around 4 million barrels per day, while consumption totals 11 million bpd

it's one of the first of its kind, so it's still a learning experience in many ways. But if doing things like that ultimately proves cost-effective, and I'm sure that technology and the application of it is going to get better as you do more of it, it becomes more assembly line rather than one-off. That could dramatically change things. China burns a tremendous amount of coal. A huge proportion of China's total energy is coming from coal, and if scientists and engineers can figure out ways to continue to use coal without having adverse impacts on climate and air quality, that would make a breakthrough difference, a dramatic difference. Should we say that that's not going to happen? That's probably–the need for it to happen–if necessity is the mother of invention, the necessity is here.

Who are the leaders in the technology race right now from where you sit?

Well, in shale, it's U.S. producers and service companies and so on. On other technologies, it's probably spread out a little bit more, with the Germans having done a tremendous amount of work in getting solar technology moving and wind, the Chinese have been doing a tremendous amount of wind technology and also, I think solar, too, in terms of the amount of solar panels being produced and wind turbines being built and sold.

And is your job getting more and more difficult with all of these rapid improvements?

Well, what's making our job harder is that–what I said earlier–is a huge proportion of the growth of energy demand is coming in the non-OECD countries where the statistical collection systems aren't nearly as sophisticated as those in countries like the United States and Europe and Japan, and as a consequence, the transparency on data is not as good as it ought to be. Some countries seem to treat energy statistics as state secrets, so getting more countries to believe in data transparency and the benefits associated with that to everybody is, I think, going to be a continuing struggle, but I'm hopeful that we're going to move in that direction. The International Energy Forum is doing a lot of work in that area, in the JODI–Joint Organization Data Initiative–effort and EIA is working with the IEA and others on that.

It must be an amazing time to be sitting in your chair right now.

Yes, it is–but I would imagine that there's probably some truth to that no matter what the date is that you put on it. Certainly watching this development in production in the U.S. has been very, very interesting. By the way, EIA is not a policy organization, but we have to inform policymakers.

I like to think about this as three big circles in a Venn diagram. One circle is the economy, and another circle is the environment, and another circle is energy security or national security. And for energy politics to really work, you've got to have something happening in all three of those places, you can't just have one or two. You can have a lot of production, but if you can't do it in an environmentally-sound way, that's not going to work. You can think about energy security and things that you would do because you have energy security, but you have to be cognizant of their environmental and economic costs. And those are the kinds of issues that policymakers, I think, always struggle with. That's why it's so hard to get agreements on these things because making all three of those key criteria work together is not often easy. EIA's job is to try to provide measurement on those issues, to try to provide some help to policymakers to figure out what are the underlying facts, so that's what we do. And doing that, I've always been excited by that kind of thing.

Are there any particular issues that you think foretell anything important coming up in the next few years?

The improvements in renewable energy in the U.S., efficiency improvements, and substitution of, in general, lower carbon-intensive energy for higher-carbon intensive energy has resulted in the U.S. having a pretty good track record over the past 10 years now, almost, on energy-related greenhouse gas emissions. That comes back to a combination of things, but the key things are the growth in renewables and the use of natural gas to generate electricity.

Of course, many scientists and environmentalists would say we need to go a lot further on those.

Right, well one of the things that we found in our International Energy Outlook was that with that growth in energy consumption–and a lot of it being coal–that carbon dioxide emissions globally are going to continue to go up, and so there's a huge need to look at that. Going beyond the issues of greenhouse gases and the impact on the climate, carbon dioxide emissions are a pretty good proxy for all kinds of air pollution issues. Looking at the growth in the developing world, in particular China, now some of these cities are looking much like U.S. cities in the late 1940s and early 1950s. The Chinese are going to want to have that fixed, and in general, I think that there are ways to do that, and I suspect we're going to move in that direction. ■

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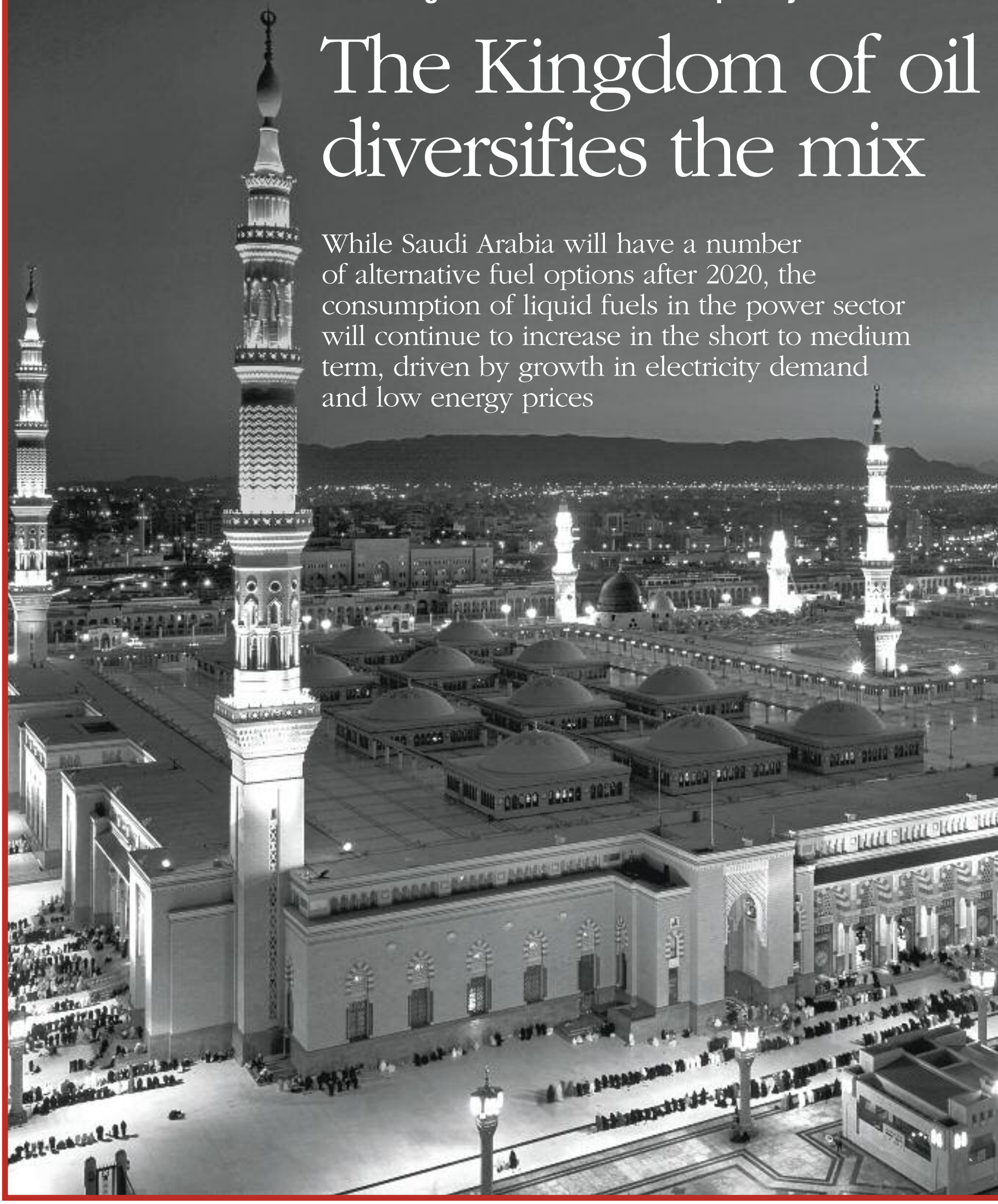
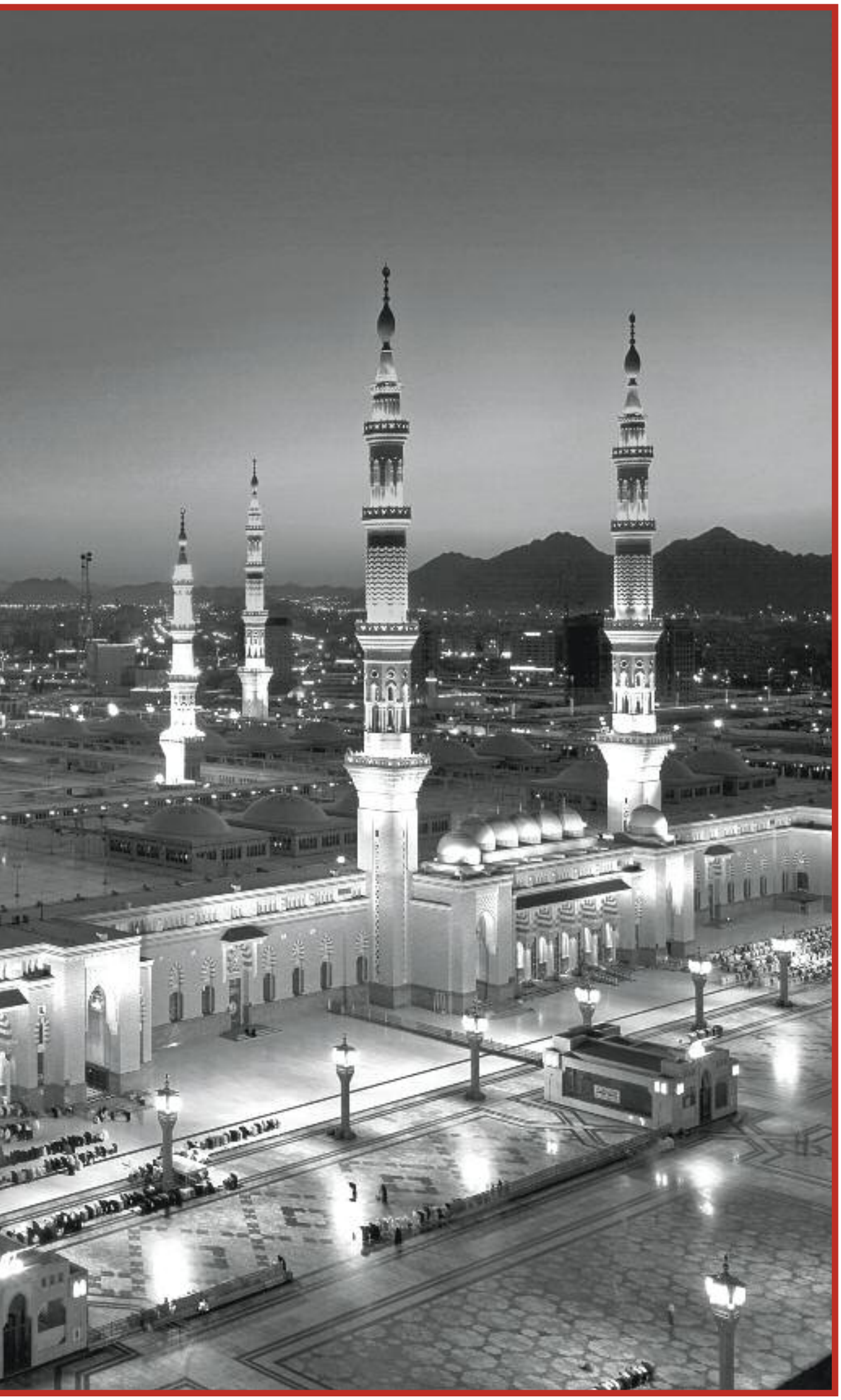
Molly Moore is a senior vice president of Sanderson Strategies Group, a Washington, D.C., media strategies firm, and a former *Washington Post* foreign correspondent.

Saudi Arabia/Summer demand swings reach a million barrels per day

The Kingdom of oil diversifies the mix

While Saudi Arabia will have a number of alternative fuel options after 2020, the consumption of liquid fuels in the power sector will continue to increase in the short to medium term, driven by growth in electricity demand and low energy prices





by BASSAM FATTOUH

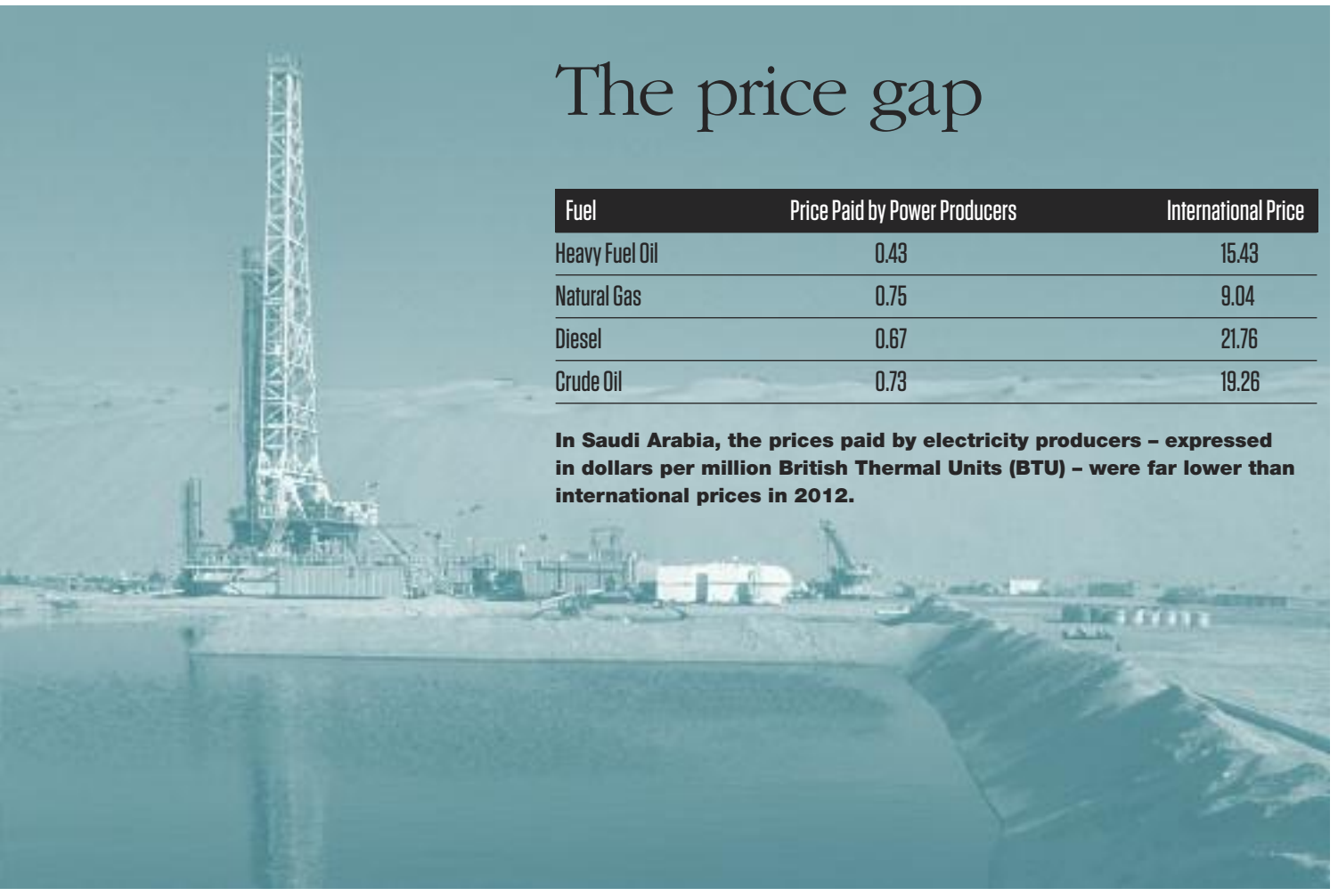
During the summer months, Saudi Arabia experiences sharp increases in oil demand. In 2011, the swing in demand from winter lows to summer highs was 750,000 b/d; a year later, it was close to 1 million b/d. In 2013, the rise was a more modest 440,000 b/d between May and July, with demand for gasoline, diesel, fuel oil and crude burn reaching 2.67 million b/d in July.

One of the key features in Saudi Arabia in the last decade has been the rapid increase in electricity demand driven by multiple factors such as rapidly expanding population, robust economic growth, improvements in standards of living, harsh weather conditions but also by a Saudi economic policy geared toward diversification into energy intensive industries and low energy pricing policy. Between 2003 and 2012, electricity sold (a proxy for electricity demand) increased from 128,629 million kWh to 240,288 million kWh, an increase of 78 percent. During the same period, the peak load increased from 31 GW in 2006 to 52 GW in 2012 and is projected to increase to 75 GW by 2020. The biggest consumer of electricity is the residential sector where in 2012 it consumed almost 50 percent of electricity generated in the Kingdom with around 70 percent of residential consumption attributed to air-conditioning.

SUBSIDIZED PRICES

Saudi consumers buy their electricity at highly subsidized prices, paying from 1.3 to 6.9 U.S. cents per kilowatt-hour depending on the type of end user, the consumption bracket, and the time of use. Recently, the government has embarked on gradual reform of electricity prices: where in 2010 electricity prices were revised upwards for the industrial, government and commercial sectors but not for the residential sector. Despite these increases, electricity prices in the Kingdom remain very low, even by regional standards.

The power sector in Saudi Arabia relies heavily on liquid fuels. In 2012, the shares of natural gas and crude oil for the Saudi Electricity Company (SEC) (the largest utility in the country that accounts for around 77 per cent of installed capacity), stood at 40 percent and 34 percent respectively followed by diesel (20 percent) and fuel oil (6 percent). The power sector obtains the various fuels at a fraction of prices in international markets as shown in Table 1 below. Despite the low cost paid for fuel, in →



The price gap

Fuel	Price Paid by Power Producers	International Price
Heavy Fuel Oil	0.43	15.43
Natural Gas	0.75	9.04
Diesel	0.67	21.76
Crude Oil	0.73	19.26

In Saudi Arabia, the prices paid by electricity producers – expressed in dollars per million British Thermal Units (BTU) – were far lower than international prices in 2012.

2012 the average cost of a unit of electricity in the Kingdom was higher than the average price collected from consumers by SEC. Originally, natural gas and/or combined cycle were expected to drive the capacity expansion in power generation. However, there was a change in policy in 2006 when the government issued a Royal Decree stating that the country's largest future power plants, which initially planned to rely on gas, would be fired by crude oil provided at a subsidized price. Therefore, the volume of gas consumed in power generation is expected to remain unchanged or increase marginally, keeping its share of the fuel mix in power generation relatively low. A big switch back to gas remains a possibility, but this shift will only materialize if large quantities of gas reserves are discovered and/or if Saudi Arabia starts importing natural gas.

REGIONAL DEMAND AND IMPLICATIONS FOR FUEL USE

The SEC divides the country into four regions: Central, Eastern, Western and Southern. While in the Eastern and Central regions natural gas is the dominant fuel for power generation, it is not used in the other two. Since most of the gas is produced and processed in the Eastern province of Saudi Arabia, the dominance of gas in the power sector of that region should not come as a surprise. This reflects the lack of adequate infrastructure capable of shifting natural gas from the production and processing centres (mainly in the Eastern region) to the Western and Southern regions. In order to meet the surges in electricity demand during summer time, the government is forced to increase its direct crude burn, especially in the months of July and August. The swings in crude burning can be very large. In 2012 the size of the swing between February and August was 476,000 b/d with crude burning reaching 779,000 b/d in August last year. The latest available data indicate that crude burn has reached 757,000 b/d in July 2013.

> The government is unlikely to change its domestic prices for oil and gas products any time soon and without a comprehensive reform of the electricity sector

SHORT-TERM OPTIONS

In the short term, Saudi Arabia has few options to deal with the challenge of reducing crude burn in the power sector:

- It can use fuel oil and diesel instead of crude oil (often imported during summer);
- It can accumulate oil stocks during periods when demand is low and use these stocks during period when demand is high;
- It can increase the use of gas in power generation to free more crude oil for exports. The last option has been strongly emphasized by Saudi officials.

Indeed, faced with rapid increase in gas demand by industry and the power sector, Saudi Aramco has been under pressure to develop its natural gas reserves. In the early 2000s, the Kingdom focused its efforts on development of the Empty Quarter. However, results were disappointing, and this has been replaced by the development of non-associated gas fields as exploration results in the Empty Quarter have proved to be disappointing so far. This represents a change in the Kingdom's gas strategy towards developing more complex, more challenging and more costly non-associated gas reserves, yet in a low gas price environment. Currently, the price of natural gas in Saudi Arabia is one of the lowest in the region ($0.75 per MMBTU) with the region itself having the lowest prices of natural gas in the world.

In 2012, Saudi Arabia's gas production (raw gas to gas plants) amounted to 10.72 bcf/d with a target of increasing production to 15.5 bcf/d by 2015. Assuming that Saudi Aramco meets its gas output target on time, will this reduce the size of the upswing in oil demand during summer in the next few years? The straightforward answer to this question is 'only a little'. First, the increase in gas production will not be able to meet the rapid increase in gas demand by the industrial and the power sector, even if targets are met. Second, the main gas discoveries are located in the Gulf and thus can feed into the power plants in the Eastern and Central regions, where natural gas is already a large component of the fuel mix. Extra gas could replace oil in some power plants in these regions, but only up to a certain point, as there are technical barriers substitution in plants that use crude. Furthermore, due to the infrastructure constraints noted above, these new fields can't feed into the power plants in the Western and Southern regions that need them most. Until large quantities of gas are found, the Saudi government is unlikely to build the required infrastructure, especially as much of the produced gas can be utilised within the Eastern region.

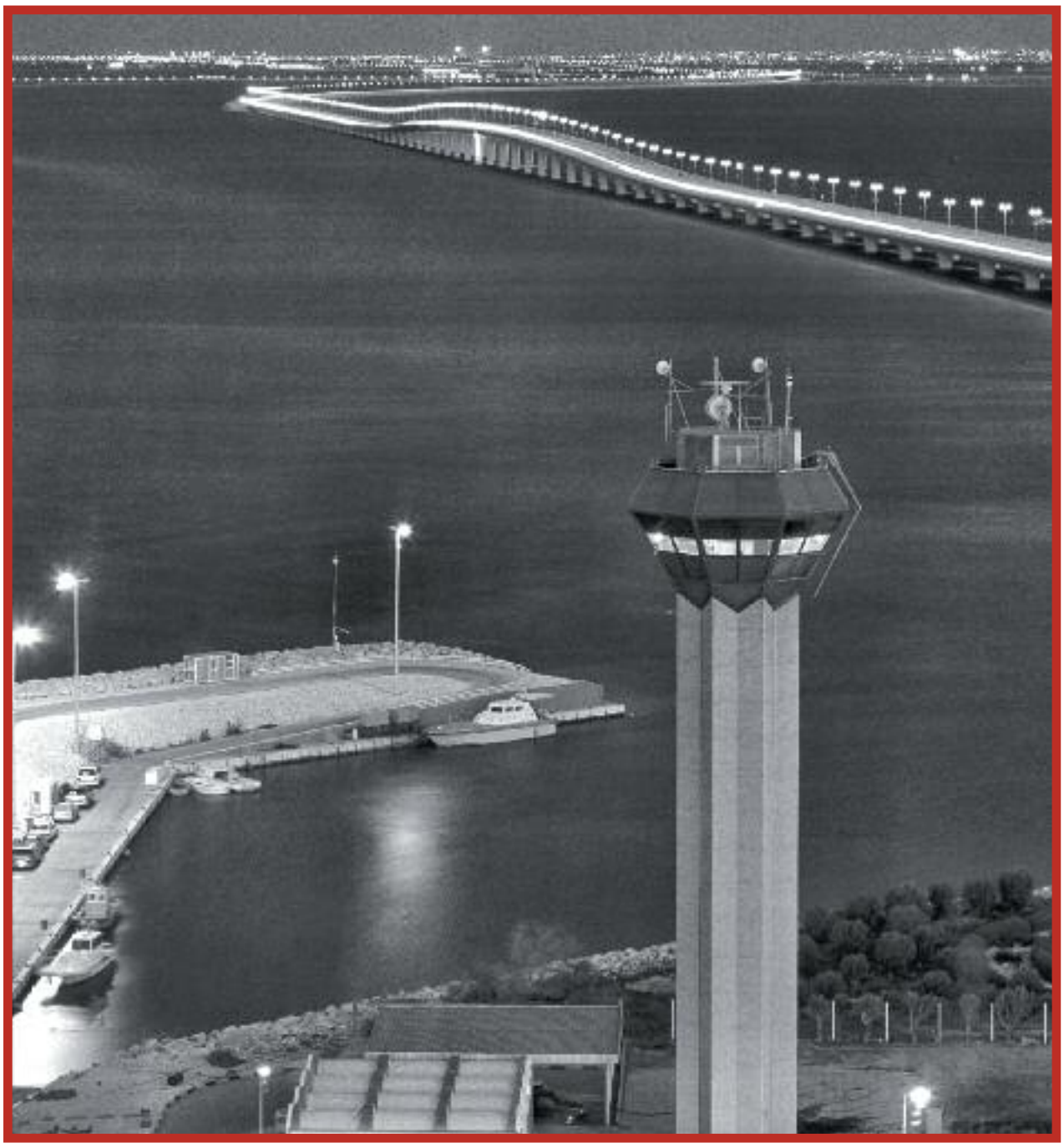
One potential source of gas supply to power plants in gas-starved regions is the Midyan field on the Northern Red Sea. There are already plans to develop new gas discoveries in this region for power generation in the northwestern part of Saudi Arabia, which currently uses oil and diesel. But the amount of gas is too small to change the dynamics in any significant way.

The other option is to rely on fuel oil and diesel, which are often imported during summer. To help meet the rapid increase in domestic demand, Saudi Arabia has invested heavily in expanding its refining capacity. Saudi Aramco is pushing ahead with three new refineries each of which is planned to have a capacity of 400,000 b/d. When these refineries come online between 2013 and 2016, this would give Saudi Aramco more flexibility to use more fuel oil and diesel in power generation reducing the reliance on direct crude burn.

Thus, although Saudi Arabia may make a conscious effort to limit the upswing in domestic crude burn, various oil products, be they diesel or fuel oil, will remain key in meeting the country's power demand needs for the foreseeable future.

MEDIUM-TERM OPTIONS ARE MORE FLEXIBLE

Currently, Saudi Arabia is pursuing a three-track strategy: change the energy mix in the power sector, improve efficiency of electricity generation and reduce demand at the consumer end by improving energy efficiency. Saudi Arabia is also pressing ahead with its ambitious plans to develop nuclear



KING FAHAD CAUSEWAY
The border station between Saudi Arabia and Bahrain and the King Fahad Causeway, a system of bridges and causeways connecting the two countries, built between 1981 and 1986.

power to meet rising electricity demand and save oil for export. The Kingdom has plans to build 16 nuclear reactors over the next 20 years, spending an estimated $7 billion on each plant to provide one-fifth of the country's electricity for industrial and residential use and for desalinisation of seawater. The government has also plans to generate some electricity from solar and is also considering wind, waste and geothermal energy sources as it seeks to reduce reliance on oil and gas. The Kingdom has a $109bn investment plan to create a solar industry that would generate a third of the country's electricity by 2032.

Saudi Arabia may also consider importing LNG, which would provide the Kingdom with the much-needed flexibility without heavy investment in gas processing plants and pipeline infrastructure (although the Kingdom will have to invest in regasification capacity). This however poses challenges, as this will create a large wedge between the price of gas sold in the domestic market and the price of gas imported from international markets.

There is also scope to improve efficiency in power generation. The efficiency of the Saudi power sector compared to other parts of the world is quite low and falls well below the world's average implying that there is a scope for large improvements in efficiency in the power sector. The Kingdom has already put in place a programme to phase out old power plants and introduce more efficient ones. This could also alter domestic demand dynamics, though there are doubts of whether this programme could be effectively implemented without a more rational pricing policy.

One route the Saudis are unlikely to take is that of adjusting the price of natural gas, petroleum products and electricity prices to reflect the true cost of these resources, which would help to rationalise demand and slow energy demand growth. In light of the Arab spring, the idea of price adjustments that would entail higher costs for basic services such as water and electricity as well as more general inflation are simply not politically appealing.

> Saudi Arabia has a 109 billion dollars investment plan to create a solar industry that would generate a third of the country's electricity by 2032

CONCLUSION

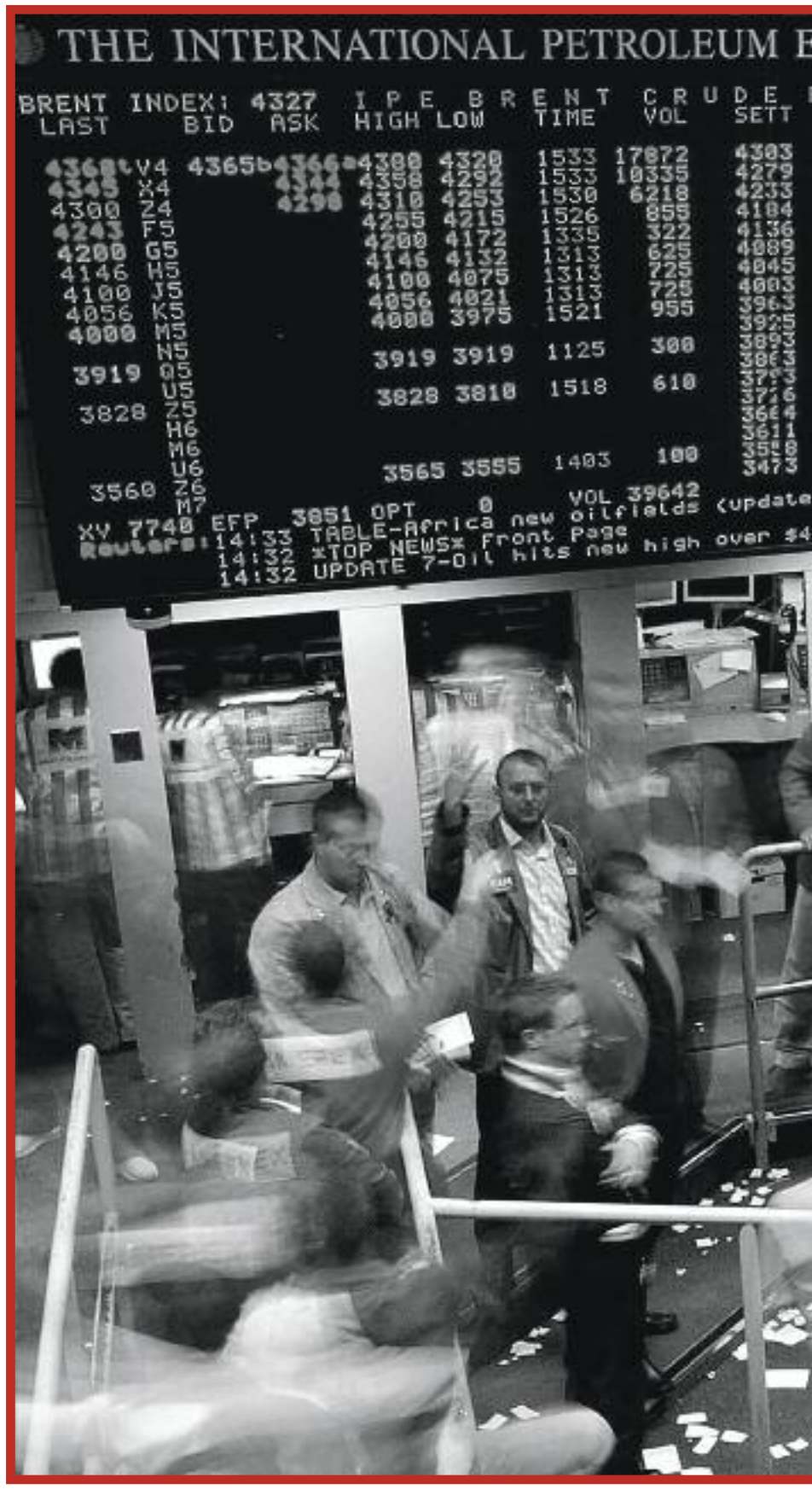
While Saudi Arabia has some options in the long term (post 2020), the consumption of liquid fuels in the power sector will continue to present a challenge for policy makers in the short to medium term. For the next few years, liquids consumption by the power sector is expected to continue to increase at a rapid pace, driven by growth in electricity demand, low energy and electricity prices, and by infrastructure and technical constraints which will prevent higher penetration of gas in the power sector. Consequently, the swings in oil demand during summer time will persist and thus Saudi domestic demand will continue to be closely monitored by markets analysts and will continue to be one of the factors affecting oil market balances and oil price behaviour, especially in some key months, when oil market fundamentals are perceived to be tight and/or when the market expects the call on Saudi Arabia to rise.

In addition to his role as Director of the Oil and Middle East Programme, Bassam Fattouh is also Research Fellow at St Antony's College, Oxford University; and Professor at the School of Oriental and African Studies.

Impact/The slowdown in emerging countries and commodity prices

Ups and downs

Although the balance of market forces points to significant downward pressure on oil prices in coming years, prices are unlikely to stay very low for long. Other commodity prices, though, will decline



by URI DADUSH

The sharp decline in the prices of most non-energy commodities over the last two years represents a marked departure from the commodities boom ushered in by the new millennium. This shift coincided with a large deceleration in the economies of emerging markets, raising two questions: is the slowdown in emerging markets mainly to blame for the decline in the price of non-oil commodities, and will it persist? Second, will it eventually cause a decline in oil prices, which have so far shown remarkable resilience?

These questions have the virtue of being precise, but, as someone once said, prediction is difficult–especially about the future. Emerging markets –which I use as a short-hand for all developing countries as defined by the World Bank–are very unlikely to return to the extraordinary 7 percent annual growth rates of the immediate pre-crisis period, but their fundamentals are strong and they can still continue to grow at a fair clip (a potential GDP growth rate of 5-5.5 percent annually) for many years to come. This would provide support for demand of all commodities, though not the same intense demand impulse they provided in the pre-crisis period. The recent slowdown in emerging markets has played a major role in the recent weakness of metals and minerals, where China now accounts for a large share of demand. Food prices, on the other hand, are much less affected by the economic cycle, and their decline owes more to other factors. Oil prices, expressed in real terms, could come under downward pressure in coming years, but this will be mainly because of increased oil supplies and of secular and global shifts in the use of oil rather than because of slowing economic growth in emerging markets.

GROWTH IN EMERGING MARKETS

The extraordinary pre-crisis growth surge in emerging markets over 2002-2007 clearly exceeded their potential growth rates, and this was reflected in rising inflation, infrastructure bottlenecks and deteriorating current account balances. Their advance was only briefly interrupted by the global recession in 2008-2009, when emerging markets showed remarkable resilience. Subsequently, expansionary monetary policies in the advanced countries coincided with improved confidence in emerging markets to cause the latter to experience large inflows of capital, appreciated currencies and another bout of rising inflation. Rising commodity prices were partly a result of buoyant demand conditions in emerging markets, but also helped reinforce them. Over the last two years, most developing countries have begun to decelerate, a result both of supply constraints and of their tightening monetary and fiscal policies. The prospect of Fed "tapering" in the summer reinforced expectations of a slowdown, and there are plenty of worries at present about overinvestment in China, macroeconomic imbalances in India, Brazil and Turkey, deteriorating terms of trade of many commodity exporters, and political rifts in several Arab countries.

However, there has been no collapse of growth in emerging markets, which are estimated by the World Bank to have grown at an annualized rate close to 6 percent in the third quarter of 2013. Looking forward, the fundamentals underpinning growth of emerging markets remain strong and are not likely to change quickly – rapid growth of the labor force, high rates of savings and investment, and the ability to advanced apply technologies from the advanced countries. Although a recovery in advanced coun-

tries will prompt a tightening of monetary policies, and some moderation of capital inflows, the net effect on emerging markets of a recovery in their main export markets should be positive, not negative. There is little, reason, therefore, not to expect growth in emerging markets to continue to outpace that of advanced countries by a wide margin in the foreseeable future. The moderation of growth of emerging markets has already adversely affect the growth of demand for some commodities, but will also make it more likely that demand will be sustained in the medium-term.

THE DECLINE IN THE PRICES OF METALS AND AGRICULTURAL COMMODITIES

Emerging markets have come to represent a large part of the demand for commodities, and, as advanced countries stagnated, the lion's share of new demand. The most striking case is the demand for metals in China, which now accounts for 45 percent of global metal consumption compared to a small fraction just a generation ago. The short-term correlation between variation in metals prices and industrial production growth in emerging markets is very high, even after controlling for other factors such as inflation and exchange rate trends, supporting the case that the recent emerging market slowdown dampened the price of some commodities.

However, with the exception of agriculture, commodity prices remain near record levels in real terms and high commodity prices over the past decade have also spurred a major expansion of supply: between 2000 and 2013, capital expenditures by major firms in the metal and oil markets increased fivefold. High prices have also increased recoverable reserves of →

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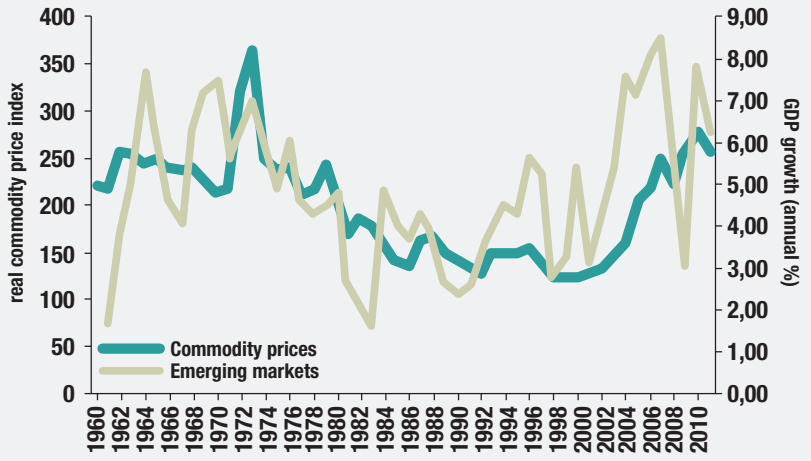
most metals, such as copper. Moreover, the persistent recession in Europe and slow recovery in the US and Japan also help account for the recent weakness of commodity prices. A recent IMF analysis finds that U.S. industrial production still has a big effect on a wide range of commodity prices, and attributes these outcomes to the long-lasting effect of shocks in economic activity in the U.S., as well as larger spillover effects on global economic activity through financial markets.

The slowdown in emerging markets appears to have had a much smaller role on food prices than on those for metal. In the short-term, food prices are much less sensitive to the macroeconomic cycle and more sensitive to weather factors as well as to supply factors (for example, acreage under cultivation) which tend to respond positively to high prices in previous years. As with all commodities, financial markets can play both a big anticipatory and amplifying role in price behavior. Over time, food prices tend to reflect mainly trends in population and long-term income growth, as well as the evolution of yields. Moreover, John Baffes, a commodity market analyst at the World Bank, has shown that energy prices play a crucial role in determining food prices, because of the high energy intensity of agriculture, which is 4-5 times greater than in manufacturing. Biofuel policies (which divert production capacity from food) also play a key role in determining food prices. The Food and Agricultural Organization recently noted that global food prices had fallen to their lowest level in three years, and that this was due mostly to a steep fall in the cost of grains, with weather-related factors accounting for record crops expected in the U.S. this year, and in the cost of sugar, where declining ethanol prices are providing Brazil—the world's largest sugar producer and exporter—an incentive to use sugarcane for sugar rather than biofuel production.

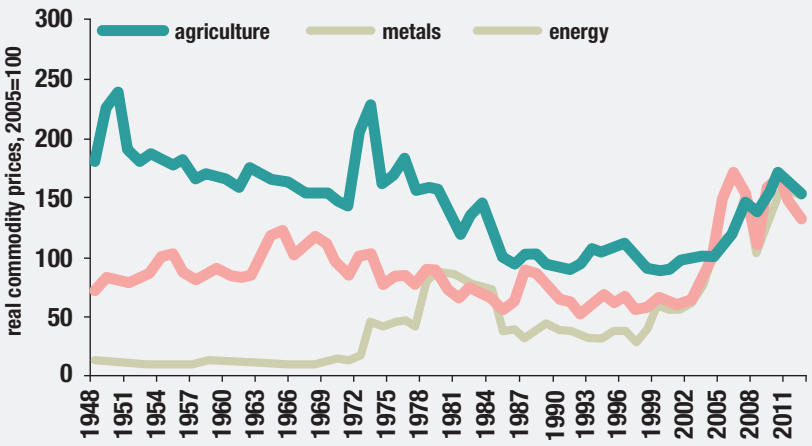
GROWTH IN EMERGING MARKETS



Source: UNCTAD, World Bank

The increase in the price of commodities has been caused, in part, by demand in emerging markets, but it has also, in turn, helped to strengthen them.

COMMODITY PRICES



Source: World Bank

The recent slowdown in emerging markets has led to the fall in prices of some commodities. However, with the exception of the agricultural industry, prices, in real terms, remain close to record levels.

OIL PRICES AND THE EMERGING MARKETS

Since emerging markets already account for half of world oil demand, up from 30 percent just ten years ago, their growth will continue to play an important role in shaping the fundamentals affecting oil prices both in the short and long term. Most forecasts call for moderate growth in oil demand over the next decade, about 1.5 percent a year, which is less than half the potential growth rate of world GDP and only a little above world population growth. Nearly all this growth of demand will occur in emerging markets.

However, important as they are, it would be misleading to attribute a dominant role to economic growth in emerging markets in determining oil prices, as other very important factors are at play both in the short and long run. In the short-term, the recovery of advanced countries – especially in the debt-afflicted Eurozone – will add to their extremely depressed oil demand. The wild cards of supply disruptions in Libya, Iraq, sanctions-constrained Iran, the Syrian conflict, and the rifts in Egypt, will also play a big role.

In the medium term, most of these fluctuations are likely to play a secondary role. While, as already discussed, the medium term growth rate of emerging markets remains favorable to oil demand, other factors are negative: increased oil and natural gas production in the United States due to new technologies (horizontal drilling and fracking); likely substitution of oil by natural gas in the transport sector; reduced oil use in transportation as cars become more fuel efficient and improvements in the battery life and cost which make electric vehicles more attractive may also play a role. It is also likely that the preoccupation with climate change and with the budgetary implications of energy subsidies in many developing countries will encourage reforms that could eventually make a dent in oil consumption.

Most important, the International Energy Agency predicts that increased conventional and unconventional production in Brazil, the Caspian Sea, West Africa, North America, and other non-OPEC oil producers will likely more than offset falling production across mature oil-exporting economies over the next five to ten years. Next year alone, non-OPEC oil producers will lift the global oil supply by the most they have done since the 1970s, producing 1.7 million additional barrels a day; the agency characterized this growth as appearing to be "less like a one-off than a preview." Such large increases in supply dwarf any shift in demand that could result from plausible variations in the annual growth rate of emerging markets.

Last but not least, much will depend on swing suppliers and their need to achieve a revenue target. Saudi Arabia, OPEC's largest member and leader by default, has pledged to abundantly supply the global market; however, it considers an oil price between $100-110/barrel to be fair, even though that price is about double its 2000-2009 average and is an estimated $20-25/barrel higher than the price the country needs to cover its spending requirements. Thus, although the balance of market forces points to significant downward pressure on oil prices in coming years, one can expect the decline to be moderated by cartel behavior., In any event, prices are unlikely to stay very low for long as the marginal cost of many new oil supplies is estimated to be in the $70-90 per barrel range, with the marginal cost of oil from Canadian tar sands, still the most important new source of supply, estimated at $80 per barrel.

CONCLUSION

Given the extraordinary volatility of commodity prices, any forward look is speculative, and interpretation of past trends is problematic given the complex array of forces affecting them. Nevertheless, one can say with confidence that very rapid growth of emerging markets played a significant role in the historic surge of many commodity prices over the last decade or so, and the same can be said of the subsequent slowdown. Emerging markets are likely to continue to grow much faster than advanced countries and thus to provide support for the demand for commodities for many years to come, though they will not generate the same large upward impetus as before the crisis. However, with the possible exception of metals, economic growth in emerging markets is not the dominant force in commodity prices it is sometimes made out to be. On balance, the many other factors pointed to in this note –especially new investments and the technology-driven growth of supply –serve to counter the view that commodity prices can resume their rise or even sustain current levels.

India/The world's largest source of oil demand growth after 2020

Let's talk about subsidies

To narrow the gap between scant domestic supplies and rising imports, India's government will have to rein in its sprawling system of energy subsidies, which costs it around $45bn each year

by JAMES CRABTREE

For those seeking evidence of a looming peak in global oil demand, India seems the last place to look. The poorest of the world's major emerging markets, it also has one of the lowest rates of per capita oil consumption. Yet despite a recent slowdown, India's economy is predicted to grow speedily over the coming two decades, becoming the world's third largest around 2030. And with that growth will come higher oil usage — much higher, in fact, a trend confirmed in November, when the International Energy Agency predicted that India would overtake China to become the single largest source of growth in global oil demand after 2020.

Indian policymakers therefore expend plenty of effort fretting about how to beef up their meager oil supplies — either by boosting domestic production or bringing in greater foreign imports — but very little anticipating a world in which global demand trends downwards. Even here, however, the picture is not quite as straightforward as it might at first appear — as became clear when politicians in New Delhi suddenly did begin to focus on curbing oil demand, during a curious episode in August this year.

THE TRADE DEFICIT AND THE CURFEW

The backdrop was a moment of severe economic crisis. Over the preceding three months, India had been buffeted by its worst period of economic turmoil in two decades. Hints by U.S. Federal Reserve chair Ben Bernanke's that he might soon "taper" the institution's emergency asset-buying program had spurred an exodus of capital from many emerging markets. India was particularly affected, with the rupee plunging to an all-time low against the U.S. dollar. New Delhi, gripped by rising panic, began to contemplate emergency measures.

Underlying this anxiety there lay a deeper problem: a yawning current account deficit, which in the final quarter of 2012 soared to a record 6.7 per cent of gross domestic product, placing extra pressure on the currency. Crude oil imports, which stood at →

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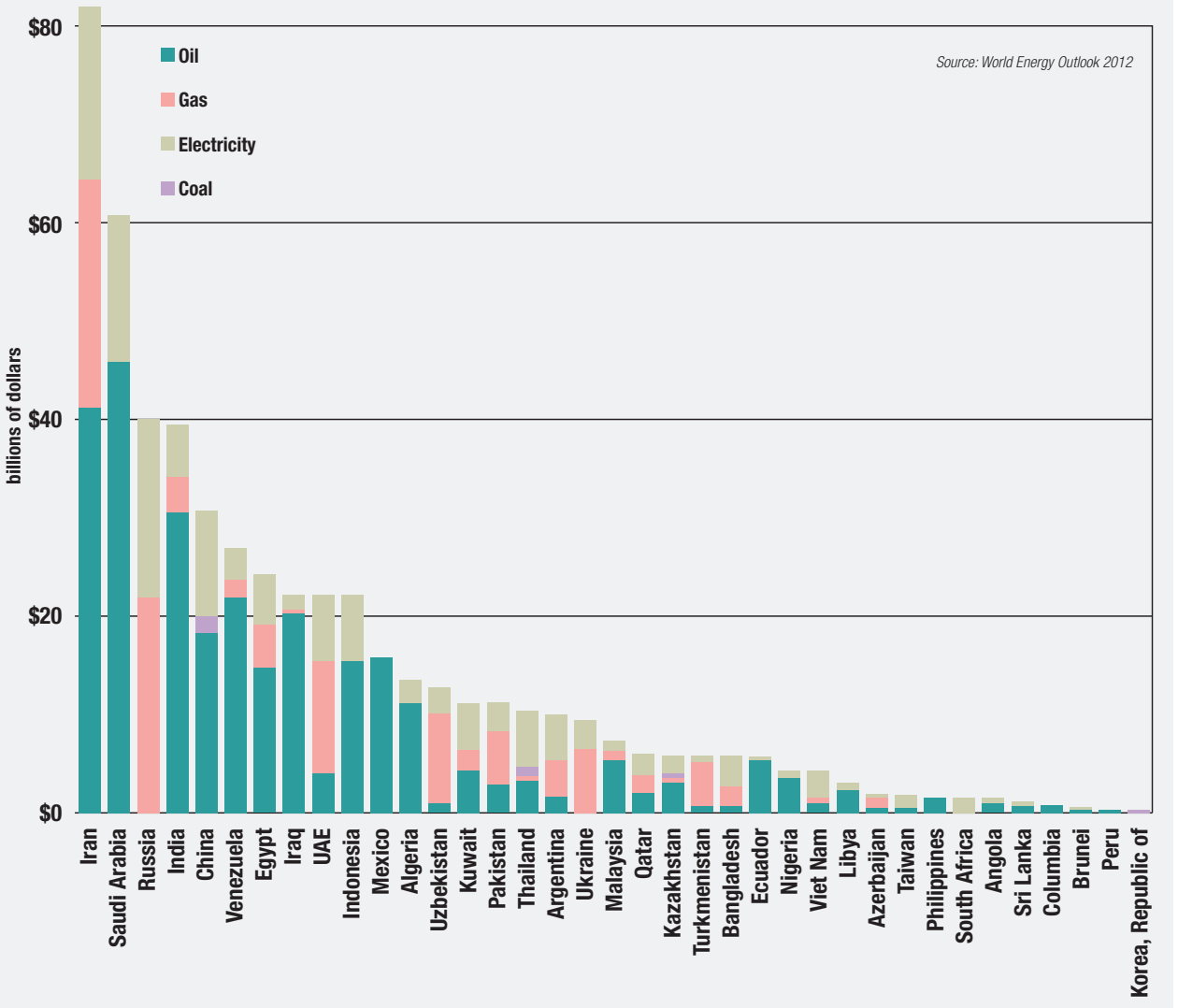
FOSSIL FUEL SUBSIDIES



According to the IEA's latest estimates, global subsidies for fossil fuel use will reach $544 billion in 2012, slightly up on 2011. The modest increase in international prices and consumption has been offset by significant progress on reining in subsidies. Subsidies for petroleum products represent more than half the total.

$144bn during the last financial year, were the largest element of that gap, while also making up more three quarters of the country's $191bn trade deficit. So how might oil demand be brought down, at least temporarily? India's oil ministry alighted, briefly, on an unusual solution: placing petrol stations under curfew at night.

The idea had little logic — it would have been an inconvenience, at best, forcing motorists to buy fuel during daylight hours — and was greeted with derision by India's media. The resulting mixture of mockery and uproar prompted the Prime Minister's office to distance itself from the notion, in turn forcing oil minister Veerappa Moily to deny it had even been under consideration. "It is not our idea," he hurriedly told Indian reporters. "No decision has been taken to keep petrol pumps dry during any part of the day." Even so, the petrol pump curfew furor served a deeper purpose, by demonstrating that, in the future, there are at least some circumstances in which India will need to consider curbing its fast-rising demand for oil, as well as simply seeking out more supplies.

THE NEW CHINA

The scale of the country's likely demand growth is clear from the IEA's latest World Energy Outlook, released in November. The report is skeptical about the idea of a decline in overall global oil demand, suggesting it will tick up over the next two decades, from 87 million barrels per day in 2011 to just over 100 in 2035. But it is clear that even if demand from OECD nations does indeed slow, emerging Asia will continue to provide overwhelmingly the most important source of new growth — with India playing an especially significant role.

> People use energy because they need it and as thriftily as they can, so it is by no means clear that higher prices would actually result in lower consumption

"When we launched our report, one of the findings I thought would be picked up strongly by the press, which was not picked up much at all, is that India is becoming the new China for the global energy market," says IEA chief economist Fatih Birol."This changes many of the long-held tenets of the global energy markets, which have often assumed that China is the engine of growth. But, after 2020, which is really very soon in terms of how the energy market behaves, it is India that will be the main source of new oil demand."

Indian oil use will increase by around 5 MBD between 2020 and 2035, as both the country's economy and population keep growing rapidly; it will overtake China, for instance, to become the world's most populous nation by 2028, according to the UN. Yet demand from individual home consumers is likely to provide a relatively minor component of this increase, with transport and industrial uses providing the bulk of demand growth.

On the former, India has strikingly low levels of car ownership: just 18 people in every 1,000 according to data from the World Bank. By comparison, more than half the population have a car in most European countries, while in China the rate is already four times higher than its Asian neighbor. India's great automotive catch up, which some projections suggest will see the country become the world's third largest passenger car market over the next decade or two, will translate into a significant source of rising oil demand. Industrial uses are also set to rise quickly, especially if India successfully manages to increase the current low proportion of its economic output that comes from manufacturing industries. "Industrial demand is already increasing," says Deepak Mahurkar, head of oil and gas at consultants PwC in India. "But it is worth noting that this growth is not much to the liking of industry itself, who would like to avoid use liquid fuels, which are more costly, and use alternatives instead, which are generally not available."

These alternatives would ideally come from domestically produced coal or natural gas. But while India has an abundance of both resources, a mixture of regulatory delays and incompetent management has seen domestic supplies fail to keep pace with growing demand. "The good things about India's growth in oil demand is that at least you are able to import this fuel," Mr Mahurkar says. "There is nowhere in India where you hear that the fuel pumps have been shut down, or a factory that can't operate because of a lack of supply. If you have the money, you can buy it."

FOREIGN RELIANCE

The same cannot be said of domestic oil production, which India has been attempting to increase in recent years, with little success. Not to be put off, the government earlier this year set an objective of achieving total energy independence by 2030, by way of greater oil exploration at home and tapping unconventional energy resources, such as shale gas. "Our government will make every effort to reduce our nation's dependence on imported oil," oil minister Veerappa Moily said in March, noting that the country's 73bn barrels of discovered oil represented only about one third

of the country's already identified resources.

Even so, most industry projections suggest India's reliance on foreign oil will continue to grow; the IEA, for instance, says India will import 92 per cent of its oil by 2035, up from just three quarters last year, and barely more than a third in 1990. "Increasing reliance on imported crude has been a serious concern for Indian policymakers," the body noted in a 2012 report on the country's energy market, "both in terms of energy insecurity and financial burden because of exposure to the fluctuation of international oil prices."

Fanciful talk of a domestic oil boom aside, India's is more likely to respond to growing demand by instructing its state-backed oil companies to seek more supplies abroad. The country's largest explorer, ONGC, recently outlined an ambitious new plan — known as "Perspective 2030", and boasting a budget of approximately $180bn — to acquire overseas oil assets over the next two decades. Indian oil groups have typically found themselves outbid by more aggressive Chinese competitors in the hunt for such resources, but ONGC has of late appeared more ambitious intent, for instance by spending $2.5bn for a stake in a large natural gas field in Mozambique this June.

Yet if India wants to narrow the gap between sluggish domestic supplies and soaring imports, it has one more obvious option: moderating the extensive regime of energy subsidies, which sees its government spend around $45bn each a year to shield their citizens from changes in global energy prices. "Most consumers weren't hit by oil price increases over the last few years, most of the burden was being taken by the oil companies and the central government exchequer," says Deepak Mahurkar of PwC. "But in India this doesn't mean people splurge on energy. They use it because they have to, and they do so in a thrifty manner, so it isn't clear that higher prices will always result in lower usage."

DEREGULATING FUEL PRICES

Energy experts are divided on this last point: some, such as Mr Mahurkar, suggest a roll-back of subsidies will just force poorer customers to spend more of their income on essential fuels, and cut back on non-essential spending elsewhere. Others disagree, pointing to moves by India's government earlier this year gradually to ease subsidies on diesel fuel, which accounts for just under half of all oil demand, a process which may see the price of the fuel fully deregulated by the middle of 2014.

This change in policy permitted oil companies to introduce regular incremental price increases for consumers which, in combination with the wider effects of the country's economic slowdown, actually saw diesel demand dip between June and August — a rare event in a country used to steadily rising demand, and a sign, according to some analysts, that subsidy reductions can persuade consumers to lower energy use. "If crude prices keep high for long periods eventually governments must increase prices, and then consumers do feel the pinch," says Dayanand Mittal, an energy expert at brokerage Ambit in Mumbai. "Recently in India, higher prices have led to weaker demand, and that could be a sign for the future."

The future of India's subsidy regime therefore has important implications both for the extent of future demand in Asia's third largest economy, and in turn the shape of global demand. "Most of the reduction in demand would come in the OECD world, from greater advances in technology, better mileage per gallon, restrictions on urban driving, and so on," says professor Nick Butler, director of the King's Policy Institute in London. "In the non OECD world, the key issue is subsidies. If prices to consumers started to reflect the world market price — or even to be used, as in the UK, as a source of tax revenue — then the growth in demand in places such as India could be lower than predicted."

AN UNUSUAL STEP

In an attempt to reduce oil demand, the Indian government moved last August to impose a night curfew on service stations. The resulting controversy and protests forced the government to do an abrupt about-turn.

China/Two scenarios and their impact on demand for commodities

Hard or soft landing?

If Beijing decides to tighten its monetary policy, the country's slowing economic growth could dip well below the current rate of 7.5 percent, triggering a decline in coal and oil prices

As evidence of economic deceleration in China mounts, many are asking whether the recent decline in Chinese growth portends worse things to come. Such concerns are grounded in the fear that financial leveraging and over-investment have made the Chinese economy more vulnerable to a collapse of growth if Chinese policy-makers decide to tighten monetary policy. Even if one assumes the more optimistic scenario of a gradual deleveraging coupled with structural reforms, China's growth could still fall well below its current rate of 7.5 percent per annum. Such a development would have far-reaching global consequences, in particular for commodity prices. China has an insatiable appetite for crude oil (it is the world's largest importer of crude), iron ore (it consumed 60 percent of the world's seaborne iron ore last year), and many other key commodities. In the event of a hard landing in China, commodity prices could collapse, leading to a glut of supplies and the end of the decade-long boom in energy and metals. Should Beijing engineer a slow and soft landing, its demand for commodities would likely decrease more gradually. Global commodity prices would likely fall, but in a more orderly fashion.

by MINXIN PEI

INVESTMENT BINGE

The most critical factor in determining which scenario occurs is Chinese leaders' ability to reduce investment without triggering a collapse of growth. Investment powers the Chinese economic engine these days: gross capital formation – at 48 percent of GDP – is the highest for a major economy. Growth of investment peaked in 2009, when year-on-year increase of investments in fixed assets hit 30.1 percent. Since then, investment growth has tapered off, averaging 22 percent per year. While China's investment binge since 2008 has supported growth and boosted commodity prices, the country has paid a huge price. Its financial leverage has reached a dangerously high level. Between 2007 and 2012, China's debt-to-GDP ratio rose 55 percentage points. Historically, such rapid increase in financial leverage typically ended with a crash. For example, between 1991 and 1996, Thailand's debt-to-GDP ratio increased by 66 percentage points. In 1997, the country's banking sector imploded under the weight of bad loans. In the five years before the American subprime crisis (2002-2007), this ratio shot up by 46 percentage points.

However, even though the slight reduction in the availability of credit has cooled off growth, China's debt-to-GDP ratio continues to rise because the total amount of credit released both through the formal banking sector and the shadow banking system shows no signs of abating. In fact, between 2011 and 2013, the average rate of growth of credit is 20 percent of GDP per year. This number worries China-watchers for two reasons. First, it indicates that Chinese growth today is supported almost entirely by credit growth and, since GDP growth is decelerating even though credit growth has remained unchanged in the last three years, credit-fueled investment is delivering less GDP growth. Such a trajectory is not sustainable. Second, persistent credit growth of such magnitude has further elevated China's financial leverage. By the end of 2013, the country's debt-to-GDP ratio is expected to hit 230 percent, the highest among emerging-market economies. Sovereign and consumer debt will be 25 and 20 percent of GDP, respectively. In the Chinese context, these two types of debt are low-risk. But the rest of the debt, roughly 195 percent of GDP, is owned by two groups of high-risk borrowers: local governments and corporations (including real estate developers). In the last five years, these two groups have borrowed the bulk of the newly created credit to invest in speculative real estate, excess manufacturing capacities, and unnecessary infrastructure.

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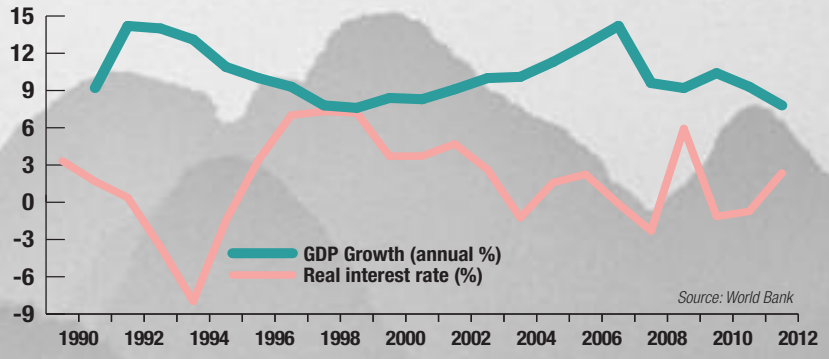
TWO INTER-RELATED CHALLENGES

In this environment of an overleveraged financial sector and slowing growth, China's economic prospects will depend on whether its leaders can manage two inter-related challenges: financial deleveraging and structural reform.If they handle these challenges effectively, China will likely experience a soft landing in the coming three years. This process will start with gradual deleveraging to slow investment growth, followed by re-capitalization of the banking system, and supported by structural reforms that will boost household consumption.

Admittedly, deleveraging, by tightening credit and forcing borrowers to pay down their debt, will have an instant negative impact on investment activities. China's GDP growth will, in response, weaken further. The real estate sector, which attracts annual investment equivalent to 10 percent of China's GDP, would be hardest hit. China's real estate bubble has remained intact mainly because of the continuing availability of credit, which enables real estate developers to build new projects and roll over their loans. Should Beijing start deleveraging, investment in the real estate sector could fall precipitously. A 50-percent decline in real estate investment (equal to 5 percent of GDP) alone →

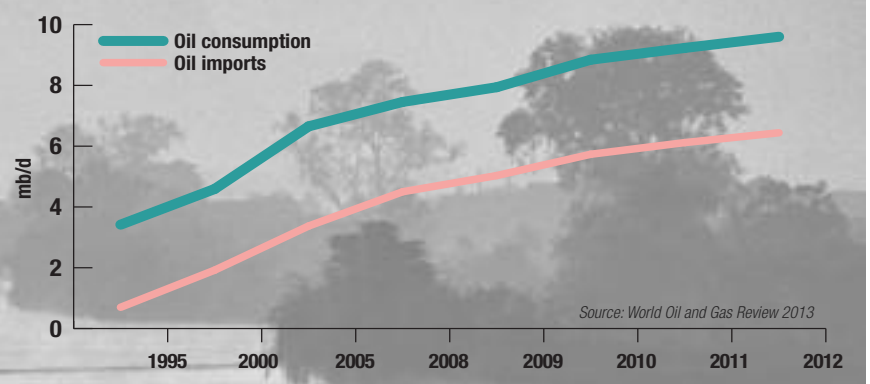
Chinomics

CREDIT DRIVES GROWTH

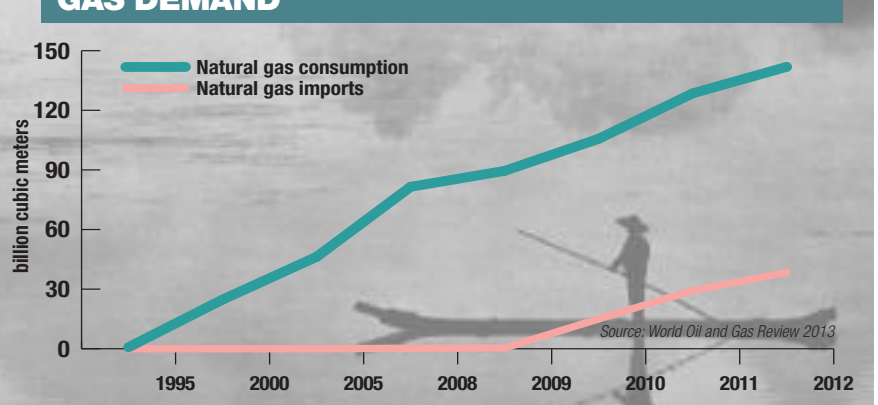


The graph shows changes in GDP and real interest rates in China. Chinese growth is currently underpinned almost entirely by rising credit.

OIL DEMAND



GAS DEMAND



The two graphs show oil and gas consumption and import trends. China is one of the world's hungriest consumers of energy. Between 2011 and 2012, the country's oil imports increased by 5.3 percent and its gas imports rose by 31.2 percent. Tighter Chinese monetary policy would accentuate the slowdown in the country's growth, with repercussions on hydrocarbon demand and therefore on prices.

could dent GDP growth by at least two percentage points.

The macroeconomic impact of deleveraging will not be restricted to the real estate sector. Local governments, which rely on the real estate sector for half of their revenues, will feel a painful fiscal squeeze. Industries supplying the real estate sector, such as steel, aluminum, and cement, will see their sales shrink as well. When all the growth-dampening effects are added up, China would be lucky to maintain 3-4 percent of GDP growth.

But financial deleveraging alone will not ensure a soft-landing. China will need to recapitalize its banking sector. The total amount of non-performing loans in the banking sector is estimated to be between at least 10-20 percent of GDP (about $800 billion to $1.6 trillion). Assuming lenders can recover half of these loans (an optimistic estimate), China will need $400-800 billion in fresh capital for its banks. If Beijing has a well-conceived bank recapitalization plan that uses fiscal injection and large write-offs to clean up the banking sector quickly, China can avoid repeating Japan's mistake of allowing zombie banks to paralyze the financial system and prolong stagnation.

The last piece of the puzzle in a soft landing scenario is finding new internal sources of growth. China will need to redirect resources to its households to boost consumption. Official data show that household consumption in China in 2012 was at 36 percent of GDP (the world's average is 60 percent). Although annual real consumption growth in China in the last five years was 9 percent, an impressive figure, there is a lot more room for growth. The key to raising household consumption is increasing personal income, which the Chinese government can accomplish with tax cuts and providing more social services. If, for example, Beijing covers more school fees and healthcare costs for ordinary Chinese people, personal income and consumption will effectively be raised.

THE HARD LANDING SCENARIO

Pessimists would argue that a soft landing scenario is daydreaming. They believe that because of the Chinese government's policy of maintaining growth at all cost, a hard landing involving a chaotic process of involuntary deleveraging and collapse of growth, is far more likely.

In a hard landing, Beijing is expected to continue its policy of supporting growth with credit. Unfortunately, this policy would provide at most two to three more years of artificially high growth (around 7-8 percent), but at potentially calamitous costs. If we use the average trend of the last three years as our baseline (loan growth equal to 20 percent of GDP in return for 8 percent of growth), Chinese debt-to-GDP ratio will rise to 250 percent at the end of 2014, 270 percent by 2015, and 290 percent by 2016. Since much of the credit will be wasted on unproductive investments (speculative real estate, excess industrial capacity, and unneeded infrastructure), the percentage of non-performing loans in the banking sector will likely be staggering. Deleveraging from such a stratospheric level of indebtedness will be far more difficult and disruptive. Even though it is impossible to predict what will trigger a crisis leading to a hard landing scenario, the unraveling would most likely start in the financial sector. Because Chinese high-risk borrowers use cross collateralization (they guarantee each other's loans), the default of a small number of borrowers (most likely medium-sized real estate developers or local government financing vehicles) could generate cascading effects. The resulting panic in the financial sector could lead to disorderly deleveraging. By the time such a crisis hit (probably in 2015), the magnitude of the problem, namely the size of the bad loans, could overwhelm the Chinese central government, which might be forced to adopt more drastic but ill-advised measures to restore stability to the financial sector.

In a hard landing scenario, even if the government manages to stave off a financial panic, lending will likely dry up. After such an episode, Beijing would no longer be able to pour good money into the investment sinkhole. Banks would be reluctant to make new loans. The overall investment rate could collapse. Real estate investment might evaporate altogether (this alone could make GDP growth fall by 4-5 percentage points). A Chinese hard landing, based on international experience, could usher in a prolonged period of low growth. One reason is that, since such a scenario assumes a much higher debt-to-GDP ratio, deleveraging will take longer, thus depressing growth for years. Another reason is that a hard landing causes enormous economic collateral damage. Healthy firms could fall victim to widespread pessimism and anemic demand. Loss of confidence could trigger capital flight. The list goes on.

GLOBAL COMMODITY PRICES

Obviously, no matter which scenario occurs, global commodity prices will likely fall. However, the impact of a soft landing would be significantly less devastating. In the event of a soft landing, commodity prices would retreat gradually, with varying levels of decline across sectors. Prices of iron core, copper and coal (used in heavy industries) would fall much more than oil (used primarily for transportation). Food prices would be marginally affected. Most importantly, the decline of commodity prices would likely be temporary and the market would find a bottom as China completed its managed deleveraging process (probably three years) and revived growth. On the other hand, a hard landing would cause an instant collapse of commodity prices across the board. In this scenario, credit-supported Chinese growth would keep commodity prices artificially high for two to three years. However, when the crisis finally hit, panic could cause prices to fall through the floor as confidence in China's ability to weather the crisis plummeted. Nobody would know where the bottom is, since the Chinese economy would be struggling to find its own footing amid chaotic financial deleveraging. A prolonged bear market could thus follow a hard landing of the Chinese economy. ■

China/Renewables output is surpassing the E.U., U.S. and Japan by 2035

No end in sight for growth in demand

Subsidies for electric vehicles and measures to combat greenhouse gas emissions will not be enough to slake China's thirst for oil. For crude demand to tail off, cars that run on alternative fuels must be more accessibly priced

China is now a more voracious consumer of oil than even the United States, say figures released in September by the U.S. government's Energy Information Administration, formalizing a historic passing of the torch. Indeed, China now imports an average of 6.3 million barrels of oil per day (bpd), outstripping the current U.S. rate of 6.2 million bpd. The trend seems unlikely to stop there. In 1996, Chinese crude demand was 5 percent of the global total but last year it reached 11 percent. Yet China's arrival at the top of the oil import tables comes at a time when the entire sector is preoccupied with a question: How long will the world's thirst for oil last? Have we already reached an upper limit on demand? Will we become less dependent on "black gold" as time goes on?

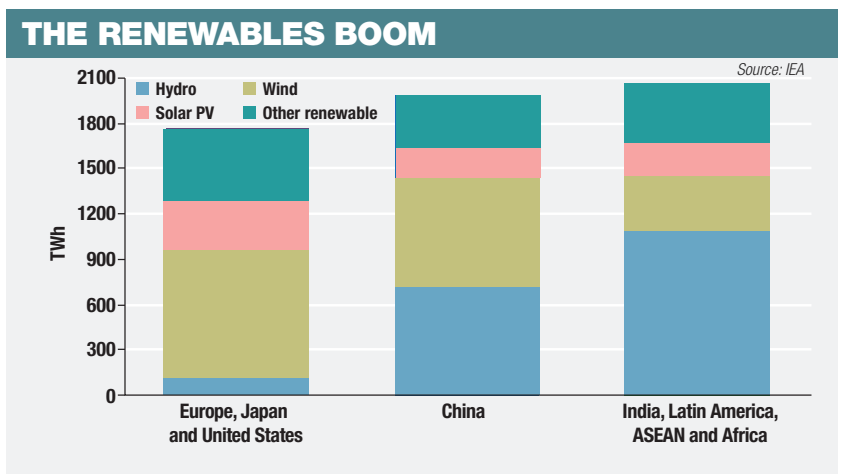
by YAO JIN

The question stems from research released in April by Citi introducing a new concept: peak oil demand. Citi's theory takes two figures as its premise, hypothesizing that if vehicle efficiency improves by 2.5 percent per year going forward, crude oil demand could peak at 92 million barrels per day – not far off current levels. The theory, however, has many detractors, especially among those who believe emerging countries are still clamoring for fossil fuels because of the increasing number of cars hitting the roads of new mega-cities such as Beijing and Shanghai. Indeed the situation in China is perhaps the most interesting: the last couple of decades have seen an exponential rise in the number of cars on the highways of China's major cities.

ELECTRIC CAR SUBSIDIES

Would an increase in electric-powered cars or hybrid motors bring a drop in oil demand in China? Several indicators from recent months suggest this is unlikely to happen. The latest round of state subsidies for electric cars, dating back to September 2013, offered ¥60,000 Yuan for buying an electric car and ¥50,000 for a bus. The aim of the program, its backers explained, is to "accelerate the development of vehicles fueled by 'new energy sources', promote energy efficiency and reduce atmospheric pollution." Yet the new vehicles have not proved particularly popular in China. However, figures alone are not enough to explain this complex and continuously evolving phenomenon. The forecasts of big agencies and think tanks "cannot take into account those slow but important changes that happen beneath the surface," argues Fereidoon Sioshansi, an analyst with Menlo Energy Economics, one of the first to set out its stall on peak oil demand. "Agencies use past figures to extrapolate future predictions, but energy trends depend on numerous factors, including prices, government policies, standards and consumer habits, which change as the years go by, especially when faced with problems like environmental pollution, which is a big issue in China," Sioshansi said. A number of conditions will have to be met if Citi's prediction is to come true. "The most fundamental factor is cost, then the existence of highly energy-efficient cars, and then the existence of mass public transport," Sioshansi explained.

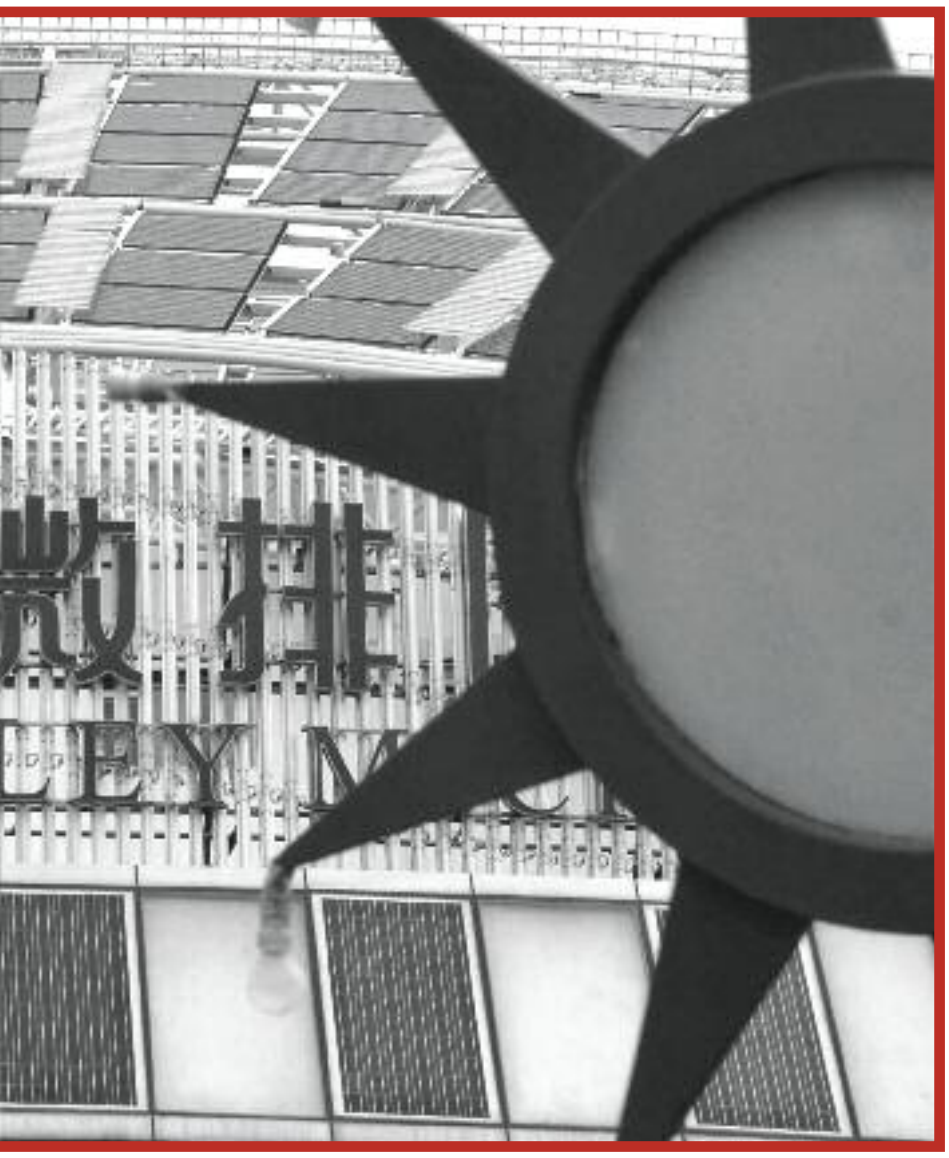
Even though nearly 20 million electric scooters (which are allowed in bicycle lanes in big cities like Beijing) are sold each year in China, the electric car is still not seen as a convenient option. At least, not by those who cannot afford a second car, reckons Li Shufu, chairman of Geely, the car maker that bought Swedish brand Volvo in 2010, who is also skeptical about the launch in Beijing of a showroom by Tesla, the leading manufacturer of luxury electric cars. It can hardly be said then, that China is rushing to adopt the electric car. The prohibitive costs exclude the middle class and sales figures seem to bear out Li Shufu's claim: of the 18 million vehicles registered last year, only 22,000 were electric cars. The lack of charging stations for electric cars is another factor discouraging potential buyers, with only 168 in the entire country.



The graph shows increasing renewable electricity generation between 2011 and 2035 across the world. China alone will record growth in excess of Europe, Japan and the United States.

MEASURES TO COMBAT POLLUTING EMISSIONS

The Chinese government has long been committed to implementing energy efficiency plans, but Beijing's problem is containing polluting emissions. And there is no convincing solution on the horizon. In June, the Chinese government approved the National Standard Five – its own version of Euro 5 – which will come into force in 2017. The new standard, which limits sulfur emissions to 10 ppm per cubic meter, means that the refining sector will have to produce cleaner fuels and car manufacturers will have to build more efficient engines if the new standards are going to be met. From 2015, cars produced



in China must be able to travel 100km on 6.9 liters of gasoline. Cars registered after 2020 will have to be even more efficient, covering the same distance with only five liters of fuel. However, the country's dependence on coal is the main target for anti-emissions measures. "Crude oil demand will be influenced by the performance of the economy," explains Xiaolai Zhou, CEO of SZ Energy Intelligence, a Chinese consulting group. "China is also reviewing its energy consumption to reduce the use of coal because of the environmental problems – a move that will result in an increase in consumption of natural gas and oil," he said.

International Energy Agency (IEA) forecasts, which predict that Beijing will become increasingly dependent on crude imports, seem to confirm this viewpoint, while also pointing towards massive development of renewable resources. According to the latest edition of the IEA's World Energy Outlook, China is set to become the leading market for Middle Eastern crude and, by 2035, will produce more renewable energy than the European Union, the United States and Japan put together. Yet the appetite for oil will not be diminished. Global oil demand is still destined to increase and should break through the 100 million bpd barrier by 2035. One of the problems facing Beijing is controlling retail prices of refined products. In order to follow market fluctuations more closely and avoid consumer protests, in March the National Development and Reform Commission (NDRC) modified the mechanism for setting fuel prices, allowing the price to be changed every 10 days instead of the 22 in use until early 2013. The move has already borne fruit, with lower pump prices for gasoline and diesel.

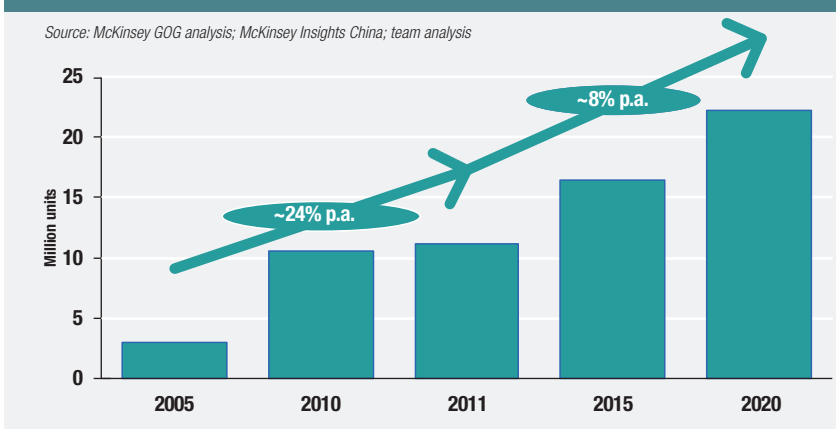
> The Chinese government has been committed to implementing energy efficiency, but Beijing's problem is containing polluting emissions in order to limit the impact on the population

UNCONVENTIONAL SOURCES

Unconventional energy sources such as shale gas (China is the world's leading country in terms of reserves) or shale oil could dampen the country's ardor for imported crude. In December 2013, the government held its third auction for the rights to tap fields of these resources, which are still underdeveloped given their potential. But while U.S. oil demand has been falling steadily since 2005 – as has been claimed by The Economist, a British weekly newspaper – next year China could see oil consumption rise 13 percent. China's state energy giants are also turning their focus towards exploring other sources, such as Brazilian offshore crude and Canadian tar sands, which have long been in the crosshairs of the country's oil corporations. "I think China will cut its dependence on oil and move towards greater energy diversification," Xiaolai Zhou went on. "Developing a variety of energy reserves is hugely dependent on China's technological and economic growth. If China makes progress on nuclear energy and shale gas, oil dependence could be reduced over the coming decades," he added.

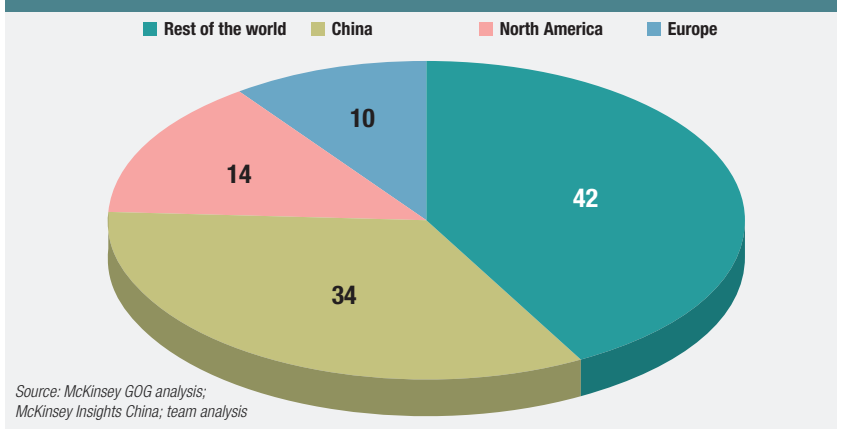
The future of the crude oil market, at least in China, will also have to take account of two other factors that will affect prices in the short term: the roles of refining and of gas. In a speech to Columbia University's Center on Global Energy Police, Antoine Halff, head of the IEA's Oil Industry and Markets division, explained both phenomena. Halff spoke of a "major transformation" in the refining sector, which is moving away from smaller refineries and is instead developing a global reach, while also taking a far greater role in China. The increasing role of refining in the oil industry has also been accompanied by the Chinese authorities' ongoing commitment to move towards cleaner energy sources, like gas, in an attempt to relieve the country's big cities of pollution, which is increasingly seen as an emergency. This, says Antonie Halff, could "really make a difference" to forecasts on the future of the crude market. However, he reckons it would be unlikely that gas would replace oil as a fuel source. For China, peak oil demand is still some way off.

THE NO. 1 SINGLE-COUNTRY CAR MARKET



China became the largest single-country market in 2010, and is expected to maintain strong growth momentum. China will even exceed North America (16.8 mn) and Europe (19.9 mn) in 2020.

THE ENGINE OF GROWTH



New car sales in China are forecast to contribute about 35 percent of the world's car-market growth between 2011 and 2020 (100% = about 33 million units).

From ownership to sharing: The mobility revolution

by DANIEL ATZORI

Among young people the real status symbols are the latest tablets and smartphones.

The increase of fuel efficiency and the adoption of alternative energies seem to be contributing to a reduction in oil consumption, known as "peak oil demand." But we may be witnessing a broader paradigm shift, which is, at the same time, social, cultural, economic and technological: it involves a move from car ownership to car sharing, which is related to a wider move from the notion of ownership to that of sharing. This is having remarkable consequences on mobility as a whole, with a resulting impact on urban environments. The combined effect of these transformations could be, therefore, a decrease in the consumption of oil.
Car culture, based on the ownership of a gasoline-powered private automobile, strongly marked the 20th century. Countless movies, songs, books and ads celebrated the four wheels as a means towards individual freedom and personal emancipation–and even love.
But today this model appears to be eroding in both Europe and the United States. The development of alternatives like bike and car sharing are revolutionizing urban mobility, in the process reducing car ownership and lowering traffic congestion and pollution. Both the economic crisis and the digital revolution are playing a part in this transformation.

Young people have less money to spend on new cars, and car ownership is viewed less and less as a rite of passage

The primary status symbols among young people today are not hot rods or luxury vehicles but up-to-date mobile devices. Not merely status symbols, they contribute powerfully to the ongoing mobility revolution. Carpooling, carsharing and ridesharing are not new concepts, but a plethora of new smartphones apps make them easier and far more efficient than ever. The consulting firm Frost & Sullivan expects 15 million car sharing members in North America by 2020, up from 1 million in Europe and North America combined in 2011. Rental car companies, like Avis, which recently bought Zipcar, are making the most of this transformation. And car manufacturers have also gotten into the game: Bmw's DriveNow, Daimler' Car2Go, Renault's Twizy Way and Volkswagen's Quicar are likely to play an important role in the future of car sharing business. Emerging economies still show a marked increase in car use. But car sharing is beginning to take hold in China. The city of Hangzhou, which was already operating a bike sharing scheme, recently launched the country's first commercial car sharing service.
Some analysts point out that the revolution we are witnessing is part of a global shift, ignited by Internet, from the notion of ownership to that of sharing. Indeed, concepts such as sharing economy, access economy and collaborative consumption are growingly being discussed; they all seem to point to the overcoming of our current model of development, towards a different one based on sharing assets and resources. This ongoing mobility revolution overlaps with the way digitalization is transforming work patterns, for example, as video conferencing has become more common and convenient it has made business travel less necessary. And of course, our work is less and less bound to the office. The very idea of workplace is changing, and the concept of working hours may vary significantly, considering the remarkable amount of time we spend online. In the future, the most significant divide may not be between wake and sleep, nor between working time and free time, but between being online and offline.

The multifaceted interaction between new technologies, such as smartphones, and new forms of mobility, is already forging the urban environments of the 21st century

So-called "smart cities" are places where original ways of working and interacting increase productivity, efficiency and quality of life, as well as lowering carbon footprint. There are countless pioneering projects in this regard. For example, a few years ago Cisco Systems launched in the Netherlands the concept of "smart work centers," flexible and interconnected workstations close to residential communities. Cloud data storage allows these new work environments to be fully integrated offices, allowing companies to reduce some of their costs without laying off workers. Together with working at home, the spread of these smart workplaces could considerably reduce long commutes and, consequently, oil consumption. Commuting is, indeed, not only a waste of time, money and energy, but also a major source of stress, anger and frustration. A recent study by Dr Benjamin Newman, Assistant Professor at University of Connecticut, entitled *The "Daily Grind": Work, Commuting, and Their Impact on Political Participation*, even establishes a link between hours spent in transit and lack of civic engagement. Smarter working environments could mean less stress, more productivity and more time to spend with family and to devote to fitness and hobbies, but could also promote the development of a more active and conscious citizenship – or netizenship.
On a global level, these issues are growingly being discussed in the public sphere. The transition from car culture to new forms of mobility is happening because of the unleashing of new energies, of which the most important is human creativity. The shape of things to come is far from clear: but original and visionary solutions could contribute to make our planet a better world. Or at least this is the hope.

Daniel Atzori has been a Senior Researcher at the Fondazione Eni Enrico Mattei (FEEM) and he is currently Editorial Team Coordinator of the magazine *Papers of Dialogue*. Atzori earned his PhD in Government and International Affairs from the University of Durham (UK).

There is no turning back for car manufacturers

by ANTONIO GALDO

Electric and/or advanced hybrid cars –I refer to them as "auto non sprecare" ["do not waste cars"]–are the future of the worldwide auto industry. There is no longer any doubt on this point, either among manufacturers or among governments forced to prop up an industry that is still in severe crisis and shedding jobs. Certainly, market shares–especially for the electric car–are still very low and there is no lack of uncertainty over the revenues they may generate. And while change is the natural way of things, this does not make it any less of a threat to entrenched industries, particularly in its initial phase.

Positive signs abound, from Canada to California and Europe

The Canadian government has just set aside $18.2 billion–an enormous figure even for a country with solid public finances–to develop a research program on electric and hybrid cars. The program will run for the next five years, but the Canadian government's decision shows that the tipping point has already arrived and that governments, when they make industrial policy and back research, need not waste time in endless, fruitless debate. The research program will take place at McMaster University, Hamilton, in collaboration with Chrysler and the Natural Sciences and Engineering Council of Canada, which will contribute $9.25 million and $8.9 million, respectively. These are significant sums of money, which will go towards blending research, industry, innovation, development and improving energy efficiency.

Car sharing and bike sharing change city travel.

A second bellwether is what has been going on at Tesla, the small market-listed Californian company run by Elon Musk. Tesla is on a magnificent–perhaps even miraculous–run, having quadrupled its share value, overtaking Fiat-Chrysler and reaching half the value of the giant General Motors (which is in poor health after having been bailed out by the U.S. Government). A case of financial speculation perhaps? Partly–but only partly–Tesla really is a new American industrial phenomenon: in 2013 it sold nearly 25,000 high-end electric cars; its first model, a luxury hatchback, costs $70,000 in the United States. You might argue that that is the top end of the market and therefore still a long way from the mid- to low-end segment, where the electric car will have to take root if it is really going to become established. In any case, the course has been set. Governments in Europe (as in Canada) are issuing rafts of policies and funding to develop electric and hybrid technology, in an attempt to make it accessible for all consumers.

The vexed issue of public funding to improve automobile efficiency

Interests that can be difficult to manage in a balanced and sensitive way come into play here. Returning momentarily to Europe, where once again the Germans and the French are setting the tone in this sector, the good signs for the future are multiplying at quite a striking rate. The German car industry is at the cutting edge in terms of technology, innovation and new products, as shown by the sales figures of Germany's car-making giants, with one in three cars sold in Europe belonging to the Volkswagen, BMW and Mercedes groups. Now, given that Germany has set itself the target of reducing average vehicle emissions to 95 grams per kilometer by 2022, it is obvious that Berlin will exert pressure on the European Commission to support the development of more efficient cars and the use of alternative fuels. In Brussels, the German government will find this policy is warmly received, even in the cumbersome decision-making center that is the European Commission's Directorate-General for Energy, which from January 1, 2014, will be in the hands of France's Dominique Ristori, who served as deputy director-general from 2006 to 2010. The French government–whose industrial policy is known to be extremely protective of national interests–has long provided nationwide incentives for electric and hybrid cars. How? By giving out checks worth 6,300 euro to people who buy an electric car, or 3,300 euro to purchasers of hybrid vehicles, plus bonuses for converting cars to liquefied petroleum gas (LPG). The French government is also backing key policies in Paris, including those supporting car sharing schemes featuring electric vehicles. These schemes have been a target for investment by Breton financier Vincent Bolloré, who just recently went public with his own company in this space. Overall then, even Europe–despite umpteen rethinks and uncertainties, and with all the unknowns of the unsustainable and anomalous political and institutional governance of the Union–seems ready for thoroughgoing change in terms of vehicle efficiency and making electric cars more popular. Europe–though we must take it with a pinch of salt, given the ongoing tensions between the E.U.'s member states–seems to be signing off the same hymn sheet, as if it were a single state like the U.S. or Canada. There will doubtless be many more installments of this particular saga. Yet one thing is certain: the global auto industry will not turn back, nor harbor the illusion of once again hitting the record sales of the pre-recession era, when fuel costs were reasonable and pollution did not scare citizens; instead it will face an increasing need for paradigmatic, technological and systemic change if it is going to survive and thrive. Such change will bring it to a road that macro-economists call a "new model of development" and that micro-citizens simply call a "better quality of life" –and that is something we can all get behind.

Antonio Galdo recently published *L'egoismo è finito* (Einaudi) and runs the website www.nonsprecare.it

International sanctions have controversial effects on Iranian oil market

by GIUSEPPE ACCONCIA

The interim agreement signed in Geneva on November 24 between Iranian negotiators and the five members of the United Nations Security Council plus Germany (P5+1) could bring an end to a decade of nuclear disputes with Iran. Many experts say the deal marks a “historic” step towards a comprehensive solution on the Iran’s nuclear program dispute. The agreement provides for three phases to be rolled out over the subsequent six months. Iran will be allowed to enrich uranium up to 5 percent, while converting existing 20 percent uranium into oxide and not extending the heavy-water reactor in Arak. In exchange Iran would obtain a partial relief from international sanctions, worth $7 billion, including limits placed on the auto industry and petrochemical exports.

New York, September 26, 2013. The Iranian President Hassan Rouhani with the Secretary General of the United Nations Ban Ki-moon. The economic decline that Iran is suffering from has encouraged the moderate Rohani to support a temporary agreement on the nuclear program with the five countries of the UN Security Council, plus Germany.

Oil exports have remained in good health despite tougher sanctions

The international sanctions have been intensified in the last months, despite the Geneva agreement. The United States authorities strengthened the penalties on Iran adding new companies– including energy, shipping and manufacturing enterprises –to the Tehran nuclear programme’s black list.
As many experts highlighted, the measures have brought controversial effects on Iranian oil market. “The international sanctions did not hurt the Iranian political establishment. Hence, for years, ultraconservatives close to former president Mahmoud Ahmadinejad did not want an agreement with the P5+1”, said Ramin Jahanbegloo, Iranian intellectual and Professor of ethics at Toronto University.
However, Iran’s fuel oil exports remain healthy despite tougher sanctions. According to Thompson Reuters, Iran exported nearly 18 million barrels of fuel oil in the first quarter of this year with an increase of nearly 12.5 per cent from the previous period in 2012. Iranian officials and intermediaries in the Gulf have adopted creative strategies to avoid the sanctions (for example working on ship-to-ship transfers, at remote ports, or blending Iranian oil with other fuels). Thus the Iranian first-quarter total exports of fuel oil rose 74 per cent from the same period in 2012.

Iranian authorities react to economic decline and currency crisis

On the other hand, the international measures have halved exports of Iranian crude. Tehran’s authorities appreared to be concerned about the effects of the new restrictions on their ability to sell oil. The fears were exacerbated by a law approved in February in the U.S. According to the bill, importers of Iranian oil, despite of being exempt from the sanctions, can risk further penalties sending the money used to buy it to Iran.
The decline in exports of Iranian crude has been confirmed by the International Energy Agency (IEA), (an organization grouping mostly Western oil-importing countries). According to IEA, crude exports fell to a million barrels a day by the end of 2012. As a consequence, Iran is undergoing a currency crisis. In recent months, rent prices have dramatically affected the housing market. Moreover, sanctions hit car prices. Those are amongst 77 goods, considered “luxury products”, whose importation has been blocked to cope with the shortage of hard currency created by Western banking sanctions. “Especially middle and upper class Iranians would benefit from a suspension of sanctions, while the poorest will continue to be supported by the public welfare system. Plus, the security forces (Sepah-e Pasdaran) have not been affected by the sanctions and continue to smuggle high-tech and pharmaceutical products”, concluded Professor Riccardo Redaelli of Università Cattolica in Milan.
The international sanctions have controversial effects on Iranian oil market. The economic decline has encouraged Iran’s moderate president, Hassan Rouhani, to support an interim deal on the nuclear program with the P5+1.
It is still problematic to work out to what extent the sanctions will be dropped, as a consequence of the Geneva temporary agreement. However, a suspension of these measures could have positive effects on Iranian exports driving down oil prices.

Giuseppe Acconcia is a journalist and researcher focusing on Iran and the Middle East. Since 2005 he has lived in Iran, Egypt and Syria. He works for news outlets in Italy (*Il Manifesto*, *Il Riformista*, *Radio 2*, *RaiNews*), the U.K. (*The Independent*) and Egypt (*Al Ahram*). He is the author of *La Primavera egiziana* (Infinito edizioni, 2012).

IAI
Istituto Affari Internazionali

"Yesterday's Fuel" and threats to the stability of producer countries

by NICOLÒ SARTORI

Falling oil demand presents significant challenges to geopolitical order. In Energy Outlook 2013, the International Energy Agency predicted that global demand for crude oil will continue to rise, driven by the appetites of emerging economies and producer countries, offsetting falling demand in industrialized countries and especially in Europe.
Meanwhile, an August 2013 article in The Economist called oil "Yesterday's Fuel." Indeed, according to the U.K. weekly, global oil demand has entered a long but inexorable decline, triggered by the rise of natural gas as a global commodity and technological progress in the automotive sector.
Much of the focus of this debate has been on economic and environmental effects, but if the predictions of "peak oil demand" theorists are borne out, the geopolitical repercussions could be significant. A contraction in oil demand would likely have a major impact on the political and socio-economic fabric of exporter countries, thus aggravating current global security and stability concerns.

The rentier state model could be under threat

If peak oil demand is combined with increased production of unconventional oil and gas, plus the growing contribution of renewables to the world's energy mix and the introduction of ambitious energy efficiency policies, the end result could have an explosive impact on the stability of a number of exporter countries.
Indeed, this cocktail of factors could precipitate a reduction in their export volumes, which might lead to a drop in crude prices if supply remains static or even if it increases.
Since most exporter countries depend on oil sector revenues for their internal stability, such a scenario could mean that the redistributive policies and socio-economic benefits that have for years insulated these regimes against political challenges will suddenly become unsustainable. The longevity of the rentier state model could, therefore, be in serious jeopardy.

Effects on "Arab Spring" countries could be dramatic

The Arab uprisings have, in fact, already struck a significant blow to the model of authoritarian stability established by the regimes of producer (and non-producer) countries in North Africa and the Middle East.
The anarchic state of Libya and the civil war in Syria are emblematic of the failure of the political and socio-economic model that took root thanks to oil revenues.
The uprisings in Bahrain and Kuwait, whose political and institutional stability seemed almost a given until the events of 2011, demonstrate that no part of the region can be considered immune.
Now, many of these countries are going through a difficult transition. On the one hand, you have persistent calls for fairer redistribution of revenues and socio-economic benefits. On the other, you have increaseed domestic demand for primary energy and electricity, due to high population growth rates, resulting in a significant dip in export capacity, and therefore a drastic decline in oil revenues.
Such a pattern, as well as a slowdown in global demand, might not only sweep away the region's most fragile regimes, but also spread to rentier states such as Saudi Arabia, which even as the Arab Springs reached their peak, seemed – at least to outsiders – to be made of sterner stuff.

London, Berkeley Square, an electric car at a charging station. Technological progress applied to the automotive industry is one of the causes of the fall in demand for oil.

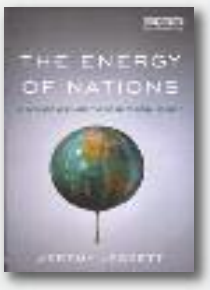
Russia's future is unclear, Caspian Sea countries could also be at risk of contagion

Russia, the world's biggest hydrocarbon exporter, could also find itself facing increasing difficulties. Oil and natural gas account for around half of fiscal revenues in Russia's budget and in recent years have been the main (if not only) stimulus for economic growth. That is a real source of insecurity for a power such as Russia, which is apprehensive about the knock-on effects of any change in the status quo of the world's energy sector. The fretfulness of the Kremlin over the United States shale gas boom is but one example of this.
As it stands, the situation facing Russia seems less critical than that of North Africa and the Middle East. Even so, a slowdown in global crude oil demand could have a significant impact on the country's economy, hampering growth and fueling popular discontent with the ruling oligarchy, already under pressure since early 2012.
The contagion could spread too with various degrees of intensity to the region around the Caspian Sea, where the effects of a decline in oil revenues could destabilize producer countries such as Azerbaijan and Kazakhstan.
That said, both these countries' regimes do seem to be less vulnerable than the Middle Eastern exporters; Baku's decision to diversify its economy could turn out to be crucial in keeping the Aliyev dynasty safe from the dissatisfaction and protests of the Azerbaijani people.
Lastly, there is the great Iranian question. Massive subsidies, economic stagnation and international sanctions have gradually sapped the Ayatollahs' regime. Despite the government-ordered repression of 2009, the aftermath of the Green Movement's protests led to the defeat of the ultra-conservatives in last June's elections. The new Iranian president, Hassan Rohani, who is a moderate reformer, not only faces the task of restoring the country's international role but will also have to review its social and economic systems if the state is to deal with the new challenges posed by the possibility of peak oil demand.

Nicolò Sartori is a researcher in the Security and Defense Department at the Istituto Affari Internazionali [Institute of Foreign Affairs] in Rome, with a special focus on the evolution of technologies characteristic of the energy industry.

the reader

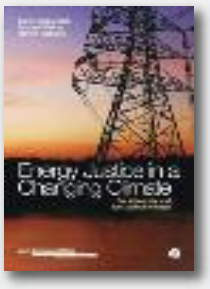
The future of renewables



Title: The Energy Of Nations. Risk Blindness And The Road To Renaissance
Author: Jeremy Leggett
Publisher: Routledge
Info: September 2013, 272 pages
Price: $31.95

The scarcity of oil supplies, climate change and the financial crisis pose a serious threat to the economies of tomorrow. World leaders are therefore duty-bound to address major future challenges. Jeremy Leggett reflects on dangers that often go underestimated, offering a vision of hope in the renewable sector, softening the economic collapse and open up a new renaissance.

Energy Justice



Title: Energy justice in a changing climate: social equity and low-carbon energy
Authors: Karen Bickerstaff, Gordon Walker, Harriet Bulkeley
Publisher: Zed Books
Info: October 2013, 232 pages
Price: $35.95

Bickerstaff, Walker and Bulkeley offer new perspectives on the interactions between climate change, energy policy, equity and social justice, developing a critical agenda for those who carry out research in these fields. Energy justice is one of the major question marks hanging over sustainability, as well as an important goal for in the clean energy sector.

South American mining

Title: Subterranean Struggles. New Dynamics of Mining, Oil and Gas in Latin America
Authors: Anthony Bebbington, Jeffrey Bury
Publisher: University of Texas Press
Info: November 2013, 361 pages
Price: $55.70

Bebbington and Bury provide the first detailed analysis of mining policy in Latin America over the past few decades. Here, a broad range of industry experts carefully examine the socio-political, environmental and political consequences of the extraction of non-renewable resources in South America, including from the point of view of local populations, which often fall victim to strife and conflict.

The sustainability race

Title: Race For Sustainability: Energy, Economy, Environment And Ethics
Author: Ken Hickson
Publisher: World Scientific Publishing Company
Info: December 2013, 328 pages
Price: : $48

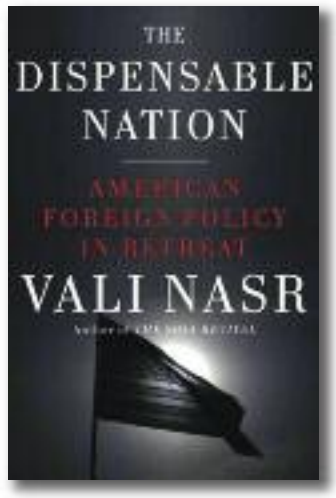
Ken Hickson exhorts the reader to "focus on renewables and energy efficiency to curb the waste of resources." The text is a real journey through sustainability, articulated through stories and specific case studies with a view to inspiring widespread involvement in meaningful action for a better future – in terms of energy, environment, ethics and economics.

by CARLO ROSSELLA

The dispensable Nation

Rajiv Chandrasekaran, one of the world's leading experts on Afghan-Pakistan issues, had it right when he said: "The Dispensable Nation by Vali Nasr is an indispensable book." This brilliant essay on American foreign policy, written by the former right-hand man of the great ambassador Richard Holbrooke, special adviser on Afghanistan and Pakistan from 2009 to 2010, takes us into the secret world of highly sensitive diplomacy and unveils how the Obama administration has conducted itself across the area that extends from Kabul to Islamabad and Iran.

Nasr, who lived and worked side by side with Holbrooke and Hillary Clinton, secretary of state during Obama's first term, rounds up their collective frustration with a president and his aides in the Pentagon and National Security Agency who focused solely on military operations at the expense of the persuasive force of diplomacy. This, he says, provoked frustration at Foggy Bottom.



Title: The dispensable Nation
Author: Vali Nasr
Publisher: Doubleday; F First Edition edition
Info: 2013, 285 pages
Price: $22.84

Obama had two heavyweights of diplomacy and foreign policy at his disposal, but preferred to rely instead on the intelligence and defense services. And now we understand the reasons for Obama's excessive reliance on intelligence. It seemed to him to be easier–as we have seen with the Snowden and Datagate revelations–to study the geopolitical map of the world using the electronic spycraft of the National Security Agency, rather than through diplomacy. Hence the United States has seen its standing diminish, as the country has shied away from an ambitious foreign policy in southern Asia and the Middle East, and continued–in the same way as the preceding Republican administration under George W. Bush did–to spend billions of dollars going down a road that has brought no progress on democracy or development, but only provoked discontent, if not disgust, with the United States.

According to Nasr, the Obama administration, having won the White House, had a chance to revive foreign policy, but the fear of a political backlash and the ever greater and more dangerous specter of international terrorism convinced it to remain in step with the Pentagon-Intelligence strategy pursued by Bush. At the same time, Nasr explains, the United States' true political and economic competitors–China and Russia–have managed to expand their political (and above all economic) influence in areas where the United States formerly held sway.

Essentially, Nasr's book makes plain all of Obama's mistakes. He is seen as a "lame duck" in international politics and the main protagonist of "American foreign policy in retreat"–as the book's subtitle goes. Only the recent reprisal of dialogue with Iran has signaled a change in tack, but that is more down to the good intentions of Iran's new President Hassan Rouhani and U.S. Secretary of State John Kerry than to Obama (despite the credit the White House has claimed for the end of the cold war with Iran).

Born in Tehran in 1966, Nasr immigrated to the United States as a child, alongside his father Hossein Nasr, an academic, in flight from the 1979 Revolution in Iran. Nasr speaks Farsi and has conducted secret negotiations with Iran; he knows Pakistan, Afghanistan, the Middle East and the Islamic Republic of Iran inside out. He is now head of one of the leading international think tanks on foreign policy and diplomacy, the Paul H. Nitze School of Advanced International Studies at Johns Hopkins University, and is a Senior Fellow at the Brookings Institution.

This book is a hymn to diplomacy: the only real way to save American foreign policy in decline and once again make the U.S.–as in the times of Truman–into an "indispensable nation."

Carlo Rossella is a journalist and executive. He has been the head of La Stampa, Panorama, and TG1 and TG5 (the TV news programs). He is currently chairman of Medusa Film, the production company of Mediaset.

The surprising truths about Energy Returned On Energy Invested (EROEI)

When the game is worth the candle

Hydroelectric power tops the list, while the greatest margin for improvement lies at the bottom end of the index with the less efficient technologies – from hydrocarbons all the way down to corn ethanol

by JAMES HANSEN

It may seem obvious that it takes energy to produce energy, but the theme – though critical – is often ignored in public debate. That may be because it sometimes points out unpopular truths.

Since financial analysts like cryptic terminology even more than bureaucrats do, the "energy cost of energy" even has its own complex acronym: "EROEI". The term stands for "Energy Returned On Energy Invested" and is a kind of index of economic efficiency.

An index of, say, 5 would mean that one unit of energy invested yields five units for onward consumption. When instead the EROEI is less than one, the cost of extracting the resource is greater than its energy value. It's sounds relatively straightfowward, but in fact the concept is more difficult than it might first appear, since these values change over time, are affected by external factors like geography and even vary considerably according to the particular axe being ground by the analyst making the calculation.

The EROEI of early American oil production is commonly estimated to have been around 100; that is, it took roughly the energy equivalent of one barrel of oil to extract a hundred barrels.

Today oil is harder to get at and typical estimates of the efficiency of U.S. production place that value at around 20 to 1, a fifth of the historical measure

Worldwide oil production overall is calculated to have an EROEI of 35. The exact values assigned mean little if they are calculated differently or represent different real-world situations. Still, though the numbers produced vary widely, the classifications of resource efficiency they generate are strikingly similar.

There is universal agreement that by far the lowest "energy cost of energy" is for hydroelectric power. The resource is cheap, renewable (it depends on water falling from the sky) and has no carbon footprint to speak of. Its EROEI ranges as high as 100. The picture is murkier at the bottom of the list, where several inefficient technologies fight for last place. The two worst are commonly considered to be biodiesel and corn (maize) ethanol – with the second often tipped as the least efficient, costing as much energy to produce as it is then capable of generating.

If the best that can be said about corn ethanol as a fuel is that it is barely worth the trouble, why does anyone bother?

The answer is of course politics: in the United States – the only place where it is produced in volume – the agricultural lobby (which favors strong cereal prices) found a common ground with other forces seeking a "renewable" way to break the country's dependence on imported oil.

A different dynamic influences production of hydroelectric power. This resource – clean, renewable and cheap – ought to be fashionable. In some countries its use is actually declining. In the United States more dams are being dismantled than built and the most important American plants are very old, dating from the 1930s (Hoover Dam) and the 1940s (Grand Coulee).

One objection to the construction of hydroelectric capacity is that new reservoirs occupy land that must be subtracted from other uses. This however hardly applies to the existing installations being taken out of service.

Perhaps the most important obstacle arises from the way in which these projects must be financed. Though highly efficient in use, they are very expensive to build. Capital costs are so great that larger installations typically must be financed by governments, meaning that the decision to build becomes primarily political – and politics may be conditioned by factors that are only distantly related to energy efficiency.

The middle ground of the EROEI hit parade is solidly occupied by hydrocarbon resources like oil and natural gas. These familiar resources are still an order of magnitude more efficient than many proposed alternative technologies.

An exception is wind power, which, with an EROEI of around 20, begins to approach the efficiency of hydrocarbons – part of the reason for the strong expansion of the technology in recent years.

A less obvious surprise is the high EROEI of petroleum resources after a century of intensive exploitation. It was once said of the Oklahoma "Teapot Dome" oil field that it was enough to drive a pick into the ground and crude oil would come bubbling up – a wild, if telling, exaggeration. Still, the depth of producing wells in those days was measured in the hundreds of feet.

A well recently drilled at Exxon's "Sakhalin-1" site in Siberia reaches a depth of 7.7 miles vertically and extends 7.1 miles horizontally out under the Arctic Ocean. Winter temperatures regularly fall below -35° F. (-37° C.), making the working environment "complicated" to say the least.

The extended-reach drilling employed at Sakhallin-1 sends the bore both down and outward. To control its direction, sensors in the drill train collect data that is sent back to the surface with pressure pulses in the drilling fluid. The bore route is premapped using 3D seismic imagery to model rock conditions and to locate the oil deposit. So much for putting the head of a pick into the ground!

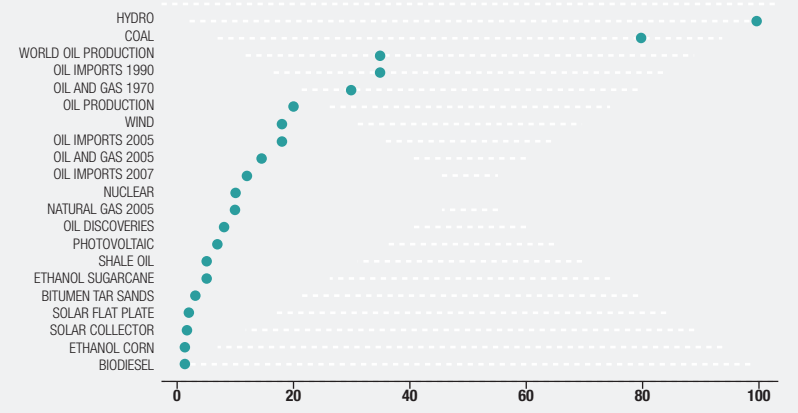
The surprising energy efficiency of petroleum extraction over time has been maintained, even in the face of difficult drilling conditions, by dramatic and continuing advances in the technologies employed

A final point arising from a glance at the EROEI rankings is that the highest value – hydroelectric power – is for a fully mature technology capable of transforming 90 percent of the potential energy of the water behind a dam into electricity – a stupendous accomplishment that leaves room for only minor, incremental improvements.

Even atomic power – well up in the ranking – is, once you get beyond the quantum physics at least, a well-understood technology, if lumbered by the unresolved problem of what to do with nuclear waste.

The greatest room for efficiency gains lies instead lower on the scale, beginning with the hydrocarbons and ranging – perhaps – all the way down to corn ethanol, which has no place to go but up.

THE U.S. EROEI INDEX



Source: Murphy & Hall (2010) Ann NY Acad Sci 1185:102-118

Hydrocarbons fall in the middle of the EROEI league table. Hydroelectric power and coal offer a better return on investment.

James Hansen provides financial reporting and international relations consulting to major Italian companies. He came to Italy as the U.S. Vice-Consul in charge of economic affairs at the U.S. Consulate General in Naples. He became a correspondent for various leading foreign press organizations, including the *International Herald Tribune*. Then he was appointed spokesman for Carlo De Benedetti, SilvioBerlusconi and, finally, head of the press office of Telecom Italy.

MARKET TRENDS

The apparent stability of oil

Price volatility has been low, but serious doubts remain over how fundamentals will develop

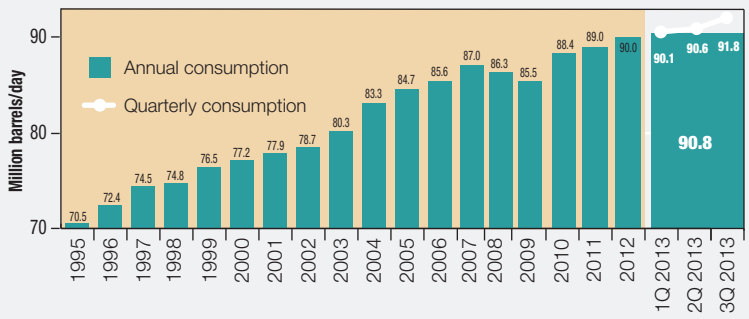
Oil prices

Oil prices continue to be driven by conflicting forces as we head towards the end of 2013. Geopolitical events are fueling price rises, while persistent uncertainties about the evolution of the global economy are pulling them down. The net result is that prices will end the year as they started it, at around $110/barrel.
The markets are keeping a close eye on economic indicators and in particular on signs of improvement in the United States and China (the world's two biggest oil consumers) as well as the recent recovery of demand in Europe, which is just now emerging from the recession.
Prices are being kept high by the various crises within OPEC (and especially in Iran, Libya and Iraq) that are eroding market availability. Meanwhile, the boom in North American production remains confined to the domestic market because of the ban on exporting U.S. crude.
In November, a fresh round of negotiations between Iran and the United Nations resulted in an agreement which allows temporary (six months) relief from sanctions, in exchange for promises from the country about scaling back its nuclear program. Therefore, Tehran is set to receive $4.2 billion in oil sales in the coming months, even though a full recovery in production seems unlikely in the short term.
Supply also remains tight because of Libya, where since the summer exports have been constantly interrupted by strikes, protests and sieges, despite the recent reopening of several terminals. Furthermore, there have been recurrent export interruptions in Iraq, both in the north and in the south – the area of the country with the greatest potential.
Given these production issues, OPEC's main concern is still price stability. In the meeting held in Vienna in early December, the cartel decided to keep the production ceiling unchanged at 30 million barrels per day (mb/d). OPEC is aware that the expected rise in demand in 2014 will be more than satisfied by growing non-OPEC supply. Iran and Libya have declared that they will rejoin the market in the first half of 2014, although these dates seem optimistic and will in any case require Saudi Arabia to put a hold on production. The production difficulties in the Middle East are having a strong impact especially on supply of sour crude, resulting in rising prices.
On the American market, meanwhile, the tight oil boom continues to affect domestic crude prices. Louisiana Light Sweet (LLS), the Gulf Coast benchmark, is following in the tracks of West Texas Intermediate (WTI), beating Brent prices and becoming increasingly disconnected from international markets.

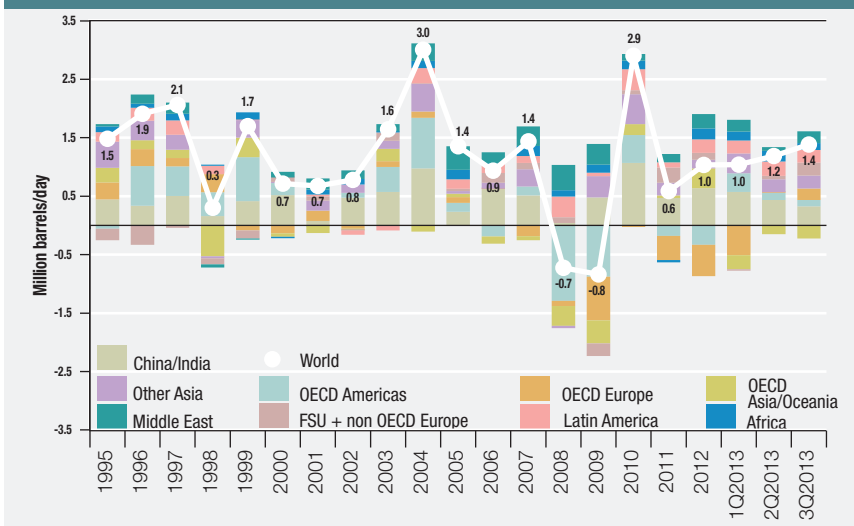
Oil demand

The third quarter of 2013 saw year-on-year global oil demand growth of 1.4 mb/d (against Q3 2012), reaching 91.8 mb/d – an increase on Q2 2013 year-on-year figures (+1.2 mb/d).
Organization for Economic Co-operation and Development (OECD) countries did surprisingly well, halting the trend of structural decline thanks to positive contributions from Europe and America.
For the first time since late 2010, Europe recorded rising consumption (+0.2 mb/d against Q3 2012), having emerged from the recession in the second quarter of this year. The OECD Americas area also saw a rise in consumption (+0.1 mb/d) due to better than expected economic growth, as the Bureau of Economic Analysis revised U.S. GDP growth in Q3 2013 from 2.8 percent to 3.6 percent. In particular, gasoline demand in the U.S. benefited from lower pump prices, while consumption of naphtha and liquefied petroleum gas (LPG) were buoyed by the good performance of the petrochemicals sector, in turn facilitated by the tight oil/shale gas boom.
Only the OECD Asia area saw a decline in consumption (-0.2 mb/d against Q3 2012), due to a sharp decline in the use of crude and fuel oil, which have been replaced in Japanese heating and electricity generation by coal – a cheaper source. Non-OECD oil demand continues to drive global demand, albeit less markedly than last year (1.3 mb/d in Q3 2013 against 1.6 mb/d in Q3 2012) because of more moderate economic growth. In China, oil consumption – on the wane since late 2012 – reflects the deterioration of the general economic backdrop. In terms of oil products, though, there were conflicting trends: fuel oil consumption was down, while naphtha and gasoline consumption rose. The weak performance of fuel oil in China is tied to its replacement with gas across all sectors, including public transport and haulage. On the other hand, the strength of naphtha reflects good performance in the petrochemicals sector, while the growth in car registrations in the first 10 months of 2013 (+15 percent compared to 2012) is boosting gasoline consumption.

GLOBAL CONSUMPTION

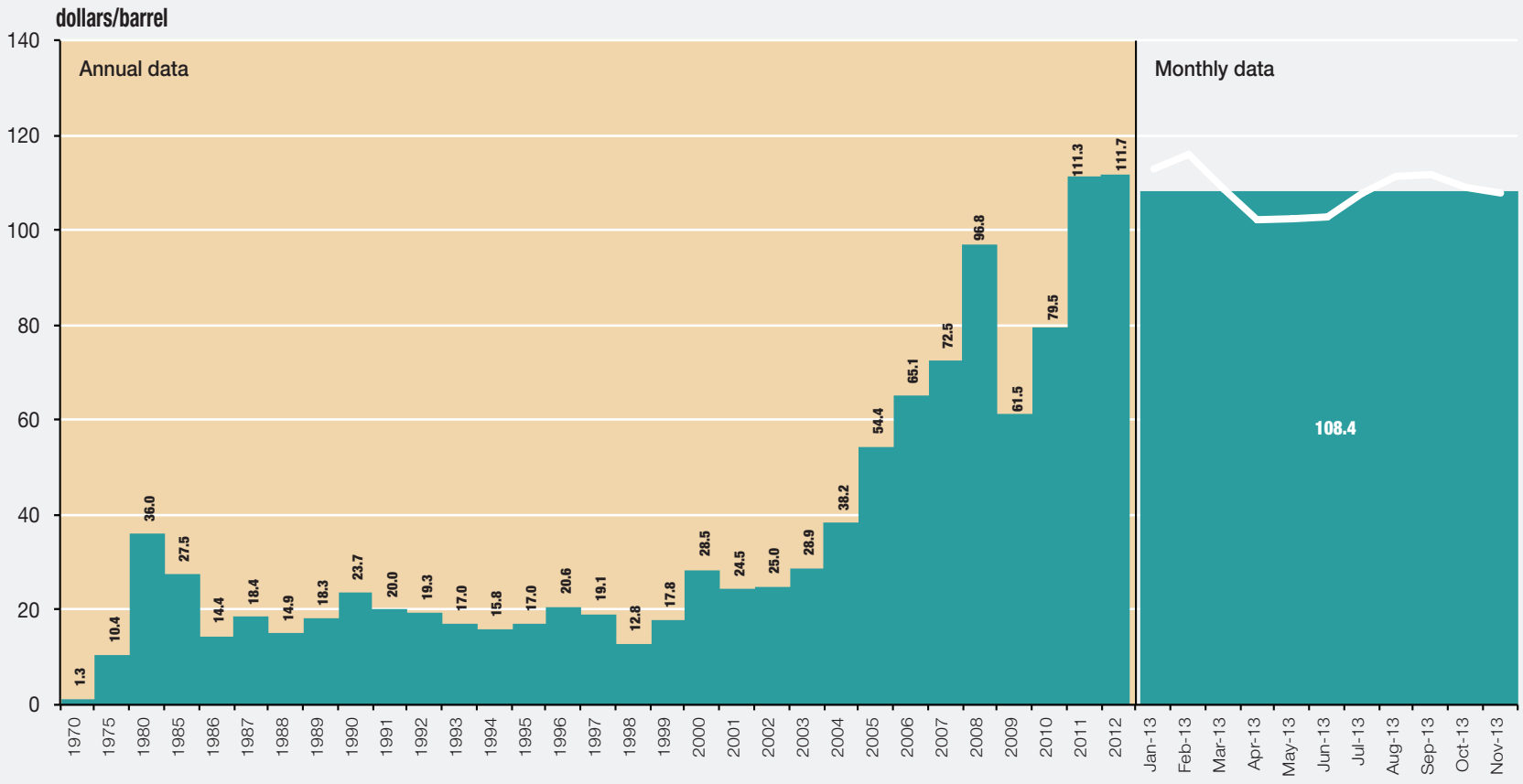


VARIATION IN GLOBAL CONSUMPTION BY AREA



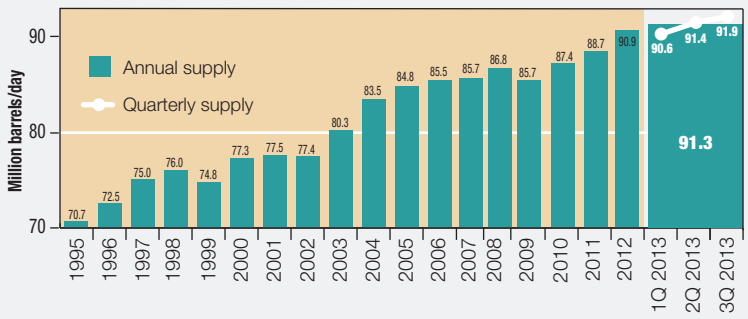
Source: Eni's processing of International Energy Agency data; change vs the same period of the previous year

BRENT PRICE

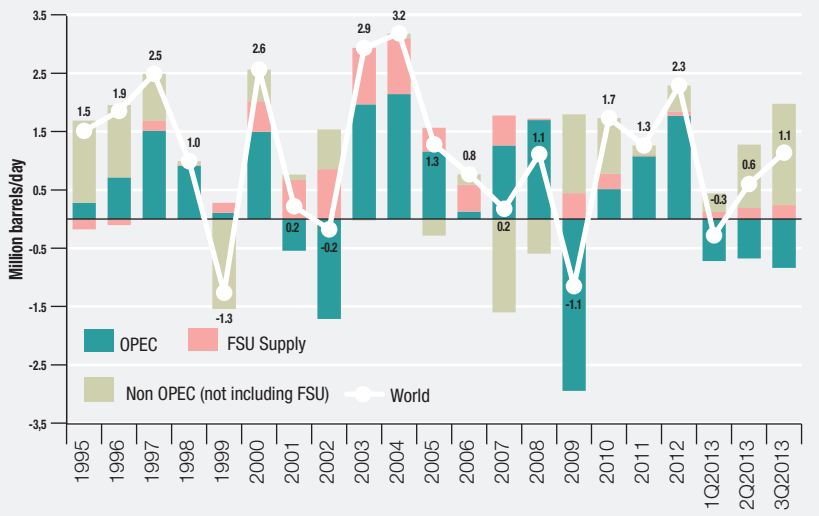


Source: IEA, spot price of Arabian Light (1970-1985); IEA, spot price of Brent (1986-1987); Platt's, spot price of Brent Dated (from 1988)

GLOBAL SUPPLY



VARIATION IN GLOBAL SUPPLY BY AREA



Source: Eni's processing of International Energy Agency data; change vs the same period of the previous year

Oil supply

Global oil supply in the third quarter of 2013 increased by more than 1 mb/d compared to the same period last year, nearly reaching 92 mb/d. Again, non-OPEC countries were responsible for the increase, while OPEC output continued to shrink. Non-OPEC growth hit levels not seen since the early 2000s, thanks to a further acceleration in U.S. tight oil production, which rose by 1.2 mb/d compared to the same quarter of 2012. In November, U.S. crude output came close to the record level of 8 mb/d – the highest since the late 1980s.

Other non-OPEC areas seeing increases were the former U.S.S.R. area (+0.2 mb/d), both in Russia and in other countries. OPEC output has fallen back for the third quarter in a row (-0.8 mb/d), as the production difficulties afflicting some members of the cartel continue. After the unrest of the summer, Libya is still in crisis and in November production fell to 220,000 barrels per day (compared with a pre-crisis level of 1.6 mb/d) and exports slowed to just 130,000 barrels per day. In Nigeria, sabotage, maintenance operations and declarations of force majeure are keeping production below 2 mb/d.

Iraq's exports have suffered further problems during the quarter. Aside from continued sabotage in the north of the country (Kirkuk-Ceyhan), November saw the emergence of logistical problems in the southern terminal in Basrah. Making the situation even more complicated, there are rumors that Basrah – Iraq's most productive region – may follow in the footsteps of Kurdistan and make a bid for autonomy. The Iranian question remains in the eye of the storm. The embargo in place since 2012 has eroded around 1 mb/d away from the market over the last two years, meaning production has fallen to its lowest level in 25 years (2.6 mb/d in Q3). Despite expectations over the agreement reached in late November between the country and the P5+1 (the five permanent members of the UN Security Council, plus Germany), it remains unlikely that the country's market will be fully restored any time soon. For one thing, production capacity has already been seriously compromised by delays in major upstream projects. Even so, remarks by the Iranian oil minister on the sidelines of OPEC's latest meeting struck an optimistic note: "Once the sanctions have been lifted," he said, "we will reach 4 mb/d even if the price of oil falls to $20 per barrel."

Oil

December 2013

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ISSN 977-203638900-8
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