

Fact. Energy *Special*

Experts about Energy 2011 and beyond

Dick Benschop

All the components needed for
the fuel cell car are ready

Jeroen de Haas

Local solutions are part of the
cradle-to-cradle principle

Wubbo Ockels

I wouldn't be surprised if most
wind turbines were gone 50
years from now

Pier Nabuurs

Ultimately solar will be the
winning technology

Sipko Schat

The real driver is to get control
of the supply chain and reduce
dependence on other countries

Ton Hoff

It will take decades for solar
power to gain market share

Deloitte.





Introduction

Few industries impact economic livelihood, societal functioning and quality of life as significantly as the energy industry. Despite, and almost certainly because of energy's absolute necessity, the energy industry faces a remarkable array of challenges even as many of its companies are achieving tremendous financial results.

Hurricanes and the oil spill disaster in the Gulf of Mexico, the economic crisis and political instability have all contributed to high volatility of energy prices. As the fog lifts over the global economy, we see an accelerating eastward shift in the world's economic centre of gravity. Continued strong energy demand in China and India calls for massive investments in all elements of the energy value chain. Meanwhile, the continuing focus on the environment and concerns about climate change have created renewed interest in alternative energy. Significant investment is needed in technologies that reduce the demand for energy products, improve the recoverability of hydrocarbon resources and foster environmental sustainability. Countries endowed with oil & gas resources are increasingly exerting control over them. In the midst of this environment, when the industry most needs creative and often hard-won solutions, its human resources are aging.

Against this background it may seem bold to make predictions for 2011 and beyond. However, it is in times of uncertainty that we need to look into the future. Predictions can be useful when formulating strategy,

since they encompass a wide array of views and inputs. We hope our predictions will inform, fuel the debate and in some cases help identify opportunities and potential courses of action.

This is the second year that Deloitte has published its Energy Predictions, based on in-depth interviews with clients, industry analysts, and senior energy practitioners from Deloitte member firms around the world. Useful as these predictions are, we wanted to offer you, our clients, more. So we went out to interview some of the Netherlands' key experts and thought leaders on energy. In this magazine we share with you their views and comments on our 2011 Energy Predictions. The ten predictions themselves are presented in summary at the bottom of the pages. For further reading please visit our website or ask for a hard copy of our Energy Predictions.

I hope you will find this magazine interesting reading.

Peter Bommel
Global Leader, Energy & Resources

Colofon

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Left: Dick Benschop, right: Marcus van den Hoek

1. M&A: Converging on emerging markets

The drive to secure global

energy resources will likely make emerging markets the fastest-growing area for M&A during 2011. According to data from Dealogic, deals by companies in emerging markets (across all industries) already account for 30 percent

of global M&A activity, while Europe's share has fallen to 29 percent — the lowest in 12 years.

M&A activity in the energy industry appears to be occurring in waves, with the oil and gas

companies from emerging markets leading the way. First there was the Chinese wave of M&A activity in Africa, Asia and now South America, as national oil companies from China moved aggressively to get a foothold in these resource-rich nations.



East leapfrogging West

The days are over when trends started in the West and moved gradually eastwards. Tomorrow's trends will be a lot jumpier, and they can start anywhere around the globe – or in different places at once. Dick Benschop, Shell's Vice President Strategy, shares his views with us on the implications of this new order for what in his job are the core issues: fossil fuels, mobility and the environment.

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The second wave, which has already begun, involves the next tier of national oil companies, which consists primarily of state-owned companies from Russia, South Korea, Brazil and Malaysia. The third wave, which is just beginning to take shape,

will likely consist of state-owned companies from India and the Commonwealth of Independent States (CIS).

During this period of industry re-adjustment, a company's post-merger integration (PMI)

skills will be paramount, particularly in emerging markets where complex financings, cultural differences and uncertain regulatory environments often impede the realisation of anticipated synergies. Companies must be wary of a number of

post-merger risks such as the quality of financial figures, the complexity of synergy goals and the viability of the execution plan. Structural differences also come into play, particularly in transactions involving the acquisition of independent

As populations age and demand sags in developed Western markets, multinationals seeking growth are shifting the focus of their activities to more promising markets. Shell is no exception, says Benschop. Closing down refinery capacity in the West to expand capacity in the East is part of this bigger picture. “The megatrend has been strengthened by the economic crisis. Emerging markets were initially hit by the slump in demand from their key export markets, but they have bounced back amazingly quickly. In the short to medium term, steep growth paths are projected for China, India, Indonesia, Brazil and other countries, while developed markets remain more troubled by uncertainty and volatility.” This has consequences for Shell. “Chemicals production naturally follows and even slightly outperforms GDP growth,” Benschop explains, “but with energy efficiency improving, fuel consumption lags GDP growth, even in emerging economies. So new refineries need to be close to where the growth is – in emerging markets.”

What makes these emerging markets so enticing? They have long been export-oriented and thus heavily dependent on European and US consumer trends. But their own population, long merely a pool of cheap labour, is developing a taste of its own for consumer goods. “Hundreds of millions of people in these countries,” says Benschop, “are rising from poverty to a relatively middle class income position. It’s a joy to watch, and it’s driving market dynamics. Their lifestyle is changing, and they’re coming to a point, for example, where they can afford cars.”

A mobility mosaic

The trend of rising mobility in emerging countries is at odds, however, with other global trends, such as dwindling fossil fuel reserves and the environmental need to cut carbon emissions. How will this play out? “A range of new technologies is emerging, each promising in a limited number of applications, but none offering the ease of transport, the high energy value and the versatility of fossil fuels,” says Benschop. Long term, therefore, he sees them existing side by side, with no one winner. “We call it a mosaic. Multiple, partly overlapping technological developments, with geographical differences depending on the resources available and on countries’ ambitions.”

companies by state-owned entities. Our experience in emerging markets suggests that PMI risks in cross-border transactions are driven not primarily by external factors like the nationality of the buyer or target but by internal structural risks.

Given the importance of PMI to the successful execution of cross-border transactions, companies targeting acquisitions in emerging markets will need to improve their abilities to navigate all sorts of merger-related risks. This means developing hard analytical

To start with, improving fuel efficiency is a universal trend. It is necessary, and it is being driven in the EU and the US by legislation. Benschop sees hybridisation as a way of achieving this. “The conventional combustion engine will increasingly incorporate electrical components.” Another early option is biofuel. “Biofuels are particularly big in Brazil, with its huge agricultural sector. The US and EU are also running with it. But it is unlikely to be big in China, where less biomass is available.”

Full-electric cars will be a niche product at first, and maybe permanently

Electric cars a niche product

Electric mobility is unmistakably on the rise, but Benschop expects the pace of market penetration to vary geographically. “Plug-in hybrids are interesting for consumers. For full electric cars, consumers would have to adjust their behaviour to the car’s recharging needs and range. So I think they will be a niche product at first, and maybe permanently.” Meanwhile, however, China is betting heavily on the electric car. A preference based on more than just reducing carbon emissions, Benschop thinks. “It’s also based on strategic considerations. China sees an opportunity for itself in the mass manufacture of everything from lithium-ion batteries to fully-fledged electric cars, for its own market and for export markets.” This dovetails with the next Chinese five-year plan, which has China moving up the value chain from its current position of low-wage manufacturing powerhouse to activities involving more highly-skilled labour and better margins. “The Chinese are busy deciding which sectors they want to specialise in, and energy ranks high on their wish list. They already own most of the world’s battery patents.”

skills as well as softer change-management capabilities in order to complete these transactions in a way that improves, not hinders, performance.





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2. Refining: The industry moves east

The global refining industry has had its share of volatility over

the years. Tight worldwide spare capacity led to a peak in refining margins in 2007 while falling demand during the economic recession led to estimated global utilisation rates of 80 percent, resulting in depressed refining margins only two years later.

During 2009, five new refineries were brought online, all from emerging nations in the Middle East and Asia. One industry commentator predicts that between 2011 and 2015, an additional 2.75 million barrels per day of refining capacity will

be added in Asia. This is the great refining continental shift; the largest consuming centres of the west moving to the largest potential consuming centres of the east.

Hydrogen back in the picture

The wildcard in the mobility game, Benschop believes, is hydrogen. Ten years ago, the hydrogen economy was heralded as our future, but since then the theme has disappeared from front pages. Technological developments have continued, however, and all the components needed for the fuel cell car are ready. It's now a matter of up scaling to mass production and installing infrastructure. Germany, working with corporate parties including Shell and Daimler, is willing to give it a serious go. "Electric cars are a hype now," Benschop says, "but everywhere I travel, I see hydrogen re-emerging. In that mosaic I was talking about, fuel cells can be a very efficient solution, especially for larger cars and commercial vehicles." Economic rivalry will speed up the transition, he thinks. "If Germany takes the plunge, Japan and potentially China cannot afford to stay behind."

All the components needed for the fuel cell car are ready

To complete the mosaic, Benschop sees a growing role in mobility for natural gas. Compressed or liquid natural gas is an eminently suitable fuel for trucks and ships, as it produces less carbon and no SOx or NOx pollution. And availability will not be a problem for many decades to come, as known gas reserves are actually growing.

Gas downstream developing

Indeed, Shell's strategic focus has shifted to give more prominence to gas, and particularly to being the leader in LNG and a big player in the exploration and production of unconventional gas. "In the US, unconvensionals have triggered a revolution, lifting the country's estimated gas reserves from 35 to over 100 years' worth, and making imports unnecessary. This has had a knock-on effect on the global

market. For one thing, LNG produced in the Middle East with the US in mind is now looking for another destination. At the same time, by copying techniques used in the US, other countries like Australia and China can tap into their own unconventional reserves." Shell's technological know-how, built up in the US, is now coming in particularly handy in China, where the company is engaged in early-stage exploration of unconventional fields in a joint venture with CNPC. With gas now in plentiful supply, Benschop sees a "gas downstream" developing, with a whole new dimension in applications. Besides in transport, gas could feature importantly in distributed power generation, fuelling combined heat and power and micro-CHP units or gas-fired heat pumps. "With a smart grid in place, we could see more gas-fired power generation close to consumers rather than in big plants. Transporting gas is more efficient than transporting electricity."

A weapon in the war on greenhouse gases

The other strategic value of gas, Benschop points out, is the role it can play in fighting climate change. For one thing, it is an ideal backup to renewable power generation. "In Spain, where the share of solar, hydro and wind in power generation is already high, we can see how unreliable these sources are. So you also need a significant number of conventional plants. But their utilisation is low. This is an emerging problem in the power generation mix that has to be addressed. What could help is to base payments to power companies not on the power they generate but on the capacity they uphold."

But in the next twenty years, there is another way gas can help the environment, says Benschop. "Replacing coal-fired power plants by gas-fired ones is a fast way of cutting carbon emissions in half." It disappoints him that emission targets take no account of the time value of abatement. "A tonne of CO2 saved now is worth more than one saved on 31 December 2019. The faster we reduce greenhouse gas levels, the greater the benefit to the environment. Natural gas can play a vital role here. The new abundance of gas has only been partly reflected in policy-making around the energy mix. From that point of view, I dare say that exploring unconventional gas in China, and thus helping China to

Why is this considered to be a monumental change? Because Asian oil companies, representing the fastest growing and potentially the largest energy consuming market, will, and may *already*, possess the market power historically

enjoyed by western international oil companies. Their size, government support and financial strength allow Asian energy companies to invest in building larger, complex and efficient refineries and chemical plants which are designed to serve

the requirements of the Asian markets. The implications for the Asian refining sector are numerous and positive, albeit currently challenging.

The magnitude of this shift reflects Asian economic growth

rates. Although Chinese gross domestic product or GDP is forecast to slow somewhat over the next five years, it is nonetheless likely to remain impressive. A recent publication by the *Economist*, "The World in 2011," estimates Chinese GDP



dampen growth in coal-fired power generation, could prove to be Shell's single biggest contribution to the fight against climate change."

No future scenario comes to mind that does not depend on CCS

We need CCS, period

After 2030, gas can continue to feature sustainably in the energy mix, combined with carbon capture and storage. CCS has a long way to go, Benschop agrees. "Carbon capture is still at the very beginning of its learning curve. The technology will get better and cheaper going forward. It's something we as a society need to think about, though. No future scenario comes to mind that does not depend on CCS. We need

it to achieve the deep reductions we're aiming for. And this is an area where Europe and the US can still nudge ahead in the technology race - provided they don't wait too long."

The Netherlands as a gas country has the tradition, the assets and the expertise to be the CCS country par excellence, Benschop feels. "The global megatrends are not moving our way. So we need to buckle down and focus on one or two things we're really good at."

Who is...?

Dick Benschop
Vice President Strategy
Royal Dutch Shell Group

Dick Benschop joined Shell in 2003. In 2009 he became Vice President Strategy for Royal Dutch Shell Group. Before that he held positions in Shell Energy Europe and in the Gas & Power business in Malaysia. Prior to joining Shell he worked in various functions in Dutch parliament and in the Dutch Labour Party. He was Deputy Minister of Foreign Affairs from 1998 to 2002. Dick studied History at VU University Amsterdam.

Marcus van den Hoek
Dutch Industry leader Energy & Resources
Deloitte

Marcus van den Hoek is the leader of Deloitte's Energy and Resources practice in the Netherlands. He has over 25 years of experience in consulting in the industry and served in several management roles in the last 15 years. He was Consulting leader in the Netherlands from 1998 until 2006. Marcus joined Deloitte in 1997. He holds a degree from Wageningen University.



growth at 8.4 percent; India follows closely behind with 8.2 percent and Vietnam at 7.0 percent. In comparison, annual growth rates are predicted to be significantly lower in the West, at no more than 1.5 percent in the U.S., 1.3 percent in the United

Kingdom, and 1.1 percent in the Netherlands.

But it's not just GDP growth that is striking. Asia has been described as the "one billion car market." This prediction reflects changing views about Asia, and

especially China, from only a few years ago. Furthermore, the Chinese government is looking to re-educate its people in the "manners" of consumerism. By providing for targeted tax incentives, rebates and price concessions, the government

hopes to increase consumption by China for both imported luxury products as well as for locally manufactured products.

What lies ahead for E&P?



Meb Somani has worked for 20 years in the oil & gas industry and another eight as an oil & gas sector dealmaker and investor at Barclays. His latest deal had him joining the board of promising Dutch newcomer Tulip Oil. He shared with us his unique double take on exploration and production trends around the globe.

Oil prices in comfort zone

Long term, I see a continuing increase in global demand for oil and gas, as supply struggles to keep up with the needs of energy-hungry emerging markets. This will involve a lot of investment across the value chain, from E&P through infrastructure, transport and refining. The role of technology is to help secure that supply cost-effectively. There's a lot of oil around - it's a matter of getting it out. Oil is an inverted market, where the most expensive oil is produced in preference to cheaper oil, provided it's not produced at a loss. The big reserves are in deep water and oil sands, which thus determine the marginal cost of production. OPEC puts the comfort zone at oil prices of \$70-90 a barrel, and that may well be sustainable in terms of demand. What could change the game is significant supply coming onto the market at \$40 a barrel or less - which would make it hard for OPEC to keep the price at \$80. In this context, the massive potential supplies in Iraq, which could at some point spill onto the market, are a wildcard.



3. Nuclear power: Electrifying emerging nations

A nuclear energy renaissance is

shaping up around the world in some unlikely regions, perhaps none more than in emerging locations that include the Middle East and China. The Middle East region is home to roughly 75 percent of the world's oil reserves as well as to

the largest global oil producer, Saudi Arabia. Many of these oil-rich nations are embarking on a new roadmap destined to shape future energy usage in the Gulf region. Kuwait, the fifth biggest oil producer among OPEC members, plans

Reactions to Gulf oil spill a blip

As far as deep water goes, the Gulf oil spill will have an impact. In the short to medium term we'll see tougher standards in the US, but other regions will suffer knock-on effects, putting some upward pressure on production costs. Some areas will be restricted and come into play later, as price and the fiscal situation demand. In time it will be seen just a blip in that offshore drilling will continue.

There's a lot of oil around - it's a matter of getting it out

US shale gas drilling unsustainable

In the US an awful lot of drilling is taking place because the drilling licences on prospects will otherwise expire, or on the basis of commitments made by financing partners. The financing is often coming from large European or Asian buyers, often NOCs. Those wells will get drilled almost regardless of healthy economics. That's an unsustainable situation that could depress prices for several years to come. The marginal cost of producing American shale gas is not clear, with estimates ranging between \$4 and \$8 or more. Some of the low end estimates may not reflect full cycle cost and volumes. At current gas prices, though, we see an M&A buying opportunity in conventional and unconventional gas. The big transactions seem to be in shale gas with premium prices being paid for access to technology. National oil companies are buying to get exposure to technology which they can deploy in their home countries.

Eastward pull away from Europe

With gas demand temporarily under pressure due to the economic crisis, projects initiated long ago under different conditions continuing to deliver gas, and LNG destined for the US now coming to Europe, there's a glut in Europe for now. How long it will last is hard to say, but what I do see is a reversal of the current dynamics. The LNG supply overhang will get pulled eastwards as demand there picks up. There is also an eastward pull on pipeline supply investments from Russia and the CIS. You have to wonder whether megaprojects like the Nabucco pipeline, taking gas through Turkey to Austria, will take off, as the economics for some of these are questionable. Supporting demand, utilities will increasingly switch to gas-fired power generation. All of this will be beneficial for European price levels. So all in all, sustained low prices are

unlikely. As for shale gas in Europe, the jury is out. The rocks may have the potential, but the circumstances are different. It's likely to be ten years before significant volumes come to market, so maybe you have a window of relatively strong gas prices in the second half of the decade until shale comes in. Even then, production costs will be closer to \$8 than to \$4.

China's unconventional

China has been trying for ten years to encourage production of its coal bed methane with mixed success. Now Chinese companies are investing in US shale gas to access technology, and they're teaming up with Shell and others at home. Strong commitment, central planning and sufficient capital can help. But success in the US was based on the opposite model: experimentation, a large number of players with acreage and a profit incentive. Take ten geologists and put them in one company, and they'll drill two wells a year. Put them in ten companies, and they'll drill ten or even fifteen wells a year. So I suspect it will take a similar timescale to that in Europe for shale gas to have a material impact in China.

Private sector capital

Alongside the capital of NOCs and sovereign wealth funds, I see more deployment of Asian private capital, from financial and industry players, in the natural resource space. This will make profit more of a driver of investment there, rather than strategic and political considerations.

Who is...?

Meb Somani

Head Oil & Gas investments
Barclays Natural Investments

Meb Somani is Head of Oil & Gas investments at Barclays Natural Investments (BNRI). He has invested in and holds board positions at several oil & gas companies in BNRI's portfolio, including Netherlands based Tulip Oil. Meb was previously Head of Oil & Gas at Actis Capital, a leading private equity investor in emerging markets. Prior to that he was Managing Director at Harrison Lovegrove & Co. Before that he was at Texaco and at Shell in senior petroleum engineering and asset management roles. Meb is a Chartered Petroleum Engineer and a long standing member of several industry associations. He holds a First Class Honours degree in Petroleum Engineering from Imperial College, London and an MBA from Henley Management College.

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to build four nuclear power reactors by 2022, joining a push toward atomic energy among Gulf countries. China, the second largest economy and the largest oil importer is planning to increase its nuclear capacity more than tenfold to

80GWe by 2020 and 400GWe by 2050. So why are these nations increasing the use of nuclear power?

Several answers come to the forefront, including diversification in order to decrease the risk

of over-relying on a single fuel source for electricity generation and reducing the use of oil now to save it for future generations, and, in the case of China, emission reduction.

Nuclear power appears to be

the best choice for these nations and many others in terms of providing diversified, sustainable, independent and clean energy close to where it is needed. Integrating nuclear power into a country's energy infrastructure is not without its challenges.

Looking at local solutions

Where will we find the solution to tomorrow's energy needs? Close to home, says Jeroen de Haas, CEO of Dutch energy company Eneco. Deloitte's Global Energy Leader Peter Bommel asks him why.

When real costs are taken into account, nuclear is often more expensive than fossil fuels. Nuclear energy takes a long time to produce. The process of permitting, environmental impact studies and the length of time from planning to design

and construction of the nuclear infrastructure typically lasts no less than several decades. Nuclear waste is still considered to be more controversial than fossil fuel emissions, often requiring large underground storage facilities. Despite these obvious hurdles,

perhaps the most important challenge for the industry is the shortage of nuclear talent within the industry.

One way governments are rectifying this situation is to implement workforce

development programs in the hopes of growing talent in the fields of construction, manufacturing, engineering and nuclear power. In particular, there is a short-term need for technical experts who can deploy and maintain nuclear projects. In the





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long-term, governments should consider campaigns that educate the general populace on the benefits of nuclear power in order to stimulate interest in the field.



4. Renewables: Here comes the sun

The sun delivers more energy to the earth in an hour than the entire world consumes in

a year. This fact alone makes it easy to understand why experts and laymen alike believe solar energy offers vast potential as a renewable resource. Many countries around the world are investing aggressively to realise this potential energy source as



Left: Peter Bommel, right: Jeroen de Haas

they seek energy independence and ways to reduce greenhouse gas emissions.

Around the world, people have grown accustomed to seeing solar arrays on the rooftops of factories and office buildings as well as

on the grounds of government buildings and military installations. What has been conspicuously absent in most places, however, has been wide-scale consumer adoption. That absence is now beginning to change.

Solar technologies will increasingly trickle down from industrial users to be embraced by residential consumers and small business. Just how fast solar energy can become mainstream will depend heavily upon how quickly solar technologies can achieve grid

parity — the point at which the cost of electricity from renewable sources rivals that of electricity derived from more traditional sources such as coal, oil, natural gas or nuclear. The time it takes to achieve grid parity is a function of several factors including

PB: On a global scale, energy demand is set to increase by 50% in the next 30 years, due to the world's growing population in general and its growing middle classes in particular. How are we going to keep pace with that?

JdH: To respond quickly enough to increasing demand, I think we are going to have to generate a lot more of our energy locally as opposed to centrally, using renewable technologies like wind, solar and biomass.

PB: In Africa, I can imagine villagers sticking solar panels to their roofs and blissfully enjoying energy independence, but what about China's megacities? With such massive concentrations of population with growing energy needs, surely you can't avoid building large-scale power plants? In fact, power plants are springing up like mushrooms in China.

JdH: Well, yes, but distributed energy is also mushrooming there. China needs more power plants now, but it won't be long before dwindling fossil fuel supplies and unacceptable carbon emission levels make further expansion of conventional power generation capacity impossible. Besides, distributed power generation can help China achieve its much-wanted energy self-sufficiency.

PB: Aren't nuclear power plants a good solution for countries like China? No fossil fuels, no carbon emissions...

JdH: The world cannot do without its current nuclear plants, and will probably need more of them before it makes the transition to renewable energy. But as long as nuclear plants cannot be made intrinsically safe, they are not sustainable and we would do better to avoid them.

PB: In that light, how do you view plans in the Netherlands to build another nuclear plant?

JdH: In my view a new nuclear plant is not a desirable option for our country. We don't need it for our security of supply, nor does it increase our independency of supply. High upfront fixed costs but low variable

operating costs could also reduce appetite for future investments in renewable energy. The energy companies who want to build the plant, EDF and Delta, are international players with international agendas. Apparently they can make a business case for a huge project like this. My own company can't. Not without considerable financial support from the Dutch government at least, and I have understood that government commitment is limited to the license only.

PB: So should the Dutch government then deny a licence to these parties?

JdH: No, I believe in letting the energy market operate as freely as possible, rather than imposing restrictions on moral grounds. So by all means, give them a licence. But what the government shouldn't do is back the colossal loans and insurance costs these companies are going to need – that would in effect constitute a considerable subsidy. Without that government backing, it's unlikely the project will take off.

A new nuclear plant is not a desirable option for our country

PB: In the renewable space, we also see big projects like offshore wind farms, Spain's solar parks and Desertec. What will they contribute to the future energy mix of Europe?

JdH: The technology is all proven. The bottleneck is logistics, getting electricity over seabeds and across national borders to where it's needed. Today's national grids are not sufficiently connected. Ideally we would have to have one big European grid, a kind of giant copper plate

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local climate, utility rates, and government support.

Several new studies suggest that photo-voltaic panels on residential and commercial buildings could achieve grid parity — i.e. with electricity grid retail prices by

2020 in many regions, and it could become competitive at utility-scale in the sunniest areas by 2030.

But are solar panels really ready to take their place at major retailers? Early indicators suggest that the

answer is "yes" — if appropriate policies are in place. Consumers can now purchase rooftop panels at many retail stores made possible by government policies which provide subsidies for residential solar applications as a means of spurring a lagging job market.

Analyses conducted by the Paris-based International Energy Agency (IEA) also suggest that major gains will be made in concentrated solar production (CSP) within the next decade. The IEA expects CSP to become competitive for peak and



where electricity can be buffered, reducing the need for storage. This calls for huge investments, and for a policy of mutual trust and courage at EU level, but currently it's every country for itself. And that is blocking progress. For instance, what interest does nuclear powerhouse France have in connecting Spain's solar parks to Northern Europe? To be honest, I'm not optimistic Europe will get its act together any time soon.

PB: What is also making the sector shy of big investments is that governments keep changing their policies with regard to renewables. Subsidies are here today and gone tomorrow.

Ideally we would have to have one big European grid, a kind of giant copper plate

JdH: Meanwhile, conventional energy is in fact heavily subsidised, if

mid-peak loads by 2020 in the sunniest places, once again if appropriate policies are adopted.



5. Water usage: Every drop is precious

Present-day economic challenges have created turmoil

within the entire energy industry, pushing up energy prices and threatening parts of the value chain that include water. Water availability affects hydro-electricity and thermal power generation as well as playing a critical role

you take into account every penny the government spends on security of its fossil fuel supply, plus the subsidy on emission rights it grants to coal-fired plants. Phase that out, and the transition to renewables would be just five years away!

PB: So assuming these big renewable projects are a long way off, that brings us back to distributed power generation. How does Eneco intend to adapt to the radically different energy landscape?

JdH: Traditional power companies are asset-driven. Every twenty years or so, they put their thinking caps on to choose their next big investment – in a gas-fired or a coal-fired plant, or maybe a nuclear one. When they've made up their minds, they can sit back again for years, in the knowledge that there will always be a market for their electricity. These companies are a dying breed. The energy company of the future doesn't deal in commodities, but in solutions.

PB: Local solutions?

JdH: Yes. It's part of the cradle-to-cradle principle, where we meet our primary needs, including energy, close to home, and deal with our waste flows close to home. The smaller these cycles are, the better. The dominant economic model of the past fifty years was based on specialisation, upscaling, centralisation. It was efficient to get our energy from a remote source, because it meant that we could go on consuming without being faced with the consequences. The attending problems for people and planet were in fact exported to another location, where they no longer seemed to be our problems. But in a globalising world, we can't do that anymore - and more and more people just don't want to. They're eager to buy into renewables. They actually enjoy generating their own electricity, and tend to use it more carefully. Communities feel ownership of their local energy sources. When we wanted to build a wind turbine in Scheveningen in 1996, people picketed against it. Now, years later, we wanted to take the outdated turbine down – and people picketed to save it. They've even given it a name now: Dune Bird. So renewables are really taking flight! That is something I am optimistic about and I look forward to the flight, including the unavoidable turbulence, because the destination is worth it.

Local solutions are part of the cradle-to-cradle principle

Who is...?

Peter Bommel

Global Energy & Resources Industry Leader
Deloitte

Peter Bommel has a distinguished career as an Energy & Resources specialist and as an audit partner in Deloitte's Dutch member firm. He has qualified as both a Dutch RA and a U.S. CPA. Prior to joining Deloitte in 1999, Peter worked for several companies in financial management positions. He lived and worked in the Western Hemisphere for almost 8 years, serving, among other jobs, as CFO of an integrated mining company.

Jeroen de Haas

CEO
Eneco Holding N.V.

Jeroen de Haas was appointed Chairman of Eneco Holding's Executive Board on 1 January 2007, having been an Executive Board member since 2000 and Vice Chairman since 2006. From 1996 to 2000, he was at the helm of energy company cooperative Enercom, six members of which merged to form Eneco in July 2000. Previously, De Haas held an executive position at Roccade. He studied Dutch law at the University of Utrecht.

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in nuclear-generated power, bioethanol production, coal and petrol from conventional crude and Canadian oil sands. In short, water is the common denominator among all energy options.

Six billion people in the world today are currently using about 54 percent of all accessible fresh water. Within the next 15 years, humanity is expected to consume about 70 percent of fresh water resources. If current predictions hold true and per

capita consumption of water continues to rise, humankind will likely be using over 90 percent of all available fresh water by 2025. This dilemma is highlighted in one recent study where researchers evaluated the fuel lifecycle for five fuel pathways: bioethanol from

corn, bioethanol from cellulosic feedstocks, petrol from U.S. conventional crude obtained from onshore wells, petrol from Saudi Arabian crude, and petrol from Canadian oil sands.

The analysis revealed that the



Happy energy

Professor Wubbo Ockels of Delft University sees the transition to renewable energy sources as the next giant step in human development. A step we're on the brink of taking.

amount of water used to produce each fuel type varies significantly from one country to another. In oil exploration and production, water consumption depends on the source and location of crude, the recovery technology, and the amount of produced

water re-injected for oil recovery. The study results also indicate that crop irrigation is the most important factor determining water consumption in the production of corn ethanol. Nearly 70 percent of U.S. corn used for ethanol is produced in regions

where 10–17 liters of water are consumed to produce one liter of ethanol. Water requirements for switchgrass ethanol production vary from 1.9 to 9.8 liters for each liter of ethanol produced.

Meanwhile, water is consumed

at a rate of 2.8–6.6 liters for each liter of gasoline produced for more than 90% of crude oil obtained from conventional onshore sources in the U.S. and more than half of crude oil imported from Saudi Arabia. For more than 55 percent of crude oil

Sustainability a matter of civilisation

"The Netherlands has always been a nation of merchants, and I think that explains why we cling to our fossil fuel based energy mix. But simply going for what is cheapest now puts us at the very bottom of the ladder of civilisation. Even a tiny step up the ladder, other values come into play. If we exercise caution, think long-term, care about what kind of world we leave to our grandchildren, then we're operating on a higher ethical level. And we accept that quality – sustainability - comes at a price.

In developing a sustainable world, we should follow the pattern of nature itself: diverse, diffused, organic

Education, fostering knowledge and passing it on to future generations, is another aspect of sustainability that our country has been neglecting. Our spending on education and research as a percentage of GDP is among the lowest in Europe. This may threaten the development of talent to build our sustainable future. And it has another consequence as well: rather than a knowledge-based society, we're steadily becoming an opinion-based society, where opinions demand the same respect as facts, and scientific findings are seen as just another opinion.

Bottom-up movement

It's no surprise, then, that our government hasn't succeeded in putting the Netherlands on the sustainability map. We've actually lost ground in recent years. But the Netherlands is ultimately a smart country, and it is getting its act together. In the past three years there's been a flurry

of bottom-up initiatives. Towns, groups of farmers starting energy co-ops. Our world-leading market gardening, flower cultivation and cattlebreeding sectors are brimming with sustainable innovation actions. And then there's the corporate initiatives. I'm amazed how fast awareness is catching on in the business community that companies have to change the way they do business if they want to still be around in another twenty years or so. All this is happening without any government push. It has nothing to do with innovation platforms, subsidies, or stimulus measures.

Along this vein, I'm certain that electric cars will catch on so quickly that our government won't know how to deal with the situation. A wide range of cute electric cars is coming onto the market, because manufacturers see a demand for them. The government insists that before we can make the transition, we need to install two coal-fired power plants so we have enough electricity. But this is not correct, we have sufficient production already. The problem with today's electric cars is their range. They need charging up after just 150 to 200 kilometres. For commercial and fiscal reasons, energy companies and the government would like to see this happen at dedicated charging poles, while consumers would much prefer to plug the car in a regular socket at home. And with the current generation of cars, they can.

I wouldn't be surprised if most wind turbines were gone 50 years from now

Solar dominance in nine years

The same struggle between innovation and vested interests is going on for solar energy. It's a viable option for power generation even in a

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from Canadian oil sands, about 5.2 liters of water is consumed for each liter of petrol produced. These figures paint a scenario that is unsustainable.



6. E&P operations: Exploiting hidden depths

Technology remains a critical

component in petroleum exploration and production (E&P) operations. From seismic surveys to deepwater drilling and artificial intelligence, the operations of today's oil companies' exploration and production departments

temperate climate like ours. I foresee more and more private households in the Netherlands buying solar panels in the near future. They're easy to install, and even at their current price and without subsidy, they offer a cheaper alternative to the electricity supplied by power companies: 17 versus 20 cents per kWh. Companies will be slower to jump on the bandwagon, as they pay much lower electricity prices – you see an inverted economy of scale here, courtesy of the government.

Meanwhile, the power companies are spreading the story that we first need to have a grid that can absorb the excess electricity produced by people's solar panels, but these are just more stalling tactics. People don't have to be able to feed in to benefit. Their overproduction, and thus their missed income, won't amount to very much. Power companies want us to think the grid is essential so they can maintain control over power supply. The beauty of distributed power generation, however, is that we may not need to maintain such a tight grip, we can afford to let it develop organically.

Nine years from now solar cells will produce more electricity than all the world's power plants together

Going forward, moreover, the price of solar panels will go rapidly down. Already, a US company can produce them at \$1.40 per watt-peak, and reports from China suggest photovoltaic film will soon be produced at a tenth of this price, \$ 0,14 per watt-peak. This means we'll see a similar

pattern to what happened with internet and mobile phones: penetration of solar will at least double every year, and nine years from now solar cells will produce more electricity than all the world's power plants together.

I'm amazed how fast awareness is catching on in the business community

There are two problems facing this model of power generation. One is efficiently storing energy generated when sunshine is abundant, the other is servicing large industrial users. If they are eventually to use the excess energy produced decentrally, the grid will have to be in place. We have another five to ten years to work on this, though.

Wind a stopgap technology

Wind energy is fantastic now, and should remain so for another 20 years. It supplements solar because it goes on during the night and under cloud, and current production costs are very competitive. But I wouldn't be surprised if most wind turbines were gone 50 years from now. Wind is a transitional technology, but the story doesn't end there. What would constitute a happy ending is solar power - plus a wonderful storage medium. We're still waiting for a real breakthrough in the latter field.

resemble a vibrant, high-tech nerve centre easily mistaken for use in deep space exploration. Motivated to improve competitive advantages and efficiencies, as well as by the reward of the "next big find," the oil industry

has historically been supportive of exploration and production technology development. The technologies used may serve to increase the probability of a find, enhance the ability to extract heavy crude and the capability to limit risks and

costs by remotely operating rigs in extreme location and weather areas such as the Antarctic.

Two giants in their respective fields, HP and Royal Dutch Shell PLC have teamed up to develop a

next-generation wireless sensing system to acquire extremely high resolution seismic data to find and measure underground reservoirs of oil and gas. This new technology improves on traditional 3D techniques by allowing images to be created

Revolution

Renewables aren't simply a replacement for fossil fuels, they're the next giant step in our cultural development. Once people understand this, the momentum will be unstoppable. Look at it economically. In our society, we spend barely 10% of our income on basic necessities, the other 90% goes towards things that make us happy. Towards meaning. As soon as the issue of sustainability shifts from the 10% to the 90% category, we're there. Everybody will want to be a part of it.

The post-industrial revolution means playing with nature to our advantage, looking for win-win outcomes

In developing a sustainable world, we should follow the pattern of nature itself: diverse, diffused, organic. Avoiding unmanageable risks (nuclear waste!), learning from each other, fine-tuning as we go along. Since the industrial revolution, our strategy has been to bulldozer nature and impose our own, artificial order on it. But we humans aren't artificial – we're a part of nature, and it's a part of us. The post-industrial revolution means playing with nature to our advantage, looking for win-win outcomes. And that's going to bring us joy. I call that Happy Energy."

From a knowledge-based society, we're steadily becoming an opinion-based society

Who is...?

Wubbo Ockels

Professor at Delft University, and Groningen University
Head of Interfaculty Institute ASSET, Delft University

Wubbo Ockels enjoys celebrity status in the Netherlands as the first Dutch astronaut to travel to outer space in 1985 with the Spaceshuttle Challenger. More recently, he has made headlines with his solar race car Luna, his ladder mill, and his Superbus. He has a PhD in nuclear physics, and worked many years for the European Space Research and Technology Centre (ESTEC). He is currently a professor at Delft University and head of its Interfaculty Institute for Applied Sustainable Science, Engineering and Technology (ASSET), while also holding a special professorship at Groningen University.

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on land rather than in a marine environment.

Steam Assisted Gravity Drainage (SAGD) is another advanced oil extraction technique that is greatly enhancing the industry's production capacity. It is currently

being used in PetroChina's heavy oil E&P project in northwestern China's Xinjiang Uygur Autonomous Region. This new technology is extremely useful in boosting production of heavy oil, which does not flow when the temperature is below 80°C.

Norway's state-owned oil company Statoil has also made a notable breakthrough in E&P technology. Developed in partnership with the Stavanger-based company Seabed Rig, the drilling equipment features a patented encapsulated design,

which allows it to withstand extreme conditions and be remotely controlled from a surface vessel. The rig began testing during the summer of 2010, and it is likely to see action in deepwater and Arctic seas soon.



7. Electric cars: Giving automakers a jolt

Purchasing a new vehicle just got more complicated.

Consumers have always had plenty of options concerning the look and feel of their cars and trucks, but soon they will have just as many choices concerning what powers them. Automakers around the world are betting R&D

dollars as well as first-mover advantages that conventional powertrains will ultimately be replaced by nascent, climate-friendly technologies such as hybrid electric vehicles (HEVs), plug-in hybrids, pure electrics, hydrogen fuel cells, compressed





Timing is everything

Having spent years at the helm of KEMA, our country's flagship centre of energy expertise, Pier Nabuurs is the right person to run a few pithy energy predictions past. He's pretty certain about where our energy will come from in the ultra-long term. Navigating our utilities through the years in between is the challenge.

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natural gas, ethanol, clean diesel, or some other concept. The question is which of these choices have the power to convince consumers to switch?

To date, compressed natural gas is being used predominantly

in heavy vehicles and in fleet applications such as transit buses, semi-trucks, school buses, waste disposal trucks and delivery vehicles. Clean diesel has made significant inroads in commercial trucking, school, and transit bus fleets as well as with auto

buyers in Europe (i.e., BMW and Volkswagen), but it has not been as readily embraced elsewhere as a top consumer choice. Ethanol has gained widespread acceptance as a petrol additive but few countries other than Brazil, which has an ideal climate

and ample landmass to produce sugar-cane ethanol, see it as a viable replacement for petrol. Hydrogen fuel cells have now been successfully demonstrated in test vehicles but are thought to be a decade or two away from mass production.

Our great-grandchildren will live in a solar powered world.

Oh, no question. Ultimately solar will be the winning technology. The sun shines all day every day, and the solar cells to convert that sunshine into electricity are becoming smaller and more versatile by the year. We can stick them to windows, walls, roofs... I'm not saying this out of a shiny-eyed belief in technological progress, but based on my experience at Philips. The first CD players were put on the market for 1400 guilders. The lenses in these players were polished microscope lenses that cost 80 guilders to make. Further along the learning curve, we mass produced them in plastic, using a whole different technology, for just a few cents. For solar, we're at the very beginning of our learning curve, so the potential for cost reduction is enormous. Long term, homes are going to be practically self-sufficient energy-wise, and large-scale solar projects like Desertec can supply big users.

They will all drive full electric cars.

Same story. Battery technology is still in its infancy, so the current problems with range and recharge time will soon be solved, and prices will drop. Current models look very similar to the cars we know, but I'm sure designers will eventually become more daring to extend functionality and cut costs. Grid developments will easily keep pace with market penetration.

Conventional power plants will be millstones round the necks of utilities.

Indeed, the question that's worrying utilities is not whether the transition to solar will take place but when? Will it happen before their conventional assets have been written off? Going forward, it's becoming increasingly risky to build new coal- or gas-fired plants. The combustion engine technology is mature, so the scope for efficiency improvement is near zero. Meanwhile, the likely long-term trend of fuel prices is growth above inflation, so the amount of MWh your capex/opex euro buys will gradually decline. But the amount of solar or wind energy your euro buys will increase. Experts put grid parity somewhere between 2020 and 2030, and that's not even factoring in the price of carbon capture and storage. It's still a complicated choice, though, because we don't know

how fast renewable generation capacity will grow, and utilities want to be sure they can supply their customers. Companies keen to invest can still safely do so now, I reckon, but time is running out. The best choice in that case is a gas-fired plant. They take less time to build, and they can be combined with other technologies like coal gasification and biogas production.

Nuclear is in for a second peak

Right. A nuclear plant is the accountant's dream: costs and revenues are utterly predictable. Also important: they produce no greenhouse gases. These days plant safety is no longer an issue, while storage of nuclear waste is predictable from a technological point of view: utilities know, down to a milligram, exactly how much of it they will need to deal with and can plan accordingly. So many utilities, especially in the Near and Far East, are likely to build new nuclear plants.

Homes are going to be practically self-sufficient energy-wise

A global system for emissions trade will stop climate change in its tracks.

If only! It's proving hard enough to get an EU-wide system up and running, let alone a global one. Emissions trade as we know it now seems to have become an end in itself, a new way to make money, rather than a means to reduce carbon emissions.

Holland will again be famous for its windmills.

I'm not optimistic. ECN is strong in wind turbine technology, but we've lost the race for production, seeing the latest big contract for an

The move toward electric-powered vehicles is already underway. In the past few years, several commercial HEVs, which are powered simultaneously by batteries and fuel, have become mainstream. Toyota, Honda, Nissan, Ford, and General Motors

all have popular models on the market, and automakers are expecting this trend to continue. In 2011, HEVs will remain popular, but plug-in electric hybrids and pure electric vehicles are also likely to proliferate based on consumer demand. This likelihood is already

being reflected in production trends. Renault and Nissan have begun to produce electric vehicles en masse while General Motors, Toyota, and Ford have projects in the works.

Some see major automakers'

commitment to producing electric vehicles as acknowledgement that the transportation industry is on the cusp of a major transformation. This shift is being driven largely by technological advances, such as capacity to store and use energy in



Left: Pier Nabuurs, right: Marcus van den Hoek

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batteries in a cost-effective way, but perhaps even more so by consumers, who have an intense desire to move away from oil-based transportation due to concerns about energy security and climate change.



8. The 'China Effect': No signs of slowing down

Almost every news publication

has detailed China's increased involvement in the oil, natural gas and mining sectors. Trade between China and Saudi Arabia is forecasted to reach US\$60 billion before 2015. Companies based in China or Hong Kong participated



offshore park has gone to a foreign bidder. We could still carve out a position in the offshore wind market, creating meaningful employment for our country. A key advantage is our ports, which offer far more scope for offshore industry than those in the UK for instance. But we would have to move quickly, or others will beat us to the post again.

Going forward, it's becoming increasingly risky to build new coal- or gas-fired plants

in US\$13 billion of outbound mining acquisitions and investments in 2009 — one hundred times the amount spent in 2005. According to the International Energy Agency (IEA), China consumed 2.252 billion tons of oil equivalents

in 2009 — about four percent more than the U.S. China's Export-Import Bank and China's Development Bank has committed billions of dollars to construction, infrastructure development and loans to Ghana, Nigeria and other

resource-rich African countries. China National Offshore Oil Company (CNOOC) and China National Petroleum Corporation (CNPC) have committed to joint ownership and projects in Nigeria, Ghana, Angola and other African countries. What

these activities demonstrate is the ever-increasing investment ties China has with natural-resource-rich locations including Ghana and Nigeria, Saudi Arabia, Brazil, Australia and Canada.

Unbundling Dutch energy companies will marginalise them.

I used to say: if somebody can tell me what problem we're trying to solve by vertically separating electricity grids from production and trade, I can tell them whether unbundling is the answer or not. But I've come to see advantages to unbundling. When Dutch grids were still a part of bigger utilities, their policy was determined by what the company as a whole was trying to achieve. Now they're free to develop their own vision and strategy, and they're embarking on innovations, thinking how best to facilitate their various customers. This gives the Netherlands an edge in developing renewables and distributed power generation.

I foresee a phase of consolidation, followed by a shakeout

China will buy up pioneers in the renewable space and enjoy a free ride.

China is currently the world's biggest polluter in terms of CO₂ and other toxic waste. Don't think they don't know that. But they're still developing their country. So while they won't be first movers, they do have an interest in renewable technology, to clean up their own act - and ultimately to become a global supplier themselves. They're willing to pay whatever it costs. Remember, twenty years on when solar cells have become cheap, it will be too late for them to gain a foothold in that market. Buying into it will be expensive in that stage. There's no such thing as a free ride. Again, it's all a matter of timing.

The big energy players of the twentieth century will go extinct.

[Smiling] Not if they're KEMA clients! Energy companies have long been monopolies and had no incentive at all to change. This is still true in

many parts of the world, but for most western companies, those days are over. I foresee a phase of consolidation, followed by a shakeout. The smarter companies will survive, though. If you look at which companies in today's Fortune 500 were around 75 years ago and are still going strong, you'll see that most of them have over time moved into new areas of activity. They are companies that identified trends and made their move when the time was right. That will be no different in the years ahead.

Who is...?

Pier Nabuurs

CEO
KEMA

Pier Nabuurs is CEO of KEMA, an international authority in energy consulting, R&D, inspection, testing and certification. He joined KEMA in 2002 after a distinguished career at Philips and Océ. He held positions in R&D, purchasing and supply chain management and was the CEO of Océ Belgium and Océ's executive director of the BU Document Printing. Pier is involved in many of the discussions about energy systems of the future in the Netherlands. He holds a degree in electrical engineering from Eindhoven University of Technology.

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China's increased global reach through its banks, oil and gas companies and other State Owned Enterprises indicates that the Chinese government and financial system are capable of continuing to back its energy industry and secure long term

natural resources supply to fuel its economic growth. By committing resources, China can foster growth in these economies and create demand for its own manufactured products. One example of the 'China Effect' is the country's insatiable demand for

raw materials, which has helped to push Brazil's growth rates close to 9.0 percent during the first half of 2010. Australia can be proud of being one of the largest suppliers of commodities, raw materials, natural gas and other resources required to fuel China's growth plans.

Extending its quest for natural resources, China is strengthening its relationships with Canada's oil sands producers. During 2010, one vessel a month carried roughly 600,000 barrels of oil heading west to Asia. In addition, new pipelines are being built in



Sipko Schat



Alexander Alting von Geusau

Banking on the Asian boom

The flow of oil, gas and electricity in the booming energy markets of the Far East ultimately depends on another kind of flow: capital. We talked about what drives Asia's capital flows with bankers Sipko Schat (Rabobank), and Alexander Alting von Geusau (ING).

Canada to support the export of additional supplies to this region. An even bigger shift is occurring with Chinese investment in companies that are developing the Canadian oil sands.



9. The green economy:
Job creation through workforce development

Governments around the world have been betting massive sums of stimulus money that the green economy will deliver jobs. With unemployment rates at record levels in many nations, some see job creation as a do or die proposition for

The simple answer to what drives capital flows in Asia, both bankers confirm, is demand. "While economic growth in China is robust, the standard of living is still very low. The majority of Chinese live on a dollar a day," Sipko Schat says, "but that is about to rise to four or five dollars. If you do the arithmetic, it's obvious a wall of demand is on its way - first of all for basics like food and energy, and eventually for luxury goods." A middle class is emerging, mostly in China and India, of 400 to 500 million people –more than all of Europe together. "And the migration to the cities is massive," Schat adds. "China builds the equivalent of two Chicagos a year."

The real driver is to get control of the supply chain and reduce dependence on other countries

Soaring energy needs

Keeping up with the region's soaring demand for energy is a formidable challenge. In China, a new coal-fired power plant is coming on stream every week, but the authorities have woken up to the growing environmental problems this causes. A few years ago, they decided to focus on renewables, particularly solar and wind energy. "The thing with China is that in no time, all noses are pointing in the same direction and the necessary funding is on the table," says Alexander Alting von Geusau. "And when the Chinese decide to do something, they go big with it." The strategy is not only to green their own energy mix, but to become exporters of renewable technology. And it seems to be working.

"A key sponsor of the World Football Cup in South Africa was Yingli – a company nobody had heard of," he continues. "In just ten years, this Chinese solar cell manufacturer has captured an impressive share of the global market."

When the Chinese decide to do something, they go big with it.

Parallel to this renewable drive, China is also building nuclear plants. "The technology is coming from Japan, Europe and the US," Alting von Geusau remarks. "although Europe hasn't built plants of its own in the past decade, and has no state-of-the-art technology to offer."

Interest in oil & gas

Meanwhile, though, China and other emerging markets are still very interested in oil and gas. First of all in producing their own reserves. Where they lack specialist expertise, they seek cooperation with international oil companies. Shell, for instance, is in a joint venture for shale gas exploration in China.

The other obvious solution is buying oil and gas from other countries. But these days, much rather than buy the commodities, countries like China prefer to buy their way into foreign oil and gas industry – to own assets. First of all because they have the money for it. "With foreign exchange reserves in the trillions, which have traditionally been invested in bonds, China sees investments in foreign companies as a way to diversify," says Schat, "but the real driver is to get control of the supply chain and reduce dependence on other countries."

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economic recovery as well as political survival.

Where will these investment dollars flow and whom will they benefit? Generally speaking, wind turbine manufacturers are building plants in the markets

they intend to supply, prompting governments in Europe and North America to funnel funds into wind expansion as a means of creating high-value domestic jobs. Solar PV manufacturing, on the other hand, is following traditional labour costs since transport

and technical skill requirements are lower for lightweight, silicon-based products. This suggests that Asia could be the primary beneficiary of stimulus funds aimed at boosting solar production, regardless of where those monies originate.

Middle Eastern oil producing nations, many of which are also investing heavily in renewable projects, have been grappling with a shortage of skilled workers for years. Meanwhile, Germany, Scotland and other European nations are struggling to staff



Left: Marcus van den Hoek, right: Sipko Schat

Prime hunting grounds are Africa and South America, but Europe, Canada and Australia are also increasingly being targeted. "There was a time that the Seven Sisters could carve up the global oil & gas market between them," says Schat, "but the environment is becoming increasingly difficult for private companies."

M&A a strategic weapon

As such, emerging giants like China are competing in the energy M&A space with Western companies. An uneasy game, as the players don't seem to be playing by the same rules. "Western companies take decisions based on returns. In China, decisions come from the centre, and they're taken on the basis of budgets and targets," Alting von Geusau confirms.

"Employment is just as important to the Chinese as returns." So they are often prepared to pay a higher price – and bag the prize.

The Chinese are not so interested in developing technologies themselves. Copying is their forte

their clean energy investments with enough workers to make them viable. North America is not immune: researchers are predicting a shortfall of 24,000 energy workers in Canada by 2014 and The National Renewable Energy Lab in the

United States has identified the shortage of skills and training as a leading barrier to renewable energy and energy efficiency growth.

Going forward, governments will need to promote workforce

development, as well as job creation, if the anticipated benefits of the green economy are to be realized. This typically includes activities such as evaluating the nation's overall goals in relation to energy security and all types of energy

production; simultaneously assessing the current supply of talent in light of attrition from retirement and other factors; forecasting the demand for talent in specific areas, and analysing the gap between supply and demand. These efforts should

M&A is also a strategic weapon in the battle for know-how. "China's strategy is to look - mostly in the US and Europe - for technologies that they can quickly upscale, and then acquire the companies and the patents," Alting von Geusau says. "They're not so interested in developing technologies themselves. Copying is their forte."

China builds the equivalent of two Chicagos a year

Where this stops depends on where other countries draw the line, Schat thinks. Especially in our current, financially turbulent times, cash-strapped companies and governments have sometimes seen foreign wealth funds with fat purses as the answer to all their problems. But in the long run, giving in to this particular temptation could prove costly in terms of lost employment and self-sufficiency. "Some governments are becoming more wary of selling off their crown jewels – resources or technology - partly in response to public opinion."

A matter of mindset

The rise of the East looks set to continue, but there will always be dynamics, within the region as well. Powerful as China looks now, it is being overtaken by its own demographics. The one-child policy will lead to a shortage of labour, while caring for the elderly will place a heavy burden on society. "Before long, India will replace China as the world's most populous country. China will have to import labour," says Schat. "Still, they are looking ahead, and making efforts to move up the value chain. Really low-end manufacturing is already being outsourced to countries like Pakistan, and education is a high priority. China is currently turning out 165,000 engineers a year, many of whom have studied in the US. And the same is happening in India."

Neither bank is pricing in an Eastern boom-and-bust scenario in the foreseeable future. More than anything, this has to do with the mindset of the people there. As Alting von Geusau puts it, "The Chinese are practical. They just want to strike a deal, earn money, and if they have to work harder and longer hours, so be it." The realistic prospect of middle-class prosperity has fired ambitions in the East, ambitions that will drive the region's economic growth for years to come.

Who is...?

Alexander Alting von Geusau

Managing Director
Head Utilities
ING London

Alexander Alting von Geusau joined ING in 1997 in the project and structured finance department in Singapore with a focus on power generation in Asia Pacific. In 1999 he moved to ING Corporate Finance in Hong Kong to become the head of the utilities sector in Asia. Since 2003 Alexander has been based in London as ING's Head Utilities. Prior to joining ING, Alexander worked for ten years as a corporate lawyer in an international law firm. Alexander holds a Master's Degree in Law from Leiden University.

Sipko Schat

Member of the Executive Board
Rabobank Group

Sipko Schat has worked for Rabobank for over 25 years. He is responsible for Rabobank International's Wholesale Clients division and has been a Member of the Executive Board since 2006. Sipko has seats on the boards of Bank Sarasin & Cie AG, NM Rothschild & Sons Ltd. and Rabo Real Estate. He holds a degree in Law from Groningen University.

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ultimately result in the creation of a workforce development plan. Such a plan is necessary to guide governments to put training programmes in place, recruit new personnel into the energy industry, and apply succession planning techniques to ensure

knowledge is transferred to future generations.



10. Unconventional gas: From unusual to undeniable

Unconventional natural gas



Patience is a virtue

Researchers are by definition no pessimists, and that certainly goes for Ton Hoff, who spent eight years running ECN, our country's energy research hotspot. But he has learned over the years that energy supply transitions are slow processes – and for good reasons. Deloitte's Marcus van den Hoek looked him up one very windy day in Petten.

is any gas that is not located in porous permeable reservoir rock, and can include coal bed methane (CMB), tight gas, shale gas, and methane hydrates. While the industry's ability to access these unconventional energy sources is not new, its

ability to do so economically and on a large scale is. For the last five years, companies have been jumping on the unconventional bandwagon — and for good reason: technological advances have made it easier and cheaper to access these resources than

it is to produce conventional natural gas from permeable rocks in rapidly depleting fields.

Production potential from tight shales and other unconventional resources has already altered the world's natural gas outlook. With

the profusion of unconventional supplies, the U.S. now has 2,247 trillion cubic feet of proven natural gas reserves, enough to last 118 years at 2007 demand levels according to a recent study from the American Clean Skies Foundation. By 2035, shale gas

MvdH: Current science suggests that solar power holds far more promise than wind energy in terms of lower production costs and higher output. Will solar come to dominate the renewable space?

TH: Yes, the sun has high potential! Right now, wind has the benefit of immediacy: we already have wind technology at our fingertips, while solar technology is still up and coming. And our country by the sea is very suitable for wind turbines - but farther inland wind is not as constant, while sunshine is everywhere. So long term I think wind's contribution to the energy mix will level off, while the sun's contribution has the potential to go on growing for years to come. But wind energy won't disappear. I don't believe in a scenario where one technology emerges as the solution to all our energy problems. There's no such thing as a silver bullet. History has taught us that it's safest to rely on a mix of energy sources. It's not a question of "either/or", we're going to need solar AND wind AND nuclear AND fossil fuels AND, just maybe, in the distant future even nuclear fusion reactors.

There's no such thing as a silver bullet

MvdH: Are you optimistic about nuclear fusion?

TH: Not in the short term. I'm glad research in this direction is continuing, as the spin-offs are very valuable. The massive costs mean that this is a truly global research effort, with preparations now underway to build the first experimental fusion reactor in France. It's the supreme challenge for fundamental physicists. If we achieve this, the potential is endless, and our energy troubles are over. But a viable fusion reactor is a very long way off.

MvdH: All very well to create miniature suns here on earth, but the fact is we already have a sun, and it provides clean, environmentally friendly energy. Wouldn't it make more sense to just focus on harnessing the solar potential, with a complementary technology to guarantee constant supply? If we keep spreading our research effort, we'll end up with an array of suboptimal alternatives.

It will take decades for solar power to gain market share

TH: I see a significant role for solar – but then you're talking about decades from now. There are several factors why it will take that long. First of all price. Right now solar power costs three times as much as conventional electricity. And even once we price carbon emission costs into conventional power so the price gap closes, it will take decades for solar power to gain market share. Upscaling production, the logistics of rolling out the infrastructure, training a whole new breed of builders that can provide the necessary high-tech installation and service, developing a smart grid that can handle decentralised generation, all this can't happen overnight.

MvdH: Those are major issues, but aren't legacy investments in centralised power generation the real obstacle to the transition?

TH: Of course it would be a waste to prematurely write off the costly infrastructure we already have. But security of supply is also an argument. Fossil fuel based energy is a mature industry with an excellent infrastructure. You're not likely to drive into a filling station only to find a sign saying "SORRY – NO PETROL TODAY". Our whole economy is based on this infrastructure. Arguments aside, it's human instinct not to give up something we know that works for something less tried and tested. What could speed up the transition of course is another oil crisis....

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could represent 62 percent of total gas produced in China and 50 percent in Australia. Canada, too, is looking to shale gas to boost its supply. Some see the potential of European shale gas resources as sufficiently robust to alter the energy supply picture.

The proliferation of unconventional natural gas production is a game-changing event, especially in light of growing concerns about climate change. Natural gas emits about half the CO₂ of coal. Its high efficiency and widespread

availability further strengthen its proposition as a clean resource. Many regions in the U.S. and elsewhere are under-saturated when it comes to using natural gas for electricity production. This provides near-term opportunities for natural-gas suppliers to grow

their businesses while helping electricity generators to comply with emissions mandates.

A number of trends are on the horizon which could dampen enthusiasm for natural gas, even though it is widely viewed as the

MvdH: But surely governments can speed up this process, for example by ending subsidies to conventional energy producers, and pricing carbon emissions into electricity tariffs?

TH: Certainly, the Dutch government could take measures, but it would be better to do this on a European or indeed a global scale.

What could speed up the transition of course is another oil crisis...

MvdH: That certainly won't happen overnight. But in the meantime, consumers could take things into their own hands. Can you imagine solar power becoming a DIY market?

TH: No, installing solar panels is quite complicated, and there's no incentive for consumers. Solar doesn't offer any extra functionality, it doesn't improve the way you watch TV or iron your clothes. Electricity is electricity, whichever way you generate it. And at the current price, solar isn't a bargain. It just might happen if solar became a kind of status symbol, with people who still use conventional energy losing prestige, becoming outcasts even. Just look, for instance, at how quickly attitudes have changed to smokers.

MvdH: At the other end of the solar scale you have the megaproject Desertec. Is that going to be a winner then?

TH: It's really interesting. The technology of concentrating sunlight to produce heat is already proven, it just needs some fine-tuning. Getting the electricity to Europe will be costly, though. But there's no question

that Desertec will someday contribute to our energy mix, taking the pressure off other resources.

MvdH: Meanwhile, our government seems to be bucking the renewable trend with plans to actually beef up our conventional power generation capacity - beyond our own needs - with two coal-fired plants and another nuclear plant. Is becoming Europe's Powerhouse a healthy ambition?

TH: If we want new coal-fired plants, we do have to press ahead with carbon capture and storage. ECN is working on this, and we see plenty of scope for making CCS cheaper. The charm for energy companies of building a nuclear plant is that it is financially predictable: the investment is all up-front, operating costs are low. I concede that making this choice will slow down the introduction of renewables. But is that a bad thing? Not necessarily. It will give these technologies time to mature. But it mustn't be an excuse to sit back. The government needs to make sure incentives remain in place to keep the transition going, slow but sure.

Who is...?

Ton Hoff
CEO
ECN

Ton Hoff became CEO of ECN (Energieonderzoek Centrum Nederland) in 2003. Prior to joining ECN he worked for Shell for over 25 years. He held positions in R&D (Amsterdam and Houston), in Long Term Strategic Planning, in Retail and was Research Director of Billiton Research and manager Environmental Affairs of Shell Nederland. Ton holds a PhD in Physics and Mathematics from VU University Amsterdam.

Ton Hoff retired as CEO as of 1 January 2011.



cleanest of the fossil fuels. In the wake of several environmental, health and safety (EH&S) incidents, a not-in-my-backyard (NIMBY) movement is gaining momentum in the Marcellus shale region, which spans Pennsylvania, New York, Ohio and West

Virginia in the United States. Critics contend that evidence is mounting about the dangers of hydraulic fracturing techniques, which involve injecting a mix of water and chemicals into the rock formations in order to crack them and to release the gas.

Community groups in the region are also sponsoring protests in the form of town hall meetings and billboard advertising campaigns to raise awareness of possible dangers to the local water supply as well as to the region's pristine lakes and natural habitats. Some

industry observers believe that this grassroots backlash will ultimately translate into tighter state and federal regulation of the industry's drilling activities.



In Conclusion

Against the background of growing demand for energy and growing concern about climate change, three topics seem to stand out in particular amongst our predictions and in the reflections of the experts we spoke to:

Transition to a low-carbon economy

Energy has always played a pivotal role in the development of mankind and in driving the economy. Over time many transitions in energy sources and prime drivers have taken place. The great transition from woody biomass to fossil fuels and fuel-consuming engines started in the 16th and 17th centuries. By 1900, several European countries were almost completely energised by coal — but energy use in rural China was much the same as 100 or 500 years earlier. When in 1859 in the US the “discovery” of drilling made it possible to produce oil in sufficient volumes, the Age of Oil began. The next energy transition—the process of electrification and the rising global dependence on hydrocarbons—brought dazzling wealth to the industrialised world in the 20th century. But this came at a huge environmental cost in terms of CO₂ and other emissions. Many, including our interviewees, believe this cannot go on and a transition to a low-carbon economy needs to be made in the next generation(s).

Here comes the sun?!

Through the ages there has always been a single dominant fuel. Until approximately 1700 this was biomass. From that time onwards the great transition to fossil fuels started. Coal came into play and rapidly developed to become the dominant fuel with a share of approximately 60% in 1900. Oil was discovered shortly before that time and, together with natural gas, became the next dominant fuel, constituting just over 60% of the energy mix in the 20th century, with coal accounting for 25%. Many believe we are entering a new phase in which hydrocarbons, renewables and nuclear will all simultaneously play important roles. It is unclear how long this transitional phase will last, but most expect it will be for the foreseeable future. Several, especially

scientists, believe eventually solar energy will become the dominant energy source of the future because it is abundant, local, clean and becoming increasingly affordable.

China; East is leapfrogging West

It is no surprise that all our interviewees see China’s impact on the global economy and the energy markets as big and growing. Not just because of the country’s surging demand for energy, but certainly also because of its increasing efforts to build a renewable energy industry and to develop related technology. China already holds more patents in battery technology than any other nation and is leading in solar and wind technology. Whereas renewable energy projects have stalled or come to a complete stop in the western world, China seems to be stepping up its environmentally friendly energy efforts. Legacy energy systems will slow down the West in the transition to a low-carbon economy. China, on the other hand, has no such problem. Being the biggest and fastest-growing market for energy solutions, China has all the scope it needs for rapid innovation and adaptation of renewable energy solutions. In many ways, China will be the game changer in the energy markets.

I would like to thank our interviewees for giving us their time and sharing their wisdom with us. More than analyses and predictions, they have offered us inspiration with their optimism and drive. In that spirit, Deloitte wishes you an exciting and prosperous 2011, in which you can count on us to help you grasp the many opportunities you encounter.

Marcus van den Hoek



Global energy demand What is hanging over our heads?

Interested in knowing what global economic trends like the China Boom mean to your business? Just give us a call. In changing times, our experts can help you stay a step ahead.

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