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INSURANCE & RENEWABLE ENERGY

Emerging Risks Briefing

INSURANCE & RENEWABLE ENERGY
EMERGING RISKS BRIEFING

Foreword

Welcome to our latest Emerging Risks Briefing in partnership with WWF. These briefings focus on the key risks and opportunities arising from environmental change, explore new research and consider the implications for business and individuals.

In this report we look at the challenges, opportunities, risks and benefits of renewable energy and discuss the barriers to widespread adoption as we look to the future. We explore the interlinked nature of systemic risk and WWF's challenging vision for a 100% renewable energy future by 2050, examining the implications for UK and EU energy policy.

If the world is to avoid dangerous climate change, very deep cuts in global emissions will be needed by mid-century. The use of fossil fuels for energy provision currently accounts for two-thirds of global greenhouse gas emissions. So switching to clean, renewable energy must be at the heart of any strategy to address climate change. Our main fossil fuel sources – oil, coal and gas – are all finite resources and we are depleting them at a rapid rate. According to the International Energy Agency, production from known oil and gas reserves will fall by 40-60% by 2030. And the nuclear crisis in Japan is a timely reminder of the dangers of atomic energy as an alternative.

It is therefore clear that when it comes to future energy generation and consumption, business as usual is not an option. Globally, we need to improve energy efficiency on both the supply and demand side and we need to accelerate the transition to a low carbon, sustainable, renewable energy future.

Making that transition will require overcoming significant barriers, chief among them is securing access to finance. Investors need long term confidence in their return on investment and clarity on how they will benefit from financial incentives. We need a broad consensus across different governments and all political parties, backed up by real and immediate action in order to drive positive change.

As a leading insurer with over 30 years' experience in the renewable energy industry, RSA has a unique insight into the challenges and opportunities facing organisations operating in this market. We helped protect the first wind turbines in the 1970s and we continue to back the pioneers of the future.

The case for sustainable alternatives to our current dependence on fossil fuels is clear and there is no doubt that renewable energy will play a key part in the global fight against climate change. It's a fight we have to win and one that RSA and WWF will continue to actively engage in. As you read this report I would challenge you to think about what role you could play or what support you could give.

Mark Potter,
Head of Renewable Energy, RSA

"THE CASE FOR SUSTAINABLE ALTERNATIVES TO OUR CURRENT DEPENDENCE ON FOSSIL FUELS IS CLEAR AND THERE IS NO DOUBT THAT RENEWABLE ENERGY WILL PLAY A KEY PART IN THE GLOBAL FIGHT AGAINST CLIMATE CHANGE. "

EXECUTIVE SUMMARY

1. The time for action is now

   Climate change is a global problem needing global action and it needs it now. Fossil fuels are running out; continuing with a business as usual approach to the generation and consumption of energy is simply not an option. We need decisive action to reduce consumption and shift to more sustainable sources of generation. Without this we will fail to meet global emissions targets and avoid catastrophic climate change impacts.

2. Vision of a renewable energy future

   WWF's vision of a 100% renewable future is not a pipe dream, it is both possible and cost-effective. As technology advances we expect to see bigger wind turbines, up to 250 metres high, larger solar plants such as those proposed across the deserts of North Africa and the Middle East, plus a greater use of other sources of renewable energy. To harness and manage the additional power generated effectively we need investment in regional and smart grids. These will better enable the transfer of power between national boundaries and smooth out the peaks of supply and demand that renewable energy is particularly vulnerable to.

3. The benefits are wide and varied

   A fundamental increase in renewable energy will have significant socio-economic as well as environmental benefits. In addition to the economic benefits from the development and manufacture of renewable energy technology, and greater security and independence of energy supply, there is vast potential for job creation and urban regeneration.

4. Carbon free but not risk free

   Renewable energy may be carbon free but it's certainly not risk free. Typically the technology involved is relatively new or still at the prototype stage, which can make assessment of risk difficult. In addition, sites are commonly in remote and often inhospitable areas, making access for maintenance and repair challenging. The skill and experience of insurers is crucial to ensure that risks are effectively managed and manufacturers are supported to develop the next generation of renewable energy.

5. Barriers can be overcome

   There are significant challenges and barriers to overcome if we are to achieve widespread adoption of renewable energy but they are surmountable. Two of the biggest barriers are finance and planning. To increase the access to finance we need to ensure renewable energy remains attractive to investors through greater certainty, long-term subsidies and feed-in tariffs. Overcoming delays in the planning process will require new and different approaches such as encouraging communities to take greater ownership of local power generation.

6. Collaboration is key

   True collaboration will be key. Only by government, insurers, manufacturers, utility companies and environmental organisations working together will we succeed in reducing our reliance on fossil fuels and moving to a low carbon, sustainable energy future.

"ONLY BY GOVERNMENT, INSURERS, MANUFACTURERS, UTILITY COMPANIES AND ENVIRONMENTAL ORGANISATIONS WORKING TOGETHER WILL WE SUCCEED IN REDUCING OUR RELIANCE ON FOSSIL FUELS AND MOVING TO A LOW CARBON, SUSTAINABLE ENERGY FUTURE. "

BROAD BENEFITS OF A GREATER SHIFT TO RENEWABLE ENERGY

In this Emerging Risks Briefing we focus on the key renewable energy technologies of wind, solar (using the power of the sun), bio (using plant material or organic waste) and hydro energy (using the power of water flow).

The environmental benefits of renewable energy are clear and well known. It helps reduce C02 emissions, protects biodiversity and provides greater independence and security of energy supply. The economic benefits are also well established. The renewable energy sector is powering the next generation of manufacturing industries and in turn creating many thousands of new jobs.

Perhaps less understood, however, is the potential positive societal impact that local ownership of power generation offers and this is an area we return to throughout this briefing.

If people own the means of power production locally and are able to generate their own electricity, selling any surplus back to the national grid, they tend to waste less energy. Greater adoption of renewable power generation, therefore has the potential to drive real behavioural change and a greater appreciation of the need to reduce consumption overall. You could say that this represents 'Big Society' thinking in practice.

Furthermore, as more communities begin to see the environmental, financial and employment benefits of local power generation, they are more likely to feel a sense of ownership of the energy infrastructure and this should help developers overcome some of the historical local planning objections.

Renewable energy can also play a role in stimulating local economies and regenerating communities. Projects are often located in remote rural areas, many miles offshore or in desert terrain. After the initial manufacturing and installation phase, they require ongoing maintenance and service support and this creates a huge opportunity for employment. The United Nations Energy Programme predicts that by 2030 there will be an additional 6.3 million jobs in solar and 2.1 million jobs in wind energy worldwide. This type and scale of investment can transform previously declining industrial areas into thriving renewable support centres.

"GREATER ADOPTION OF RENEWABLE POWER GENERATION, HAS THE POTENTIAL TO DRIVE REAL BEHAVIOUR CHANGE AND A GREATER APPRECIATION OF THE NEED TO REDUCE CONSUMPTION OVERALL. YOU COULD SAY THAT THIS WOULD REPRESENT 'BIG SOCIETY' THINKING IN PRACTICE. "

SYSTEMIC RISK

Deteriorating ecological systems have the potential to create impacts that cannot easily be predicted on historical experience alone. This increases the importance of investigating the links between economic, political and ecological systems or in other words understanding systemic risk.

WWF and RSA are developing a systemic risk model that looks at the direct impact of environmental changes on business and how these can effect economic activity. In addition, by having a greater understanding of systemic risk, we also intend to help identify opportunities to enhance economic growth and create other socio-economic benefits.

Creating a systemic risk model

We began this work by looking at risk in the marine environment and our Emerging Risk Briefing on this topic is available to download from www.wwfrsapartners.com.

When compiling that report some key lessons were learned:

- **Mapping cumulative risks** – when we use mapping technology to create an overall picture of business activity and its associated risks, we start to get an understanding of how they interact with and impact on one another.
- **Increased natural system volatility and reduced ecological resilience** – we are starting to see an increase in extreme weather conditions as a consequence of climate change.

  At the same time the capacity of ecological systems to buffer this volatility is decreasing. For example, heavy rain falling on deforested mountains flows straight onto agricultural plains and adjacent properties. When this is compounded by local rivers having been straightened it results in the natural systems being unable to cope with subsequent floods.
- **Systemic risk analysis can create opportunities** – for example creating Marine Protection Areas to protect endangered species can boost fish numbers and fish sizes, and also help to protect the livelihoods of coastal communities and contribute to a long-term sustainable fishing industry.

Systemic risk and renewable energy

So what does this mean for the future of renewable energy? In the remainder of this briefing we review both the risks and opportunities of renewable energy.

As we consider the potential for solar, bio, hydro and wind power a number of key themes begin to emerge.

- Facing a future with a growing population what will be the impact on global energy demand?
- Through improved energy efficiency can we do more with less?
- How can we balance competing pressures for land and water use?
- If we are serious about significantly increasing the proportion of our energy that is generated from renewable sources, how do we overcome the financial, legislative and logistical barriers?
- Can we use investment in renewable energy to stimulate economic growth, provide new employment opportunities and help regenerate declining urban areas?
- What role should governments, business, consumers and the insurance industry play?

It is only through analysing how these themes interlink that we can begin to understand the systemic risks of renewable energy.

THE ECOSYSTEM DECLINE WILL PROMPT RAPID CHANGE IN PEOPLE'S LIVES

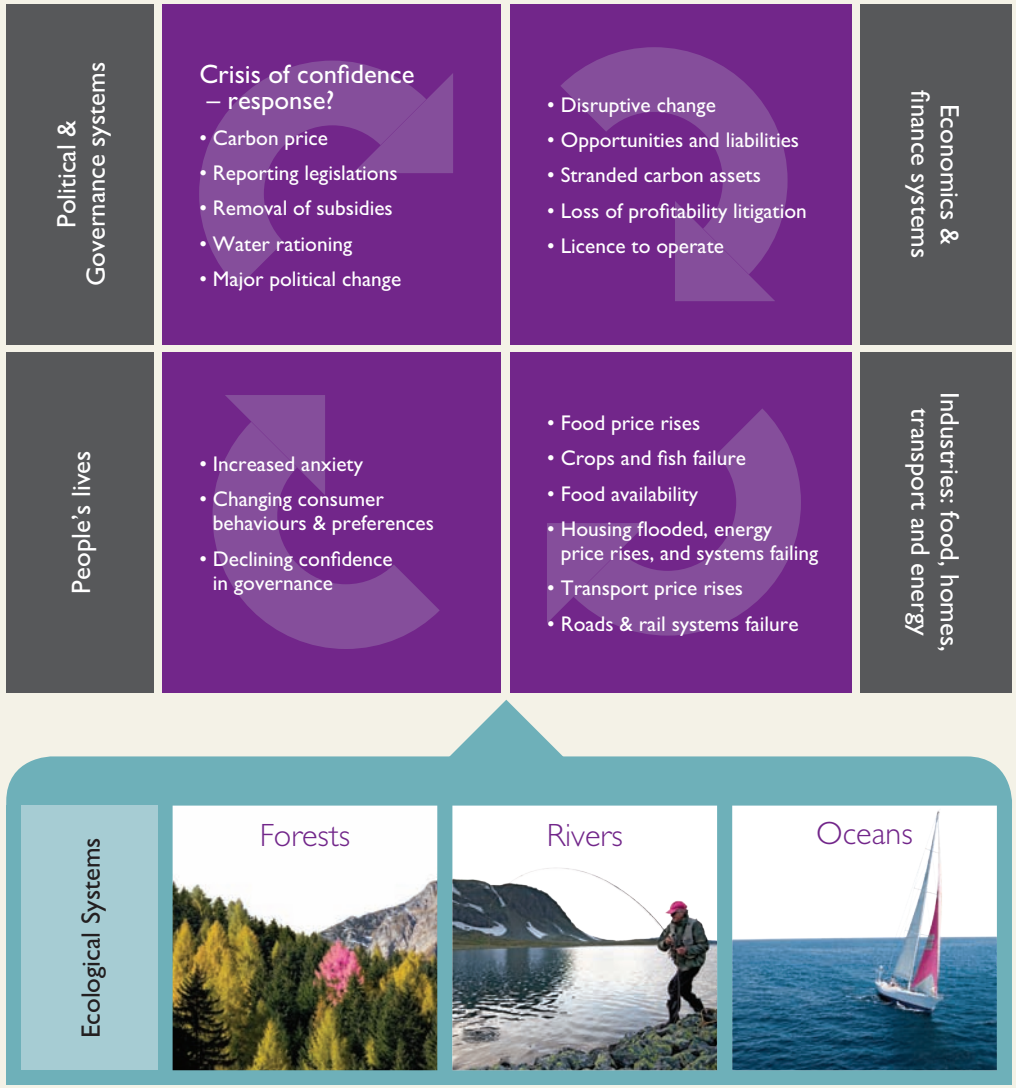


Fig 1. This diagram illustrates how deteriorating ecological systems have the potential to create unpredictable change, which warrants in-depth research to establish the systemic risks at play.

WILL GOVERNANCE SYSTEMS – POLITICIANS, ECONOMICS, FINANCE AND BUSINESS LEADERS – RESPOND ADEQUATELY?

Oliver Greenfield,
Head of Sustainable Business and Economics,
WWF-UK

WWF'S 2050 VISION
– THE CLEAN ENERGY IMPERATIVE

The way we produce and use energy today is not sustainable.

- Energy generation is responsible for two-thirds of the world's greenhouse gas emissions, and its share is increasing at a faster rate than for any other sector. Without a dramatic change in our approach to energy, the world will be committed to disastrous levels of warming.
- Continued dependence on fossil fuels will mean looking to sources which are harder to extract and potentially more environmentally damaging such as deep ocean oil reserves, tar sands and shale gas.
- Nuclear is a risky and expensive option, producing dangerous waste that remains highly toxic for thousands of years, and contributing to political instability and insecurity.

But is it possible to achieve a world that relies only on sustainable renewable energy sources while also meeting human development needs?

WWF's Energy Report[1] demonstrates that it is possible to achieve an almost 100% renewable energy system within the next four decades – but makes clear that formidable challenges need to be overcome.

Doing more with less

The absolute priority is to use energy more wisely. Global energy demand in 2050 could be 15% lower than in 2005, in striking contrast to business as usual projections which predict a doubling in energy demand. This difference is not based on any reduction in activity – population, industrial output, passenger travel and freight transport continue to grow, particularly in developing countries. Instead, it is the result of a major drive for energy and resource efficiency.

So, how is this possible? WWF believes industry could reduce energy consumption through new processes, recycled materials, and innovative product design. New buildings can be designed to use almost no energy for heating or cooling, and ambitious retrofits to existing buildings could greatly reduce energy needs. In transport, there are opportunities to improve efficiency through technology and switching to less polluting modes of travel.

Electrification

It is also clear that electricity must play a vital role in a clean energy future. Currently, electricity makes up less than one-fifth of the world's total energy demand; by 2050 it could account for almost half.

Electricity is a good option for improving the efficiency of heating and transport – for example through electric cars. And, over time, there is huge potential for renewable sources of electricity such as solar, wind, geothermal, wave and tidal to expand.

The renewable power future will depend on building a grid infrastructure fit for the 21st century – based on large international super-grids and smart local and regional grids. Such a foundation will enable the balancing of variable renewable resources from different regions. For example, Europe can meet its energy needs through a package of wind and wave power from the north-west, sustainable hydropower from the Alps and Scandinavia, and solar power from the Mediterranean.

Land use and bioenergy

However, even after significant improvements in energy efficiency and a growing switch to electricity, we will still need to develop renewable fuels for heat and transport. The main option here is bioenergy – the thorniest issue highlighted by WWF's Energy Report which predicts a substantial increase in the amount of bioenergy. Much of this could come from waste residues and commercial forests and, over time, through new technologies such as algae. But there is also a need for biofuel crops – which raise concerns over food security, pressure on land use and biodiversity, and increased water use for irrigation.

Current analysis suggests that on a global level there may be enough land available to grow biofuels sustainably. But more work is needed to identify where this land is, and to ensure that safeguards are in place that avoid damaging impacts on food security, biodiversity and water supplies. One finding is very clear – our current use of land is highly inefficient. In particular, a reduction in meat consumption in the developed world would not only be good for our health – it would also free up land for nature conservation, bioenergy production and other more sustainable uses.

"RENEWABLE ENERGY MAKES ECONOMIC SENSE. IT IS PREDICTED THAT BY 2050 THE WORLD WILL BE SAVING NEARLY €4 TRILLION EVERY YEAR COMPARED TO A 'BUSINESS-AS-USUAL' SCENARIO, DUE TO MUCH REDUCED FUEL COSTS."

Keith Allott,
Head of Climate Change, WWF-UK

Equity

A sustainable energy future must be a fair one. Rich countries have built their economies on cheap, plentiful fossil fuels and continue to consume the vast majority of global energy supplies. Meanwhile, 1.4 billion people have no access to reliable electricity and hundreds of millions of people use unsustainable biomass for cooking and heating. This has serious impacts on biodiversity and health. For example, about two million women and children die prematurely each year from indoor pollution from traditional cooking fires.

We must end unsustainable biomass use by providing people with better alternatives such as efficient cooking stoves. From solar power across Africa, to geothermal power in Indonesia, developing countries have great potential to power economic growth with renewable energy. Renewables also offer hope to the hundreds of millions of people who have limited access to energy.

Environmental issues

Of course, all energy sources have some environmental impacts, and renewables are no exception. Most renewable energy sources are inherently much less damaging than fossil fuels or nuclear energy, although care still needs to be taken in siting and operation. The renewables with the biggest potential impacts are unsustainable bioenergy and large-scale hydropower. WWF is working to develop sustainability standards for a range of renewable energy technologies to ensure that they are deployed in a way which respects environmental and social safeguards.

Finance

Renewable energy makes economic sense. It is predicted that by 2050 the world will be saving nearly €4 trillion every year, compared to a 'business-as-usual' scenario, due to much reduced fuel costs. That projection is based on a conservative estimate of future oil prices – and doesn't take into account the costs associated with climate change, the value of the millions of jobs created, or the health and social benefits such as better air quality and well-being.

But building a cleaner energy future will be a significant investment challenge. To install renewable energy on a massive scale, modernise electricity grids, transform public transport infrastructure, and improve the efficiency of our existing buildings will require global capital expenditure of €1 trillion a year, growing to around €3.5 trillion a year over the next 25 years. To achieve this level of investment, politicians need to create supportive legislation to build investor confidence in renewables and efficiency. They also need to stop subsidising fossil fuels and nuclear power.

WWF's energy vision is ambitious and radical – but it is grounded firmly in today's reality. Only technologies and processes that are already proven have been included – although a significant ramping up in research and development is essential to accelerate their deployment.

In WWF's view, switching to renewable energy isn't just the best choice – it is our only option.

[1] The Energy Report: 100% renewable energy by 2050, wwf.org.uk/energyreport

THE FUTURE ENERGY MIX IN 2050

By 2050, fossil fuels, traditional biomass and nuclear power should almost entirely be phased out and replaced by a more varied mixture of sustainable renewable energy sources.

The adjacent table shows the potential amount of energy that could be supplied by key renewable technologies in 2050 in exajoules (10^{18} joules) based on the analysis in the WWF's Energy Report. For comparison, current total energy use for electricity, heat and transport is 320 exajoules.

In addition, it also highlights the main insured risks and the key environmental issues associated with each of the different technologies in turn.

GLOBAL POTENTIAL OF SOLAR POWER BY 2050

PHOTOVOLTAICS	220 EXAJOULES
Key insured risks • Inverter failure • Failure due to moisture ingress • Storm damage	Key environmental issues • Types of materials used • End-of-life recovery and recycling • Dependence on sunlight availability
CONCENTRATING SOLAR POWER	**150 EXAJOULES**
Key insured risks • Fire • Storm damage to mirrors • Thermal oil heat exchanger failure	Key environmental issues • Use of water, especially in hot, arid areas • Dependence on sunlight availability, although storage techniques are emerging
CONCENTRATING SOLAR HIGH TEMPERATURE HEAT	**20 EXAJOULES**
Key insured risks • Storm damage to solar reflectors • Solar heat receptor fatigue failure • Heat exchanger fatigue failure	Key environmental issues • Use of water, especially in hot, arid areas • Dependence on sunlight availability

GLOBAL POTENTIAL OF WATER POWER BY 2050

HYDRO	16 EXAJOULES
Key insured risks • Damage to turbine due to water ingress • Electrical failure • Flood	Key environmental issues • Impact on river flow, water availability and downstream ecosystems • Land take and displacement of communities and ecosystems
WAVE & TIDAL	**3 EXAJOULES**
Key insured risks • Fatigue failure of structure • Water ingress and damage • Power cable failure	Key environmental issues • Impact on marine environment • Impact on shipping • Sensitive siting required

GLOBAL POTENTIAL OF BIOENERGY BY 2050

BIOENERGY	100 EXAJOULES
Key insured risks • Fire • Quality of materials used in construction • Expertise of operators	Key environmental issues • Land use competition with food production and biodiversity • Water use for energy crops • Agrochemical use for energy crops

GLOBAL POTENTIAL OF GEOTHERMAL ENERGY BY 2050

LOW TEMPERATURE HEAT	20 EXAJOULES
Key insured risks • Pump failure • Heat exchanger failure • Generator failure	Key environmental issues • Some risks if land-use not well managed • Use of chemicals but risks managed by closed loop systems
HIGH TEMPERATURE HEAT	**3 EXAJOULES**
Key insured risks • Well failure • Thermal cycle plant failure • Turbine generator failure	Key environmental issues • Some risks if land-use not well managed • Use of chemicals but risks managed by closed loop systems
GEOTHERMAL ELECTRICITY	**8 EXAJOULES**
Key insured risks • Failure of heat exchange / steam generation plant • Failure of transformer • Steam turbine failure	Key environmental issues • Some risks if land-use not well managed • Use of chemicals but risks managed by closed loop systems

GLOBAL POTENTIAL OF WIND POWER BY 2050

ONSHORE	115 EXAJOULES
Key insured risks • Fatigue failure of main rotating parts • Electrical failure • Cable damage	Key environmental issues • Potential biodiversity impacts • Visual impact • Sensitive siting required
OFFSHORE	**60 EXAJOULES**
Key insured risks • Fatigue failure and corrosion damage • Electrical failure • Blade failure due to lightning strike	Key environmental issues • Potential biodiversity impacts • Potential impact on shipping • Sensitive siting required

CLEAN ENERGY:
WHAT NEXT FOR THE EU AND UK?

The key messages of WWF's Energy Report are very relevant to the EU and UK context. In particular, it highlights the importance of:

- reducing energy demand;
- pushing ahead with a strong but sustainable deployment of renewables;
- investing strategically in the underlying grid infrastructure;
- making careful use of bioenergy in those sectors of the economy that are short of other alternatives to reduce their emissions; and
- investing early in the necessary decarbonisation infrastructure.

Reducing our demand for energy

If the EU and UK are serious about decarbonising their economies in a way that is cost efficient and sustainable, reducing energy demand will be a key part of that strategy. In a recent study looking at 'what might be reasonable changes to expect in the future'[2], the UK Energy Research Centre (UKERC) found that there was potential to reduce energy demand in the UK's homes and transport sectors by 50% by 2050[3], which could reduce the costs of delivering a low-carbon energy system by up to £70bn. Similar conclusions were made at EU level: the European Climate Foundation's Roadmap 2050 analysis found that energy efficiency measures could reduce the cost of decarbonising the EU's power sector by about 30%.[4]

Renewables have a tremendous potential

Renewables can undoubtedly provide an overwhelming proportion of our energy needs, casting doubt over the need to rely on less sustainable forms of energy such as nuclear. In the case of the UK, not only does this make sense from an energy security perspective, as we would be relying on our own energy resources, but it also makes sense from an economic perspective given the existing opportunity for the UK to become an industrial leader in marine renewables in particular.

The Offshore Valuation Report[5], which was recently published by the UK Government and key industry players[6], showed that if the UK used 29% of its practical offshore resource, the marine renewables industry could make the UK a net exporter of electricity by 2050, creating around 145,000 jobs in the process and around £62bn of annual revenues for the UK economy[7] – and this does not take into account other jobs that could be created if the UK supply chain was to start exporting as well. In fact, Renewable UK, the main trade association for the renewables industry, recently found that between 2007/2008 and 2009/2010, full time employment in the UK's wind industry grew by 91% while employment in the rest of the economy went down by 3.4%[8].

Smart and super grids are key

If we are to have a much greater amount of variable energy in our electricity system, we will need to be strategic in how we build and extend our current grid infrastructure. In particular, smart grids and the installation of smart meters should help make our demand for energy more flexible – by helping defer, to an extent, intensive energy uses at times of high demand and lower output from renewable plant. Equally important is the question of interconnection between European grids, which will help spread the intermittency of renewable energy over a much wider geographical area. The European Climate Foundation's Roadmap 2050 project found that increased interconnection could substantially decrease the number of 'back-up' power stations needed to support a strong deployment of renewables. For example, in its 80% renewable energy scenario for Europe, 'back-up' power stations would only need to operate around 5% of the time, increasing to around 8% in a 100% renewable energy scenario. This lowers the overall requirement for 'back-up' power stations by 35-40%.

It's time to invest!

Meeting the decarbonisation challenge will require substantial investment and the EU's legally binding commitments to cut emissions by at least 20% of 1990 levels by 2020 will be a major driver of this. In the UK alone, Ofgem, the gas and electricity regulator, announced in its 'Discovery' project that up to £200billion would be needed to build the country's low-carbon infrastructure. This will require innovative and facilitative ways of financing. The creation of a Green Investment Bank, structured as a bank rather than a fund and with an initial capitalisation of £3billion could play a key role in helping to finance projects on energy efficiency and emerging renewable technologies.

"IF THE EU AND UK ARE SERIOUS ABOUT DECARBONISING THEIR ECONOMIES IN A WAY THAT IS COST EFFICIENT AND SUSTAINABLE, REDUCING ENERGY DEMAND WILL BE A KEY PART OF THAT STRATEGY. "

Nick Molho,
Head of Energy Policy,
WWF-UK

[2] Making the transition to a secure and low-carbon energy system, UK Energy Research Centre, UKERC Energy 2050 Project, April 2009, http://www.ukerc.ac.uk/Downloads/PDF/U/UKERCEnergy2050/0906UKERC2050.pdf, page 104.

[3] Compared to business as usual levels.

[4] Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe, European Climate Foundation, April 2010, http://www.roadmap2050.eu/downloads. See Executive Summary to Volume 1

[5] The Offshore Valuation Report: A valuation of the UK's offshore renewable energy resource, 2010, http://www.offshorevaluation.org/downloads/offshore_valuation_exec.pdf

[6] Such as Statoil, RWE Innogy, Dong Energy and the Crown Estate in its important role as "landlord" of the seabed.

[7] The installed capacity figures in this scenario are 116GW by 2030 and 169GW by 2050. The report also contains more ambitious scenarios which would require a greater use of the UK's offshore resource.

[8] http://www.bwea.com/media/news/articles/pr20110201.html

SOLAR

Solar energy is derived from the light and heat naturally radiated from the sun. The potential to generate power from solar sources is enormous.

Indeed it is estimated that enough energy from sunlight reaches the earth in just 70 minutes to meet our total annual global energy demands[9]. Put another way, the amount of solar energy that reaches the surface of the planet is so vast that in one year it is double the amount that will ever be obtained from all the Earth's non renewable fossil fuels combined. Of course not all of this can be captured but it gives a flavour of the scale of the opportunity that solar power presents.

Harnessing solar power is not a new phenomenon. As far back as 400BC, Ancient Greeks and Native Americans were using the sun as an energy source. By building their homes into the side of hills they were able to benefit from heat stored in the earth during the day slowly being released back over night. However, it took the oil embargo of the 1970s and the Gulf War in the 1990s to give solar power a much needed boost as people became worried about our dependence on overseas countries for oil and petrol supplies.

Currently, there are two types of technologies able to convert solar rays into electrical power, solar thermal and photovoltaic. Solar thermal plants convert the heat received from the sun into electrical power through conventional steam driven generating equipment. They tend to be large-scale commercial installations and have been in operation since the 1980s when the first plants were constructed in California. Photovoltaic plants use semiconductors to directly convert light radiated energy from the sun into electrical output. They tend to be more domestic in nature and are typified by the solar panels seen on house roofs.

Given its limitless supply, solar power clearly has huge potential to help reduce our reliance on fossil fuels. At the moment, solar energy contributes only 0.02% of the world's total energy supply but it is growing quickly[10]. Europe is currently enjoying a solar boom, led largely by Spain, Italy and Germany where demand has been boosted by generous feed-in tariffs or subsidies. On sunny days, solar power now accounts for up to a tenth of Germany's electricity production.

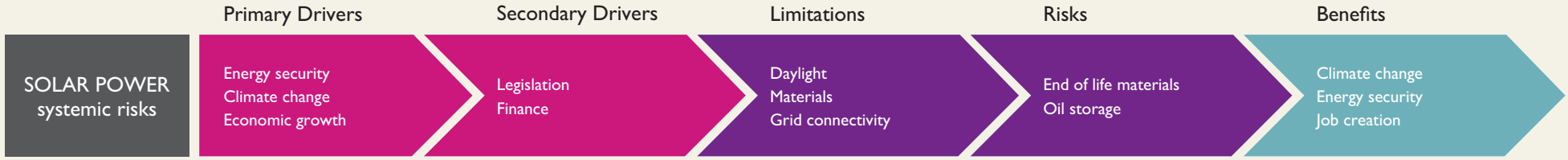
From an environmental perspective, solar power plants are relatively low impact: they produce virtually no emissions and consume no fuel other than sunlight.

Solar energy insurance risks

RSA is a leading insurer of solar energy. We are particularly well positioned in the growing market in Europe and through our global reach we have the ability to write insurance in over 130 countries.

Photovoltaic technology is recognised as being a relatively benign risk and is therefore attractive from an insurance perspective. Both property and liability cover is available for owners of solar power installations. Property cover provides protection against damage caused by fire, lightning, explosion, storm, flood, earthquake, theft and terrorism. For commercial generating plants, liability cover is required by law to provide protection for employees and other visitors, including contractors.

As mass generation solar power is in its relative infancy, much of the technology, particularly relating to thermal plants, is still prototypical and many components are likely to be bespoke so repair costs will tend to be higher and repair periods longer. As the industry matures, greater standardisation is likely to occur, bringing benefits in terms of increased reliability and reductions in repair time and costs.



"GIVEN ITS LIMITLESS SUPPLY, SOLAR POWER CLEARLY HAS HUGE POTENTIAL TO HELP REDUCE OUR RELIANCE ON FOSSIL FUELS."

Steve Kelly,
Head of Solar & Bioenergy,
RSA

Barriers to widespread adoption

As with many other renewable technologies there are significant economic hurdles to overcome. Although we are seeing dramatic falls in the cost of solar power, the cost of building a large-scale plant is still considerable and innovative financing solutions such as the UK's Green Investment Bank and realistic long-term feed-in tariffs, coupled with a supportive legislative environment, will be critical to secure the investment required.

Location is also a crucial factor. The efficiency of solar power plants is closely linked to their position relative to the Earth's latitude. Put simply, the intensity of solar radiation peaks at the equator so large areas of the northern and southern hemispheres are unsuitable for major solar power plants.

However, perhaps the greatest barrier, and the area where governments can provide the greatest assistance, is grid connectivity. By their very nature, large-scale solar plants tend to be located in remote areas away from centres of population and electricity grids. Solar power supply is also inevitably reliant on the weather and only available during daylight hours. This volatility of supply presents issues for national grids and in the future smart grids will be needed to link power generation from a variety of sources and from a diverse geographical area in order to smooth out supply and demand pressures.

Encouragingly this requirement is being recognised by governments. At a recent European Council meeting, members acknowledged that Europe needs a completely new €200 billion grid.

Looking to the future

If the cost of solar power continues to fall it could become cost competitive with fossil fuels in many countries within a decade or so. As the move towards a low carbon energy future gathers pace there is a growing global interest in solar technology. There are already ambitious plans to install a 100 GW solar power network for transmission of power from the Middle East and North Africa to Europe by 2050. To put this into context, this one network alone is greater than the UK's total generation capacity of 85 GW. We can also expect to see further growth in the USA and across mainland Europe and it is expected that China will become a particularly large user as well as manufacturer of solar cells.

In WWF's vision for a 100% renewable energy world in 2050, solar energy is expected to supply around half of our total electricity, half of our industrial heating and 15% of our industrial heat and fuel globally.

To meet this goal, and effectively harness the immense potential solar energy has, requires a truly collaborative approach from insurers, manufacturers, utility companies and governments. Only by working together will issues such as those around prototypical risks and grid connectivity be solved.

With our global reach and extensive experience in renewable energy, RSA is excited by the opportunities solar power provides and together with our partners at WWF we are ready to play our part in shaping the future of energy.

[9] RSA Renewable Energy Team statistics, March 2011

[10] The Energy Report: 100% renewable energy by 2050, wwf.org.uk/energyreport, page 31

BIOENERGY

Throughout history, humans have used plant materials as fuel for heating, lighting and cooking. Today bioenergy is generated from waste, crops or forest resources in the form of biogas, biomass and biofuel.

Biogas is generated by the action of bacteria breaking down organic waste. Organic waste includes sewage sludge, green or botanical waste and food waste. There are two types of biogas energy plants: anaerobic digestion and landfill gas. Anaerobic digestion is a form of composting which takes place in a carefully controlled and engineered environment. Landfill gas production is similar to anaerobic digestion with the main exception that it initially takes place with oxygen present. Waste treated in this way produces a methane rich biogas that can be used for power generation and the residual nutrient rich liquid and solid material is suitable for use as fertiliser on farmland. Recovering energy from waste is becoming increasingly important environmentally, as it helps reduce the volume of material sent to landfill as well as creating a relatively cheap and sustainable source of fuel.

Biomass refers to energy production from the burning of organic waste or crops grown specifically to provide a fuel source. There are two types of biofuels – biodiesel and bioethanol. Biodiesel is generated from vegetable oils (rape, palm or soya) or from tallow derived from animal fats. Bioethanol is mainly produced by the sugar fermentation process of crops such as corn, maize and wheat together with straw, willow, poplar trees, sawdust and various grasses. In 2010, worldwide biofuel generation reached 27.2 billion gallons of ethanol and biodiesel, up from 23.6 billion gallons in the prior year[11].

Environmentally, biomass and biofuels are the most challenging renewable energy sources. There is particular concern about the potential for deforestation and the diversion of land from food production to grow crops for fuel. In its Energy Report, WWF predicts that we will need around 250 million hectares of crops or about one sixth of total global cropland by 2050, for bio energy production. Moreover, some crops offer little emission reduction benefit over their lifecycle. For these reasons, WWF is keen to see mandatory sustainability criteria being adopted for all sources of biomass.

As all forms of bioenergy require an initial fuel source, the security of these raw materials is a key environmental risk. The emissions benefit from developing a bio plant in Wales would be significantly undermined if the wood chip to fuel it is transported from Canada.

An increased demand for bioenergy generated from wood or plant stock could result in significant land use pressures in the future. With the world's population expected to grow to over 9 billion over the next 40 years, it is important that biofuel cultivation does not use land and water required to grow food for people. If it is not managed sustainably the environmental and social impacts will be devastating. Despite these challenges there is a potential environmental 'double win' with bioenergy. It can provide both a way of generating clean power and of disposing of waste. Bioenergy can therefore play a key role in helping the UK reach its target of reducing the amount of waste sent to landfill to 35% of 1995 levels[12].

Bioenergy and insurance risks

Biogas is recognised as being the more benign risk in the bioenergy family. Due to the nature of the feedstocks involved in biomass, such as woodchip, the risk of fire tends to be higher than with biogas.

Both property and liability cover are available for owners of biogas, biomass and biofuel installations. Property cover provides protection against damage caused by explosion, fire, flood, theft and terrorism.

For commercial bioenergy generating plants, liability cover is required by law in many countries to provide protection for employees and other visitors, including contractors.

There is huge potential for greater bioenergy generation and in theory every commercial premise could manage its own waste. For example, a paper or pulp company could install a biomass kit on the back of their factory to enable them to process their waste and generate electricity. However, developments like this are not risk free as the business will be operating outside its core discipline and therefore might lack the expertise to operate the biomass elements safely.

Barriers to widespread adoption

Unlike other forms of renewable energy, bioenergy does not suffer the same grid connectivity issues, as more often than not the energy is being generated for local use. Furthermore, bioenergy production is more controllable and not subject to the weather, therefore any surplus supply sold back to the grid is much easier for the infrastructure to manage.

Despite bioenergy having been around in some shape or form since the methane gas lamps of the late 1800s there are still no recognised manufacturing standards. This variability of technology presents a risk to insurers and a barrier to widespread development of bioenergy. As a leading renewable energy insurer, RSA is keen to play its part in managing the risks of bioenergy production. To do this we need increased standardisation of plant equipment to reduce the prototypical nature of the technology. If manufacturers can overcome this it should accelerate the development and uptake of bioenergy significantly.

Finally, gaining planning permission, particularly for larger-scale commercial installations, is often a barrier. One way of overcoming planning objections would be to encourage greater local ownership of power generation by stressing the benefits that it can bring communities through revenue generation and job creation.

Looking to the future

Due to its reliability of supply, bioenergy is a good counter balance to other types of renewable energy and despite some social and environmental concerns it has an important role to play in an overall future energy mix.

Biofuels (global production and wholesale pricing of ethanol and biodiesel) reached over $56bn in 2010 and are projected to grow to $112bn by 2020[13]. BP's recent acquisition of Brazilian ethanol and sugar producer Comanhia Nacional de Acucar e Alcool for $680m will increase its capacity to 1.4bn litres a year, equivalent to 9 billion barrels. In areas where very high temperatures are required, such as steel production, or where liquid fuel remains essential such as aviation, biofuels will grow in importance. Indeed the International Air Transport Association has estimated that 15% of all jet fuel is expected to be bio-derived by 2020, rising to 50% by 2040.

Some firms are already working on the next generation of biofuels. KIOR, an American based biofuels company, for example converts waste wood into a crude oil replacement called Re-Crude. It aims to produce ethanol without competing with food crops for agricultural land. Algae is also being developed as a low input, high yield feedstock. According to Greg Mitchell of the University of California algae can produce 100 times more oil per acre than soy beans and 10 times more than palm oil[14].

However, the future drivers of bioenergy growth are just as likely to be linked to tougher measures on waste management as they are to renewable energy production targets. Indeed, currently in the UK, the Office of Fair Trading is investigating whether businesses are being encouraged enough to generate energy from sewage, food waste and by-products from farming.

Finally, to ensure bioenergy growth is sustainable, we must prioritise the use of waste over harvested plant materials and also ensure that the use of bioenergy is linked to efforts to reduce demand in the transport sector, in particular, pending improvements in battery and hydrogen technologies. The many benefits of bioenergy production must not be overshadowed by other environmental impacts.

"UNLIKE OTHER FORMS OF RENEWABLE ENERGY, BIOENERGY DOES NOT SUFFER THE SAME GRID CONNECTIVITY ISSUES, AS MORE OFTEN THAN NOT THE ENERGY IS BEING GENERATED FOR LOCAL USE."

[11] http://www.thebioenergysite.com/news/8355/global-renewables-markets-reach-1881-billion
[12] http://www.recycling-guide.org.uk/targets.html
[13] Clean Energy Trends 2011, Clean Edge Inc (www.cleanedge.com), March 2011, page 3
[14] http://www.wipo.int/wipo_magazine/en/2009/01/article_0005.html

SMALL-SCALE HYDRO

Hydropower has been used for hundreds of years, from the first water wheels and watermills built to grind flour from grain and to saw timber and stone.

Hydroelectric power is the generation of electric power from the movement of water. A hydroelectric facility requires a dependable flow of water and a reasonable height of fall of water, called the head. In a typical installation, water is fed from a reservoir through a channel or pipe into a turbine. The pressure of the flowing water on the turbine blades causes the shaft to rotate. The rotating shaft is connected to an electrical generator which converts the motion of the shaft into electrical energy.

Hydropower is currently the world's largest renewable energy source, providing nearly one-fifth of all electricity worldwide.

Large hydropower facilities or clusters of smaller plants can have severe environmental and social impacts. Constructing dams, especially large ones, changes water flow downstream and upstream, impacting freshwater ecosystems and potentially the livelihoods of those people who depend on fisheries, wetlands and regular deposits of sediment for agriculture. They can also fragment habitats and cut-off fish access to traditional spawning grounds. Creating reservoirs often means flooding large areas of land and it is estimated that between 40-80 million people worldwide have been displaced as a result of hydroelectric schemes[15].

In contrast, small hydro plants can be developed using existing dams or through the development of new dams, whose primary purpose is river and lake-water level control, or irrigation. Many small hydro projects use run-of-river designs that don't involve the construction of dams. Instead, these facilities often have overtopping weirs and intake structures which allow rivers to continue along their natural course, although can still present connectivity issues. A properly designed and constructed small hydro facility will therefore have a much reduced impact on the environment. The key to achieving this is careful planning involving full and proper environmental and cumulative impact assessments and broad stakeholder consultation.

Hydro power insurance risks

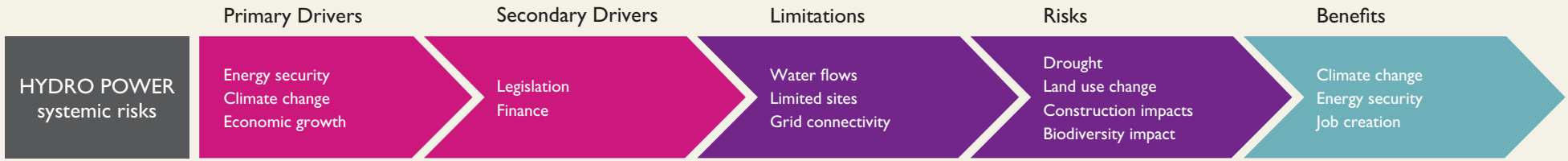
Small-scale hydro is a proven technology that has been in use for over 100 years. It is a relatively simple mechanical technology, with reliable equipment and designs.

RSA is a leading insurer of small hydro risks in Italy, Spain, Colombia, Chile, Canada and Scandinavia. We also offer insurance in the UK, Ireland, India, Brazil and Mexico. Small hydro definitions vary around the world; at RSA we categorise them as plants generating 50MW or less of power.

From an insurance perspective there are three main scenarios that may give rise to a claim: physical damage to the facility, loss of income as a result of that damage, and injury to third parties or damage to their property.

During the construction of a small hydro facility the main risks are fire, flood, earthquake, landslide, collapse, damage to equipment in transit and the subsequent delayed revenue generation as a result of any of these.

Once a site is operational the following additional risks exist: dam or weir failure, failure of the turbine blades, shafts, bearings, valves etc, vibration, erosion and corrosion of equipment, failure of electrical equipment and the subsequent loss of revenue due to downtime caused by any of these.



Barriers to widespread adoption

Hydro development costs can be high relative to other power technologies, especially when you consider that many suitable hydro sites are quite remote. The costs associated with building the necessary infrastructure to reach the site, the expense of building in a remote area, added to the investment in transmission capability required to get the energy to the grid means that it simply isn't economical to build on many of the sites that are suitable for small hydro.

In addition, a hydro site will generally take much longer to reach full generation capacity than other types of renewable energy such as wind and solar, with development times of seven or more years not uncommon. Public pressure can also severely impact on hydro development proposals, further adding to the time delays in reaching full capacity.

There is no reason, however, why a properly constructed and maintained hydro facility can't operate for many decades. In Canada for example, governments offer 40 year guaranteed power purchase agreements in recognition of the lifespan of a hydro plant.

Small hydro can be grid-connected but it is also one of the few examples of renewable energy that can also be effectively deployed as off-grid technology, providing reliable power to remote and often deprived communities. This has a number of potential benefits such as removing or severely reducing reliance on burning fossil fuels that are often very expensive to import. In turn this allows communities to channel funds towards other necessities such as schools, religious buildings or medical centres. Additionally, if properly planned after an appropriate consultation process, a hydro installation can be the catalyst for developing new roads and bridges and for creating new jobs, thereby stimulating local economic growth.

[15] http://unep.org/dams/WCD/

Looking to the future

The small hydro market is healthy and generation has grown by about 6% each year for the last decade. Significant growth has taken place in China and Brazil and we don't expect this to change in the near term, which could present environmental issues if left unchecked and unregulated. As a result of the support and green energy initiatives of the Obama administration, the US is also expected to invest in small hydro capacity, especially if it taps into its huge supply of existing dams. It has been estimated that the US has more than 50,000 dams which could, in theory, support power generation.

In addition, we anticipate continued growth in Italy and Canada due to the strong government support for renewable energy projects and their high level of expertise in developing and operating hydro facilities.

One key environmental benefit of small hydro is that in many instances existing dams, which may have been originally built to control flooding or for irrigation purposes, can be retrofitted to generate power. Because the dams have already been constructed, the major civil works are complete and it is therefore possible to add green power generation with a much smaller impact on the environment than a new build. Other attractive benefits to developers are that the cost and time needed to construct these projects is lower because the major infrastructure is already in place.

With increasing onus on governments to pursue renewable and low carbon forms of energy, hydropower will and should continue to part of the overall energy mix. But thorough risk assessments, careful site selection and appropriate product design is imperative.

"HYDROPOWER IS CURRENTLY THE WORLD'S LARGEST RENEWABLE ENERGY SOURCE, PROVIDING NEARLY ONE-FIFTH OF ALL ELECTRICITY WORLDWIDE."

Geoff Carter,
Head of Hydro,
RSA

CASE STUDY:
HYDROPOWER IN LATIN AMERICA

Latin America has a strong dependence on hydropower which contributes 80% of the energy mix in Brazil, 60% in Peru, and 40% in Bolivia.

In spite of this, huge untapped potential remains with only 20-30% of the possible resource currently exploited. With the majority of the most easily accessible sites already exhausted, developers are increasingly looking to the Amazon where around 140 dams are at some stage of planning.

While there is a proliferation of dams in planning there are risks and issues associated with using them for hydro power generation. Amazonian rivers carry huge quantities of sediment, which can be blocked by hydropower development with devastating consequences on upstream and downstream freshwater habitats. In addition, this can cause considerable problems for developers since sediment can lead to corrosion of turbines plus a reduction in water storage area and hence generation capacity. The Mascarenhas plant on the Doce River, built in 1974, silted up just five years after completion and the reservoir now has to be dredged on a near daily basis[16].

Another major area of risk in the Amazon region is underperformance resulting from heavily seasonal flows. Currently most reservoirs are of inadequate size to capture seasonal flows which are concentrated into a few months of the year. Balbina, in Amazonas State, is one of the worst examples, with a flooded area of 2360 sq km generating a meagre average of 112MW due to very long periods of low rainfall and productivity. Climate change scenarios for the region suggest rainfall and flows occurring in even more concentrated periods, which is only likely to exacerbate the problem.

In the Amazon, WWF has developed a Decision Support System database which highlights freshwater conservation priority areas that should be protected against development. Additionally, the organisation is working with governments, community groups and hydropower experts in the region to discuss how to avoid dams but still generate the energy people need, for example:

- investing in and developing other renewable energy sources that are under utilised in Latin America such as wind and solar. Diversifying the energy mix in Latin America can provide governments with better security against potential power outages, such as those that hit Brazil in 2000, resulting from a severe drought; and
- increasing energy efficiency on both supply and demand sides offers great scope for energy savings. In Brazil the adoption of the best available technology could reduce demand to such an extent that it would avoid the need to construct new energy plants to support expansion for the next 10 years.

Damian Fleming,
Freshwater Programmes Manager,
WWF-UK

"DIVERSIFYING THE ENERGY MIX IN LATIN AMERICA CAN PROVIDE GOVERNMENTS WITH BETTER SECURITY AGAINST POTENTIAL POWER OUTAGES, SUCH AS THOSE THAT HIT BRAZIL IN 2000, RESULTING FROM A SEVERE DROUGHT. "

[16] de Oliveira Carvalho, N (1999) Reservoir sedimentation effects on Hydropower generation – a case study

WIND

People have harnessed the power of the wind for hundreds of years, from the earliest sailing ships to the large electricity generating turbines that are a common sight on land and sea today.

Wind power currently only supplies around 2% of global electricity demand but capacity has more than doubled in the last four years. In some countries wind power already plays a far larger role in the overall energy mix. In Denmark, for instance, it accounts for one-fifth of the country's electricity production. According to WWF, wind could meet a quarter of world's electricity demand by 2050 if current growth rates continue, requiring an additional one million onshore and 100,000 offshore turbines.

Although wind farms clearly have a visible effect on the landscape, their environmental impact can be minimal if planned sensitively. When sited on farmland, almost all the land around them can still be used for grazing or crops; and when offshore, the waters surrounding the towers provide a safe haven for fish species. Unlike fossil fuel power plants, wind farms don't require water for cooling.

Wind energy insurance risks

Turbine technology is generally proven, reliable and of high quality. This makes wind power attractive from an insurance perspective.

RSA has been at the forefront of this industry for five decades; insuring onshore turbines in the late 1970s, the world's first offshore wind farm and the largest current installation, the London Array.

We offer insurance cover at all stages of the wind farm lifespan from the transportation of the components to the site, through the erection of the turbines to the operational phase of the farm.

Cover is provided against damage caused by fire, storm, theft, vandalism, earthquake, landslide, volcanic eruption, flooding, tornado, typhoon and hurricane. During the turbine construction phase the key risks relate to impact to the blades, theft of components, electrical fault and weather related damage. Once the wind farm is in operation the risk of mechanical failure either from lack of quality, lack of control or new designs increases.

Biodiversity impacts

One of the myths often put about by renewable energy detractors is the potential harm that wind turbines cause bird and marine life either through collision with the blades or the disruptive impact of vibration on an animal's sonar.

Our own view is formed from 30 years insurance and risk management experience in this field. We have insured onshore windfarms since the 1970s. We insured the first offshore farms off the coast of Denmark in the 1990s and continue to insure the new generation of floating turbines being developed today.

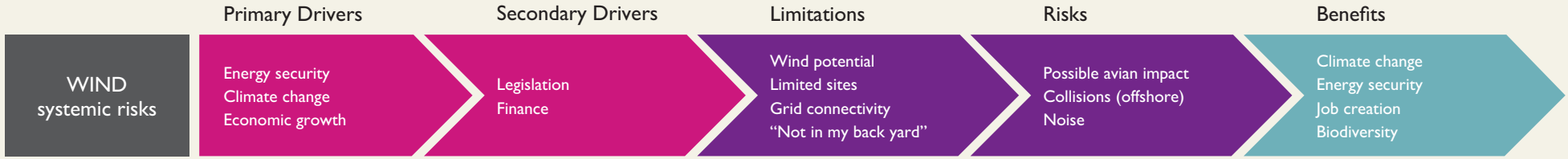
We have not seen widespread death of birdlife: birds feel the vibrations and see the turbines so simply adjust their direction. Nor have we seen dolphins, whales or other marine life adversely affected. In fact, we believe that the opposite is true and windfarms can have a positive biodiversity impact.

Offshore windfarms can provide a safe haven for wildlife. As ships are unable and indeed not allowed to sail through windfarms the lack of trawling or nets between the turbines means they are a safe environment for mussels and fish species to flourish. In addition, studies have shown that some foundations can effectively become artificial reefs which can also lead to an increase in fish populations due to the ready supply of food. Furthermore we also often see seals and other animals using the installations as basking areas on sunny days when the tide is low.

Barriers to widespread adoption

The barriers to further widespread adoption of wind energy can be broken down into three broad categories, all of which can be managed and in a short number of years could be eliminated.

As with other forms of renewable energy, the finance required is significant and for investment in wind energy to be attractive against competing opportunities it needs a guaranteed return for the investor.



"WIND POWER CURRENTLY ONLY SUPPLIES AROUND 2% OF GLOBAL ELECTRICITY DEMAND BUT CAPACITY HAS MORE THAN DOUBLED IN THE LAST FOUR YEARS."

The basis of this to date has been a combination of fixed feed-in tariffs provided by governments, availability guarantees from turbine manufacturers and risk transfer in the form of insurance. One area of concern is feed-in tariffs, which in the current 'age of austerity', are increasingly coming under scrutiny and in some cases are expected to be reduced or even withdrawn. On the other hand, however, availability guarantees have become more widespread in recent months due to the highly competitive nature of the industry and the influx of new manufacturers from China, India and south east Asia. All good news for investors.

Historically, one of the bottlenecks limiting the growth of wind energy has been the supply of major components such as gearboxes, bearings and shafts, although this has now largely been eased by an increase in the number of component manufacturers and their proximity to major markets, however it is a situation that still needs monitoring. One of the greatest areas of focus now relates to the availability of technical knowledge and experienced contractors. In addition the supply of specialist vessels required in the construction of offshore installations has at times been an issue. In 2010 there were only 15 jack-up vessels in use globally, however, some £3.45 billion has been invested in new, larger ships and over the next 18 months we expect a further 23 to become operational.

Finally, gaining public acceptance and planning permission for new wind farms is a common challenge, particularly for onshore installations. Complaints relating to visual impact, flickering and sound pollution have all hampered the planning permission process in several countries.

Looking to the future

The US has long been the largest wind power market in the world, but China took the lead in terms of new capacity in 2010 installing 16,500 MW of wind power, 64% growth on the previous year.

As technology advances and the earliest wind farms come to the end of their lifespan we are increasingly seeing older and smaller turbines replaced by new higher output ones. The first offshore wind farm in Vindeby in southern Denmark was constructed in 1991 and comprised eleven 450KW turbines. Today 6 and 7 MW turbines are in production and in a relatively few years we expect to see 10 and even 20 MW turbines which at 250 metres high with 120 metre blades will dwarf today's towers. Floating turbines which have less impact on the seabed and can be sited in deeper water are already being trialled.

The net effect will be a decline in the overall number of turbines but total output will increase. It is estimated that two thirds of the older models will be decommissioned and replaced with higher output models at a ratio of 3:1. An increase in the number and scale of offshore wind farms also has the potential to have a positive knock-on effect to the wider economy as a whole new service infrastructure with tens of thousands of associated jobs is developed to support them. For example, in the UK the regional development agency One North East estimates that 20,000 jobs will be created over the next decade as a direct result of new offshore wind schemes.

While turbines may split aesthetic opinion with equal numbers of people considering them an eyesore as think there is something beautiful about them one thing is clear, wind is often the easiest way for governments to reduce CO2 emissions and as the world moves towards a low carbon future more and more wind turbines are likely to be a feature of the global landscape.

Niels Kragelund,
Head of Wind Energy, RSA

CONCLUSION

So what will the future energy landscape look like? On the one hand, the world's fossil fuel resources are finite and we are using them up at a rapid rate, on the other, the supply of renewable energy sources, particularly solar, wind and marine, is limitless.

With the global population expected to increase to 8.9 billion by 2050[17], the price of oil reaching records highs and the nuclear industry still reeling from the Japanese crisis at Fukushima the need for renewable energy has never been greater.

How much of a role renewable energy will have depends on how brave and far sighted we are. We can achieve a 100% renewable future by 2050 but it will require a concerted effort to get there. So what needs to happen?

We need to ensure access to capital. The cost of developing a solar or wind farm is substantial but with the right financial structures in place the economic case can be compelling and will become even more so, as costs fall with technology improvements and economies of scale.

We need governments to provide competitive and lasting financial incentives for renewable energy developments to give investors the confidence to invest in the long term.

Crucially, we need a more regional approach to grid infrastructure to help match fluctuating supply and demand. The UK, for example, could meet all of its energy needs through a combination of its own wind and tidal power supplemented by Alpine hydro and solar from the Mediterranean.

Hand in hand we also need to reduce the global demand for energy through a combination of increasing efficiency, for example by greater home insulation or increased use of electric powered cars, but also through behaviour change such as a reduction in long haul travel and greater use of public transport.

Renewable energy might be carbon free but it's not risk free. As technology continues to develop and we see ever bigger wind turbines and larger solar plants, we need insurers and manufacturers to work together to understand, manage and reduce the risks.

Not only is a fundamental and sustained transition to renewable energy beneficial from an environmental perspective, there are also wider socio-economic benefits too. The renewable energy industry has the potential to bring electricity to areas of the world currently devoid of it, to generate tens if not hundreds of thousands of new jobs and to regenerate previous urban waste lands.

The time for action is now. Both WWF and RSA stand ready to continue to play their parts in managing the shift to a sustainable energy future. Are you?

USEFUL LINKS

For more information on RSA's partnership with WWF go to www.wwfrsapartners.com

The Energy Report: 100% renewable energy by 2050, on wwf.org.uk/energyreport

[17] www.un.org/esa/population/publicactions/longrage2WorldPop2300final.pdf

RSA and WWF have entered into a three-year global partnership to strengthen understanding of the links between insurance and environmental risk. Through joint research, emerging risk briefings and product development the two organisations will encourage action among business, customers and governments. For more information about the partnership visit www.wwfrsapartners.com

ABOUT WWF

WWF is one of the world's largest independent conservation organisations, with more than five million supporters and a global network active in more than one hundred countries. We're working to create solutions to the most serious environmental issues facing our planet, so that people and nature can thrive. Through our engagement with the public, businesses and government, we focus on safeguarding the natural world, tackling climate change and changing the way we live.

And in this our 50th anniversary year, our belief in a better future grows stronger by the day. Together, we can make it happen.

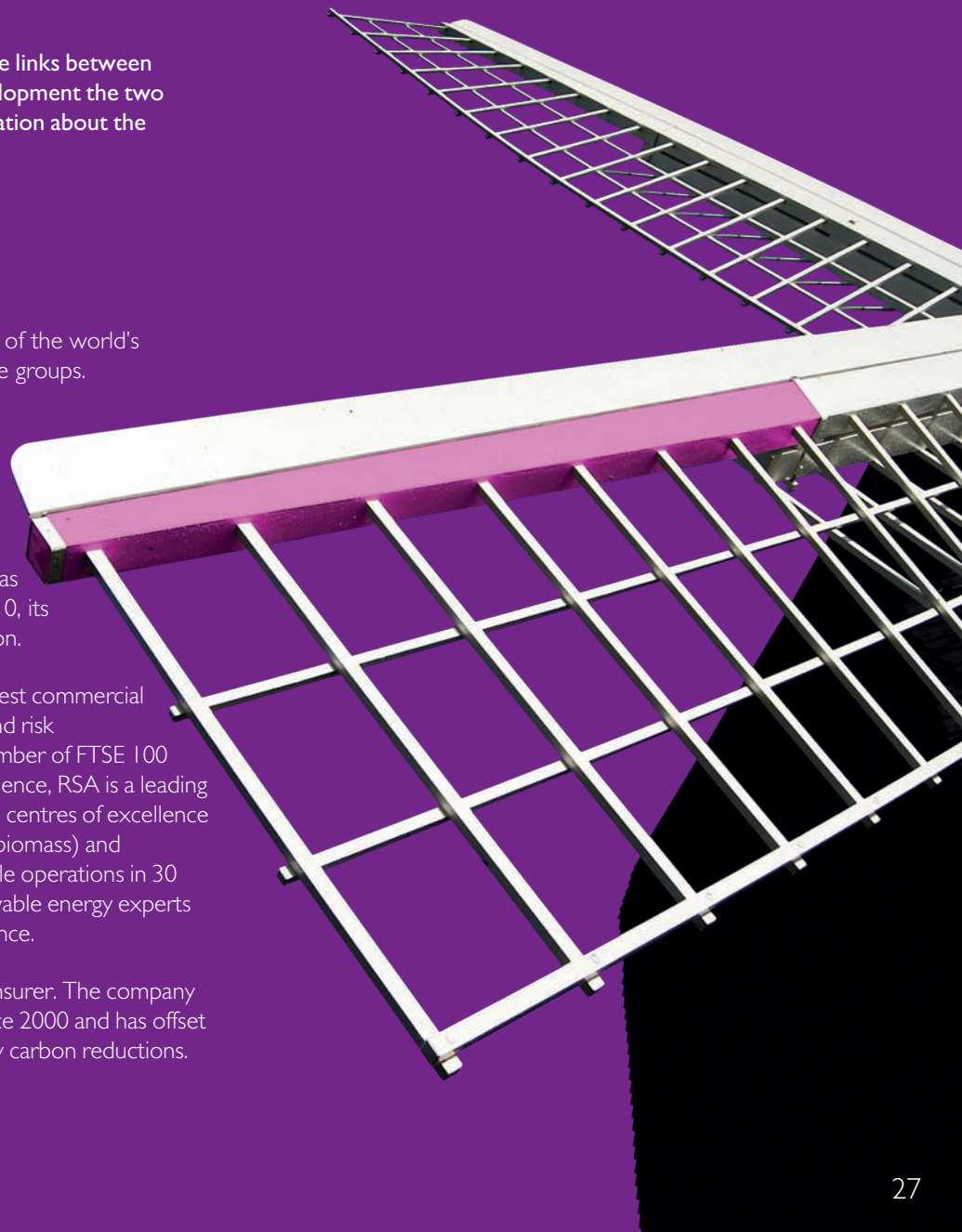
Find out more about our work, past and present, at wwf.org.uk

ABOUT RSA

With a 300 year heritage, RSA is one of the world's leading multinational quoted insurance groups. RSA has major operations in the UK, Scandinavia, Canada, Ireland, Asia and the Middle East, Latin America and Central and Eastern Europe and has the capability to write business in over 130 countries. Focusing on general insurance, RSA has around 22,000 employees and, in 2010, its net written premiums were £7.5 billion.

Within the UK, RSA is the second largest commercial lines insurer, covering the insurance and risk management needs of a significant number of FTSE 100 companies. With over 30 years experience, RSA is a leading renewable energy insurer. It has three centres of excellence in Canada (hydro), the UK (solar and biomass) and Denmark (wind), supporting renewable operations in 30 countries. Together, its team of renewable energy experts has over 600 years combined experience.

RSA was the first UK carbon neutral insurer. The company has cut its carbon footprint by half since 2000 and has offset the remainder by purchasing voluntary carbon reductions.



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Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony and nature.

With an almost 300 year heritage, RSA Group is one of the world's leading global insurers. Focusing on general insurance, it has the capability to write business in over 130 countries, with major operations in the UK, Scandinavia, Canada, Ireland, Central & Eastern Europe, Asia, the Middle East and Latin America.