The energy complex

AT A GLANCE

- Economic expansion and population growth are putting considerable pressure on energy resources
- The concept of 'peak oil' is overstated but governments understand the need to move away from finite fossil fuels
- A higher oil price is supporting the exploration of new, previously uneconomic fields
- The move to decarbonisation, renewable energies and bio-fuels has begun but will take time
- Carbon capture could offer short-term hope by cleaning up fossil fuel energy production
- There will be winners and losers (at both the country and corporate level) from this changing energy landscape.

The average American currently consumes 11.4 kW of energy a year, compared to 1.6kW for each Chinese person and 0.7kW for each Indian.

Global energy demand will grow by more than half over the next quarter of a century.

Coal is expected to see significant growth in absolute terms, while renewables are growing quickly from a very low base.

The modern world is built on energy. Nearly every aspect of Western life is dependent upon the production and utilisation of energy, be it the internal combustion used for much of our transportation, the energy that drives industry or the generating hubs and networks that power our homes.

Consider the transition to a decarbonised world as governments encourage a move away from finite fossil fuels to greener, renewable source of energy. This theme has the scope to be transformative at the national economic level for resource-rich countries and at the corporate level for those firms that can provide scalable energy solutions and develop new technologies.

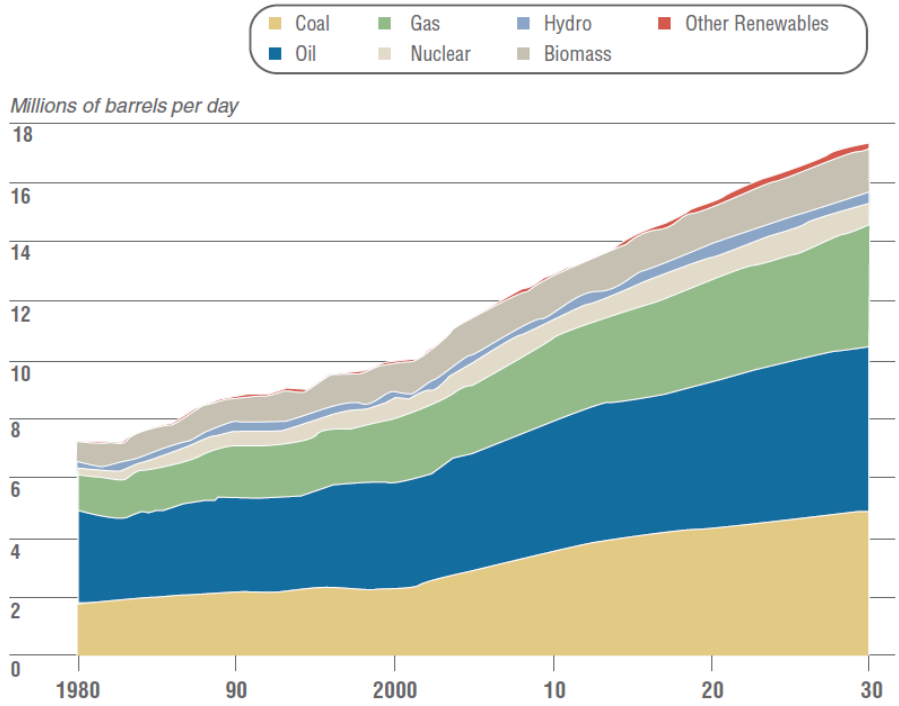
AN ENERGY-HUNGRY WORLD

Our demand for energy is immense and growing. World energy consumption in 2008 stood at 11,294.9 billion tonnes of oil equivalent, a growth of 195.6% since 1965. At the moment, developed nations use an average of five times more energy per capita than their developing counterparts. However, developing nations are catching up fast; three of the world's top six energy users are now considered developing nations - China, Russia and India. To put that in context, these top six energy-consuming countries are responsible for 55% of all energy used worldwide.

With developing nations such as India and China growing rapidly, so too will global energy consumption. On average, each American currently consumes 11.4 kW of energy a year, compared to 1.6kW for each Chinese person and 0.7kW for each Indian. With China and India combined representing over a third of the world's population, their rapid development is set to significantly increase energy consumption in coming years.

The world's seemingly voracious appetite for energy is confronted, however, by two related problems: the finite supply of (and the unwanted dependency upon) fossil fuels such as oil and coal, and climate change.

ACTUAL AND PROJECTED ENERGY USE



Source: PFC Energy International and NIC Global Trends 2025 'A transformed world'.

Fidelity INTERNATIONAL

'PEAK OIL' PRESSURE?

It is well understood that the problem with fossil fuels is that they are finite. Just how finite is a matter that polarises opinion, however. Some argue that we are close to reaching a 'peak oil' situation, after which oil supply will decrease, constraining global growth. Others are more optimistic. In fact, most of the apocalyptic projections made by peak oil theorists have been debunked as they tend to underestimate the amount of oil in the ground. Tony Hayward, Chief Executive of BP, believes that we have more than enough to meet our needs and we are more likely to see "a demand peak rather than a supply peak, because there's plenty of oil in the world". Hayward believes that demand for oil generally will peak at 95-105 million barrels a day.

On some estimates, Canada's oil sands represent the largest oil reserves outside Saudi Arabia.

'Peak supply' worries are not new. Historically, periods of strong growth have given rise to gloomy predictions: many Britons believed wood was going to run out in the 15th century, while economist William Jevons warned in the late 19th century that coal was in terminal decline. The human race's ability to invent, innovate and continue to make economic progress is invariably underestimated.

Nevertheless, the fact remains that we are burning through a lot of our proven oil supplies. This means energy companies are turning to less-accessible deposits to satisfy demand, such as deep sea deposits, sands oil and shale gas. Although the cost of extraction is significantly greater, the higher oil price makes these marginal fields economically viable. Higher-cost deposits such as those in the oil sands of Canada and off the coast of Brazil will significantly boost supply and calm fears over 'peak oil', but will also put upward pressure on the price of a barrel.

THE PERILS OF ENERGY DEPENDENCY

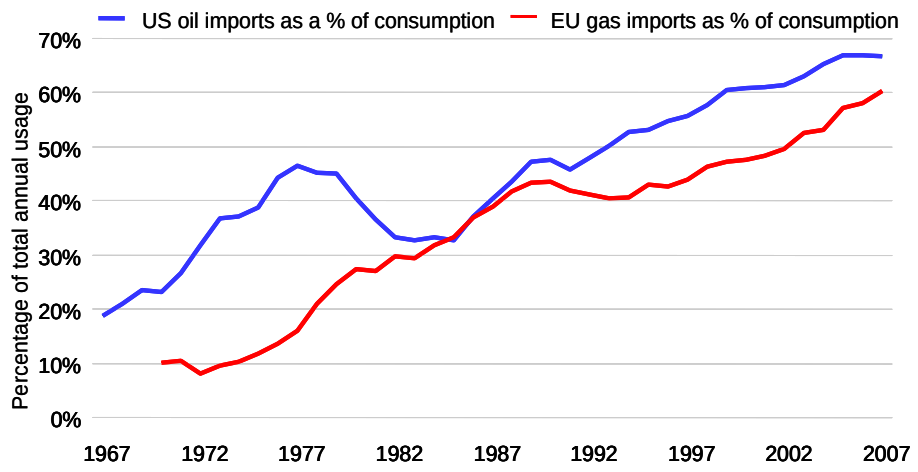
Geo-politics also plays a part when it comes to 'less accessible' fossil fuel deposits. Many of these resources are found in less politically stable regions (such as Venezuela and Nigeria) or in areas where there are competing claims (under the polar ice caps, or in the Falkland Islands).

The high strategic value and attendant political instability that comes with access to energy can cripple the relationship between countries. For example, the Russian-Ukrainian gas crisis of 2008 woke a slumbering Europe up to the problems that overreliance on foreign energy can cause.

This is a big problem because much of the world is dependent on a handful of resource-rich nations. The EU 27 countries, for example, had an aggregate energy dependence of 53.8% in 2008 (i.e. more than half the energy used in the EU is sourced from elsewhere). Some countries, such as Ireland, Luxembourg, Cyprus and Malta import over 90% of their energy. Fossil fuel hegemony rests with a small number of deposit-blessed nations, such as the Gulf states and Russia. Russia supplied 33% of oil imports and 40% of gas imports to the EU in 2008.

As we shift away from fossil fuels towards renewable energies, this axis of energy power will diminish and new winners will emerge. These are likely to be companies embracing new technologies rather than nation states.

THE US AND EUROPE HAVE SEEN A RISING DEPENDENCE ON ENERGY IMPORTS



Source: BP Statistical Review of World Energy 2008

The US and Europe now import a significant proportion of their energy

Significant investment in oil infrastructure has been a barrier to innovation, but availability, dependency and climate change are putting growing pressure for change.

Climate Change Winners?

There are some beneficiaries of increasingly temperate weather.

Russia has most to gain given its untapped reserves of natural gas and oil in Siberia and the Arctic. Warmer temperatures should make these reserves more accessible.

In Canada, climate change could open up millions of square miles to development, particularly in the resource-rich Hudson Bay.

BARRIERS TO CHANGE ARE WEAKENING

In the energy sector, it takes an average of 25 years for a new production technology to become widely adopted due to the need for new infrastructure. Displacing oil, and the significant investment in infrastructure that supports it, will take even longer. The limited penetration of natural gas, a fuel superior to oil in many respects (more environmentally-friendly and efficient), illustrates the difficulty of a transition to a new fuel.

However, the appetite among governments and businesses is growing, as they look to reduce their dependence on a dwindling fossil fuel with a volatile price. The greatest possibility for a transition away from oil comes in the shape of better renewable sources (such as solar and wind) alongside improvements in battery technology that would support the wider use of electric products. Governments and consumers are important in this transition because one of the big tailwinds for energy innovation comes from climate change.

CLIMATE CHANGE

Although there are still plenty of sceptics, governments now recognise climate change as a problem that needs to be addressed. Hundreds of billions of dollars are being spent yearly in the name of combating climate change, providing excellent investment opportunities for the practitioners who can identify the winners at the corporate level. The potential market is massive.

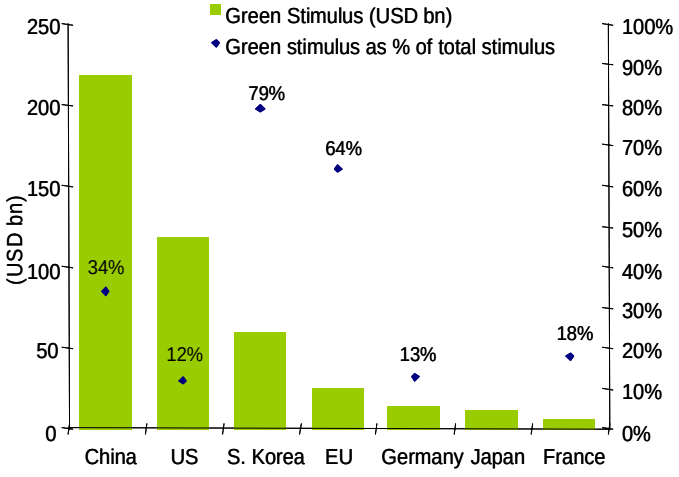
In China alone, energy use doubled between 1990 and 2006, and is expected to double again by 2025. Whilst much of this will be met by fossil fuels as the government realise their dependency on external fuel sources and are committed to increasing the use of renewables. The companies that provide cost effective, renewable energy solutions globally should be rewarded by investors.

THE ECONOMICS OF EFFICIENCY

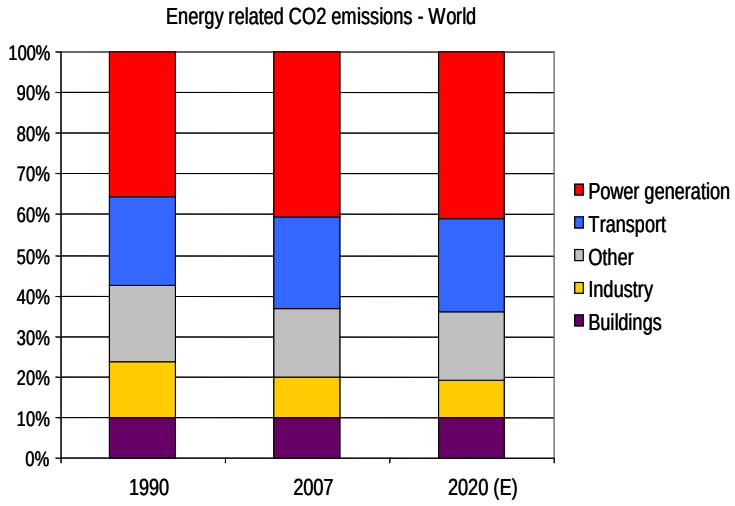
As it will take time for renewable technologies to achieve the necessary scale and infrastructure to challenge fossil fuel, the short-term focus will be on increasing the efficiency of existing technology. Developing economies are particularly profligate in their use of energy compared to Western nations and so straightforward efficiency gains are possible. China's 2006-2010 five-year plan aims to increase energy efficiency by 20%. This will help to cut costs, as global fuel prices rise, and reduce emissions, as the same industries operate using less energy.

Of course, many firms have already woken up to the benefits of efficiency. Shipping giant Maersk has recently been playing up the environmentally-friendly side of its new E-class container ships. This might seem strange because the ship's engines burn fuel at 16 tonnes an hour. However, the ships operate 20% more efficiently than older designs, despite being much bigger.

INCENTIVES TO GO GREEN



Sources: HSBC and the Financial Times



DECARBONISATION AND THE RISE OF RENEWABLE ENERGIES

Efficiency gains in the use of fossil fuel energies are short-term wins. In the longer term, we need to make a large scale transition to a decarbonised world, based on renewable sources of energy. Governments worldwide have realised this for some time, and as a result, have been using both the carrot and the stick to incentivise industry and accelerate the transition (see chart above).

While this bodes well for the long term, there is evidence that investments in green energy will be profitable in the short term too. McKinsey estimates that renewable energy will constitute the vast majority of new capacity added in the EU and US within the next decade (see chart below). The figure is lower in percentage terms for China, but still constitutes a significant expansion. Although costs will run into trillions of dollars, the payoffs could be equally large.

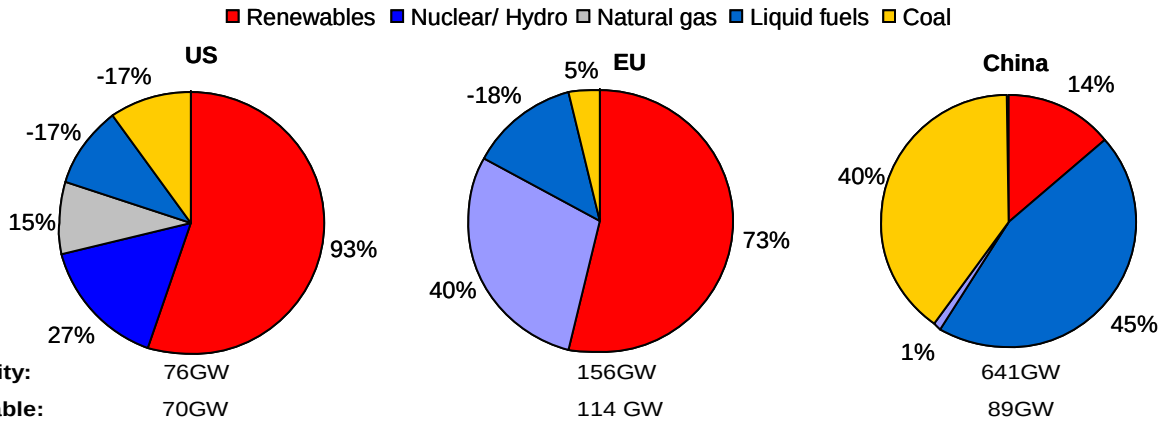
This investment is already under way. Despite also being an enormous user of fossil fuels, China hopes to be at the forefront of the renewable energy wave, in order to limit energy dependency. The Chinese government has allocated RMB 210 billion ($30.7 billion) for energy-saving and carbon-reduction projects under its RMB 4 trillion economic stimulus package. China's main focus is wind, where it intends to invest RMB 100 billion ($14.6 billion) to more than double its 2008 wind power capacity by 2010.

Equally, the US pledged $22 billion in stimulus for green energy investment last year. Again, wind takes pride of place for cost reasons, but with a slump in demand forcing prices down by 30%, interest in solar also increased in 2009.

Decarbonisation, then, has already become a major investment opportunity, but it is one that is set to grow dramatically in coming decades. The European Union's leading power companies have set themselves the goal of producing all of their electricity carbon free by 2050. There will be a range of winners and losers in this transition. Certainly, the companies which supply the components for wind and solar farms have a significant opportunity to expand and grow their earnings.

NEW CAPACITY BUILD TO 2020

Estimated new capacity build by technology to 2020 (GWh)



	US	EU	China
Total new capacity:	76GW	156GW	641GW
Of which renewable:	70GW	114 GW	89GW

Source: McKinsey

HYDRO-ELECTRIC OR NUCLEAR?

Of the traditional renewable energies, hydro electricity is the most prolific at present. In 2008, according to Platts, hydroelectricity represented 19% of the world's generated power. The largest hydroelectric dams easily match big fossil fuel plants in terms of power generation. Three Gorges dam in China, currently under construction, is expected to produce 22,500GW a year upon completion – twenty times the average for fossil fuel plants. However, hydro offers limited scope for expansion because of a lack of suitable sites and the cost involved in developing them.

The story is similar for nuclear energy. While nuclear energy is set to grow in coming decades, with many plants already under development, there are issues that hold it back. The scarcity of uranium and the difficulty of enriching it limit development, as do fears over radioactive waste. Because of this, and the decommissioning of existing plants, nuclear is unlikely to expand far beyond the 9% of global energy it currently produces.

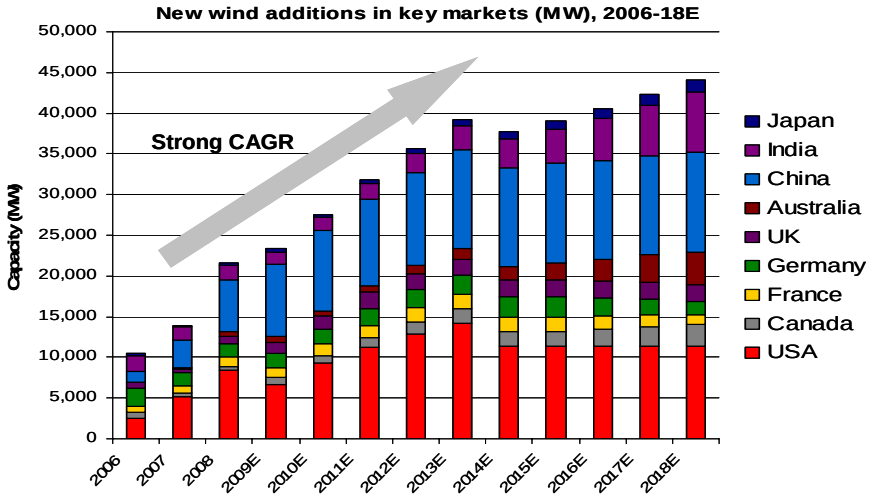
A WORD ON WIND

As government backing increases and technology advances, wind could compete with fossil fuels on cost, perhaps becoming the cheapest option in the future.

Wind energy is more promising. Its potential expansion is enormous, as wherever wind speeds are great enough, energy could be produced. At present, this is most economically viable on land, which stands expansive nations such as America in good stead. Wind farms can also be located offshore but, at present, the cost of doing so is roughly three times greater than onshore.

While significantly cheaper than solar, wind still struggles to compete in price terms with coal and gas. UBS estimates that, in 2010, one MWH of wind energy will cost €73.5, gas €61.1 and coal €67.1. As we have seen, however, government stimulus is significant. This, combined with cost-cutting technical advances, should see wind power grow a great deal in the next decade. It is not only energy and installation companies (such as Vestas Wind Systems) that are set to benefit, but also the companies which produce the parts needed for each turbine.

WIND POWER IS GROWING STRONGLY



Source: Company data, Goldman Sachs Research estimates.

SHINING A LIGHT ON SOLAR:

Solar energy is equally promising. As a 'free' energy source, the purchase and installation of panels represents the only significant cost. Considered uneconomic historically, the price of solar has been falling rapidly in recent years, down 30% in 2009 alone. Tests by the EU Energy Institute have recently shown that 90% of solar panels, previously expected to last 20 years, will actually last 30, bringing down lifetime energy costs.

The EU Energy Institute has forecast that solar panels will be cost-competitive with energy from the grid for half the homes in Europe by 2020 - without a subsidy. Solar has a long way to go before it matches at-source prices, which are much lower than end-user grid prices, but it is rapidly heading in the right direction. This bodes well for companies like JA Solar and First Solar. It also bodes well for China, the world's leading solar-panel exporter, which exports 95% of the photovoltaic panels it produces.

BEEFING UP ON BIO-FUELS

Biofuel can be produced from many different materials, from chip wood to waste oil. Many companies already use at least some biofuel, but its environmental impact must be reduced.

Bio-fuels, produced from organic renewable sources, are already being widely developed. Many firms produce bio-fuel from farmed crops and biological waste material, and corporations are taking advantage of this cheaper, greener fuel. McDonalds, for example, recently announced that it would be using the waste oil from its restaurants to fuel its fleet of delivery vehicles. These are small-scale developments, but steps in the right direction.

The problem is that the fuels distilled from crops often take as much energy to manufacture as they produce, making their environmental benefit negligible. Equally, the current use of bio-fuel is constrained by land use, water availability and competition from using those resources for the production of food. Further technical development is needed before bio-fuels become a large-scale, economically-viable and environmentally-friendly challenger to oil. However, there is significant promise in the form of algae-based fuel production (as it can grow quickly on non-arable land), and investments in this field may pay dividends in the future.

AN ELECTRIFYING TRANSPORT SOLUTION

Decarbonisation will be an important theme in coming decades, but it will be significantly more effective if it is combined with another shift: the electrification of transport. Electric cars are here already. Unfortunately the infrastructure required to support them is not and there are problems with battery life. At present, electric cars take significantly longer to charge than it takes to fill a car with petrol, and can only go comparatively short distances before needing to be recharged again.

However, hybrid cars, such as the Toyota Prius – the most fuel-efficient car in the US – have proven very popular with consumers because of their 'green' credentials.

The problems holding back electric cars are not insurmountable and the next few decades should see fast growth in electric vehicles and hybrids. Indeed, the Chinese company Build Your Dreams claims it has manufactured a car that can travel 250 miles on a single charge and can be half-recharged in just ten minutes. Infrastructure is developing too, with Wales recently announcing plans for a 'hydrogen highway' specifically designed to support electric cars.

This still does not see electric transport competing with conventional cars and haulage, but it should not be long before electric vehicles do become a much more significant and credible player in the transportation market. As governments and industry invest in infrastructure, pioneering companies like BYD have the potential to make considerable profits for their investors.

CLEANING UP DIRTY FOSSIL FUELS WITH CARBON CAPTURE

Currently, fitting new power stations with carbon capture systems renders them perhaps twice as expensive to build as conventional plants, and 30-50 percent more expensive to run, though estimates vary.

The decarbonised energy sources we have mentioned offer significant hope for the future. However, in the short- to medium-term, fossil fuels will continue to be significant players in the energy industry. Developed countries will not be able to scale back fossil fuel consumption to any great extent for decades and emerging markets are adding new capacity at an alarming rate. At its peak in 2007, China was adding capacity at a rate of about 2,000MW per week, the large majority of it coal-fired. To mitigate the environmental impact of this, rapid development of nascent carbon capture technologies is required.

Although the technology exists, carbon capture has not yet developed enough to be cost effective on an industrial scale. Many supporters were excited when the Swedish company Vattenfall launched its pioneering carbon capture power plant at Schwarze Pumpe near Berlin in 2008. This plant, however, generates just 30 MW a year, whereas an average commercial power plant can produce around 1,000MW a year.

Carbon capture has the potential to help in the battle against climate change but significant investment is needed. A successful deployment of clean coal technology could however pose a major challenge to oil energy markets, and is likely to be championed by coal rich/oil poor nations. For those governments and companies that make the investment, the potential rewards are great.

LOCALISING ENERGY PRODUCTION

One theme set to grow in future is the localisation of energy production. As green technologies, such as wind and solar, become cheaper and more accessible, they will continue to proliferate beyond commercial use. Increasingly, small businesses and homeowners are generating their own power using renewable sources. If the technology continues to become more affordable, the localisation of energy production could see individuals generating the energy they need and selling surpluses back to the grid. Combined with large green developments, such as batteries of solar panels and wind farms, this could mean less rather more power stations in tomorrow's world.

The first steps towards a new generation of 'smart grids' (that can that can send information and receive instructions) have already been taken. The US has promised $3.4 billion in grants to pay for smart grid equipment, and they are being considered by other countries too. Smart grids offer are number of benefits.

- Equipment failures that cause blackouts can be anticipated and prevented as installations flash warning signals.
- Smart grids will allow networks to handle large volumes of electricity from renewable sources, which are often, in the cases of wind and solar power, available only intermittently and impossible to store.
- The smart grids could help curb power demand, both because transmission losses will be smaller and because it will make it possible to lower demand at peak times thanks to 'smart meters' in homes.

A FEW ENERGY 'WILD-CARDS'

Beyond the themes discussed, there a few experimental technologies which could offer potential if they get off the ground. These 'wild cards' are mostly theoretical at present, but they are being researched to some degree and have the potential to drastically alter the way we produce energy.

Desert sands

In only six hours, the world's deserts receive more energy than the earth's population consumes in a year. Harnessing this power offers huge potential, as 90% of the world's inhabitants live within 3,000km of a desert. A group of 20 companies, among them Siemens, Deutsche Bank and Munich

RE, believe that European consumers could source their electricity from the Saharan sun.

While the idea is adventurous, it is not science fiction. Scientists claim that hundreds of north African “Concentrating Solar Power” plants - each generating intense heat through sunlight focused by lenses or mirrors – could, by 2050, supply about 15% of Europe’s electricity needs. However, covering the desert with mirrors, laying transmission cables across the Mediterranean and connecting these to a new European super-grid does not come cheap. Until the current estimated cost of €400 billion can be slashed, the ‘Desertec’ project remains an interesting theory.

Billions of dollars are spent worldwide each year researching ‘wild cards’. The stakes are high; successful development could create phenomenal wealth and shift global power balances.

Space-solar

There is one place that we can get even closer to the sun than the Sahara - space. At the end of 2009, a conglomerate of Japanese companies including Mitsubishi Electric and IHI Corp. joined forces in a 2 trillion yen ($21 billion) project that has the aim of building a giant solar-power generator in space within three decades. The idea is to harness the sun’s power using four kilometres of solar panels in a 1GW power station and beam the electricity back to earth in the form of microwaves. Being in space it could generate power from the sun regardless of weather conditions, unlike earth-based solar generators. However, like the Desertec project, the cost of implementing the plan needs to be slashed if it is to become reality.

Nuclear fusion

Nuclear fusion is how the sun creates energy and is essentially the production of a vast amount of heat as particles join together, as opposed to nuclear fission (used in conventional nuclear power plants), where they are torn apart. In theory, harnessing this reaction could produce huge amounts of energy with no impact on the environment. Research into nuclear fusion is being done as a result of international collaboration by the European Union, China, Japan, South Korea, the US, Russia and India and is costing tens of billions of dollars. But many believe we are 50 years away from an effective solution, if one is ever found at all.

CONCLUSION

The evolution of the world’s energy production will be inextricably linked to the path of global growth and the balance of global power in the coming century. The investment opportunities that will accompany this story are likely to be both significant and diverse.

Many of the themes are investible now. Some of the innovations that look set to grow exponentially in coming years already benefit from substantial foundations. This is true not least for wind and solar, but also biofuels and carbon capture. Companies like Vestas Wind Systems and SMA Solar have established themselves as global leaders in their fields. As political incentives increasingly swing towards green technologies, such companies (and companies as yet unknown) have the potential to grow strongly. As do shrewd investments in energy stocks.

In the interim, increasing efficiency will boost the margins of the companies which embrace it. In the long-run, anything could happen. ‘Wild-cards’, such as space-based solar generators or nuclear fusion, could revolutionise the energy market.

What is certain is that there will be winners and losers from the changes in how we get our energy. Rigorous research and analysis will be crucial in identifying the beneficiaries. Those who understand and anticipate the wide-ranging implications of the themes we have discussed, and spot the beneficiaries before the market, will prosper. Few industries are likely to produce as many companies with the earnings growth potential that is available in the energy industry in coming decades. The possibilities are electrifying.