



CLIMATE CHANGE IS ALREADY A REALITY

Even if fossil fuel supplies were infinite, we would have another compelling reason for an urgent switch to renewable energy: climate change. Hundreds of millions of people worldwide are already affected by water shortages, crop failures, tropical diseases, flooding and extreme weather events – conditions that are likely to be made worse by increasing concentrations of greenhouse gases in the Earth's atmosphere. The WHO estimates that climate change is already causing more than 150,000 deaths a year⁶.

Global warming threatens the fragile balance of our planet's ecosystems, and could consign a quarter of all species to extinction⁷. The loss of ecological services from forests, coral reefs and other ecosystems will also have huge economic implications⁸. The costs of adapting to climate change will be colossal: a recent report suggests that by 2030, the world may need to spend more than €200 billion a year on measures such as building flood defences, transporting water for agriculture and rebuilding infrastructure affected by climate change⁹. To avoid devastating consequences, we must keep eventual global warming below 1.5°C compared to pre-Industrial temperatures. To have a chance of doing that, global greenhouse gas emissions need to start falling within the next five years, and we need to cut them by at least 80 per cent globally by 2050 (from 1990 levels) – and even further beyond that date.

The global energy sector holds the key. It is responsible for around two-thirds of global greenhouse gas emissions, an amount that is increasing at a faster rate than for any other sector. Coal is the most carbon-intensive fuel and the single largest source of global greenhouse gas emissions. Embracing renewable energy, along with ambitious energy-saving measures, is the best way to achieve the rapid emissions reductions we need.

6. <http://www.who.int/globalchange/news/fsclimandhealth/en/index.html>

7. <http://www.nature.com/nature/journal/v427/n6970/abs/nature02121.html>

8. For a report on the effects of climate change on ecosystem services, see The Economics of Ecosystems and Biodiversity (TEEB) TEEB Climate Issues Update, September 2009.

9. Martin Parry, Nigel Arnell, Pam Berry, David Dodman, Samuel Fankhauser, Chris Hope, Sari Kovats, Robert Nicholls, David Satterthwaite, Richard Tiffin, Tim Wheeler (2009) Assessing the Costs of Adaptation to Climate Change: A Review of the UNFCCC and Other Recent Estimates, International Institute for Environment and Development and Grantham Institute for Climate Change, London.

CLIMATE CHANGE IS ALREADY A REALITY



**“NUCLEAR IS AN
UNETHICAL AND
EXPENSIVE OPTION”**



NUCLEAR WASTE WILL BE DANGEROUS FOR 10,000 YEARS

For some, nuclear power is seen to be a part of the solution to the energy crisis. It produces large-scale electricity with low carbon emissions – although mining and enriching uranium is very energy intensive.

But we cannot escape the reality that nuclear fission produces dangerous waste that remains highly toxic for thousands of years – and there is nowhere in the world where it can be stored safely. The United States and Germany alone have accumulated more than 50,000 and 12,000 tonnes respectively, of highly radioactive waste which has not yet been disposed of securely. According to the U.S. Environmental Protection Agency, it will be at least 10,000 years before its threat to public health is substantively reduced.

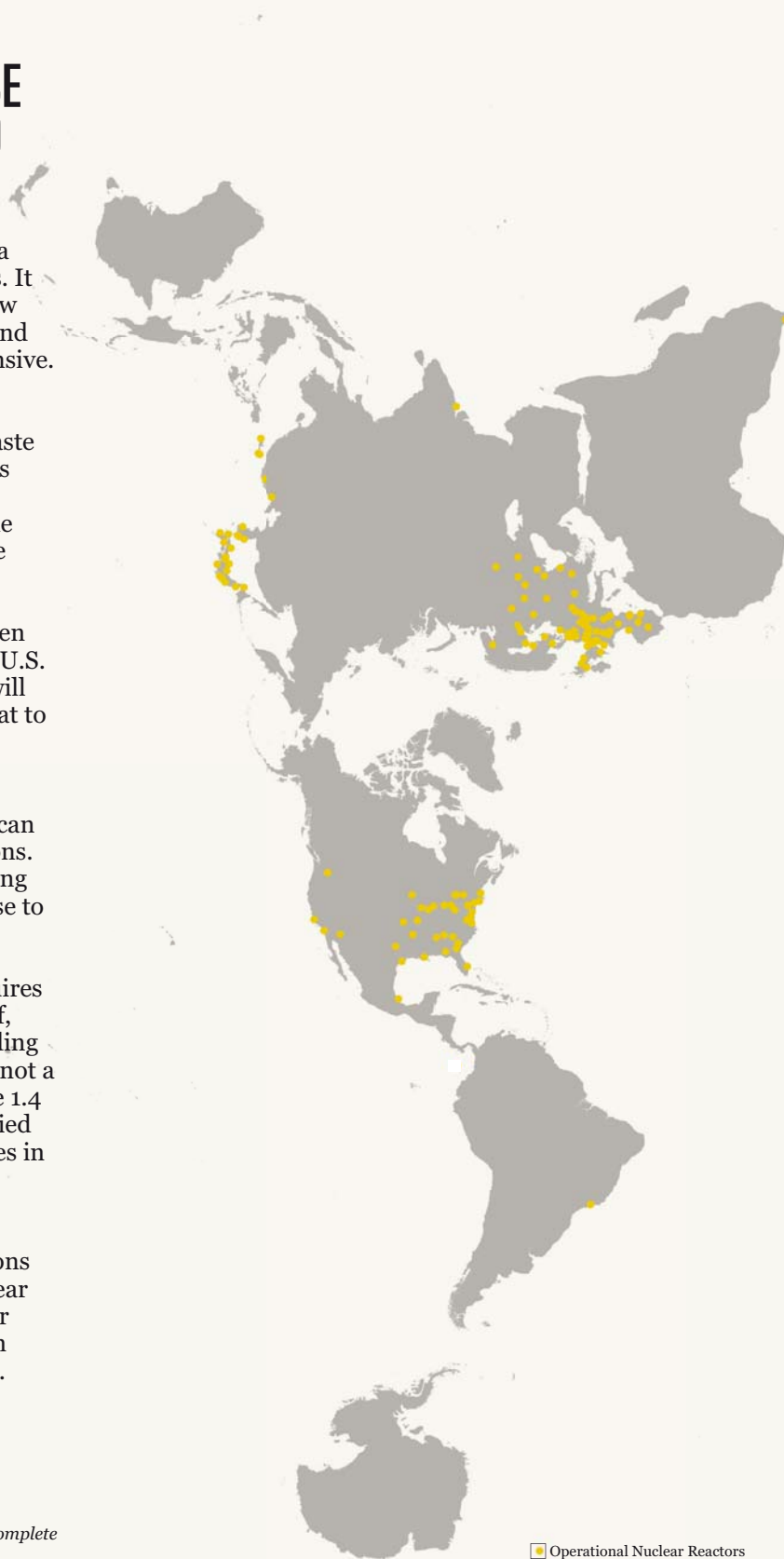
Equally troubling, the materials and technology needed for nuclear energy can also be used to produce nuclear weapons. In a politically unstable world, spreading nuclear capability is a dangerous course to take.

Nuclear is no ‘easy’ technology. It requires a highly sophisticated and trained staff, and only works on a large scale, providing power around the clock. It is certainly not a viable way to provide electricity for the 1.4 billion people whom are currently denied it¹⁰, many of whom live in remote places in fragile states.

Nuclear power is also an extremely expensive option. Before pouring billions into creating a new generation of nuclear power stations, we need to ask whether that money would be better invested in other, sustainable energy technologies.

10. IEA, World Energy Outlook (WEO), 2010, Paris

Map 3: Operational nuclear reactors
P. Hearn, Jr., T. Hare, et. al., *Global GIS Database: Complete Global Set*, 2002



Operational Nuclear Reactors

WWF'S PERSPECTIVE

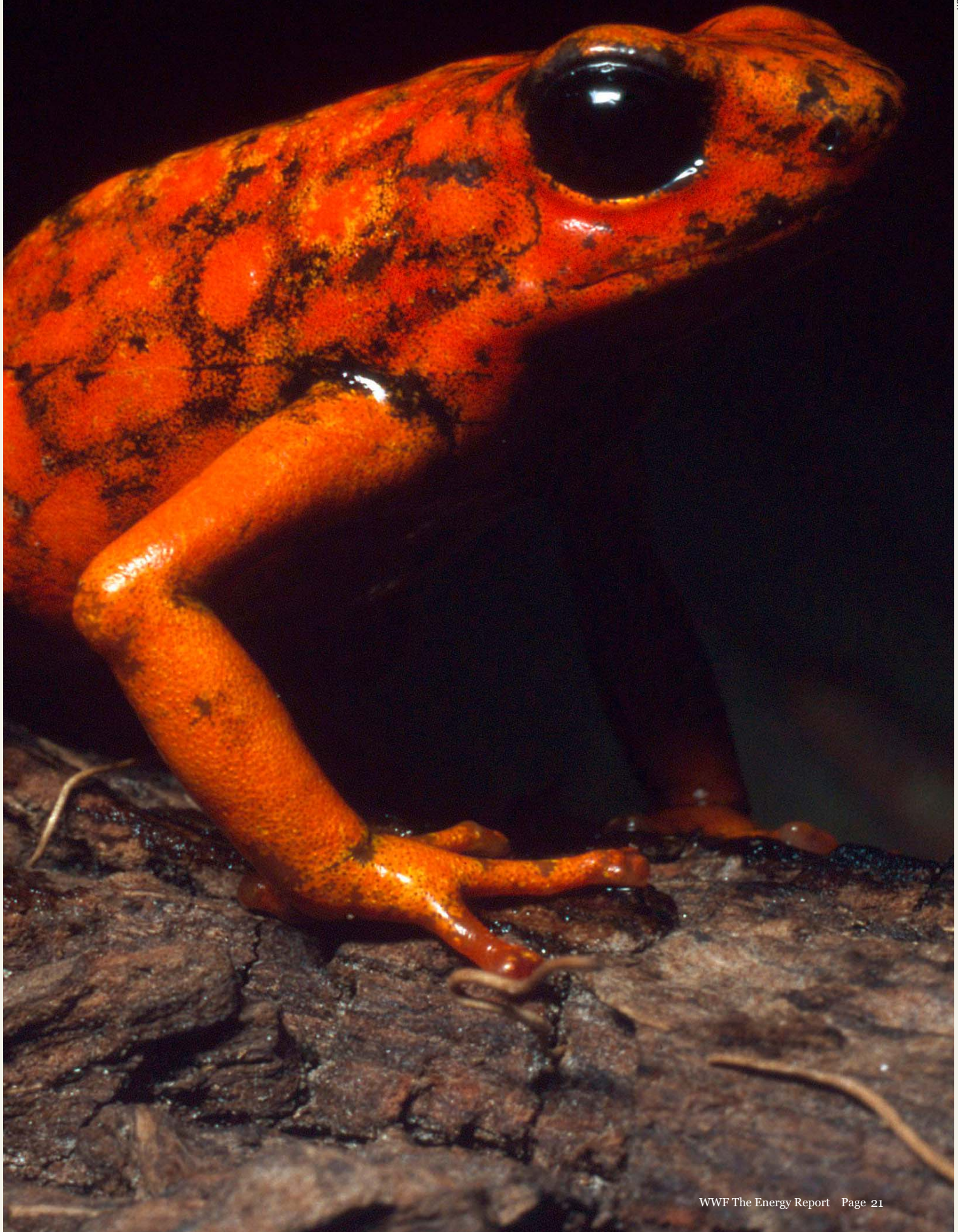
Climate change threatens to undo everything that conservation organizations like WWF have achieved over the last half-century. Polar bears may make the headlines, but in reality very few species will be unaffected by a changing climate. Many species could become extinct. Even entire ecosystems – such as coral reefs, mountain habitats, and large blocks of tropical rainforests such as the Amazon – could completely disappear.

Many plants and animals that have adapted to their environment over millions of years are vulnerable to even slight changes in temperature and rainfall. Warming and acidifying seas threaten coral reefs and krill – the basis of the marine food chain in many parts of the world. Large mammals like whales and elephants may be forced to travel further in search of food, leaving the safety of the protected areas that WWF and others have fought so hard to secure.

As part of the interwoven web of life, humans will not be immune to the consequences of a changing climate. WWF's mission is to protect the magnificent array of living things that inhabit our planet and to create a healthy and prosperous future in which humans live in harmony with nature. Solving the energy crisis is fundamental to this, whatever tough choices and challenges it brings.

“WE PREDICT, ON THE BASIS OF MID-RANGE CLIMATE-WARMING SCENARIOS FOR 2050, THAT 15–37% OF SPECIES IN OUR SAMPLE OF REGIONS AND TAXA WILL BE ‘COMMITTED TO EXTINCTION’”*

* Thomas C.D. et al, 2004, Extinction risk from climate change. *Nature*, Vol 427, No. 8



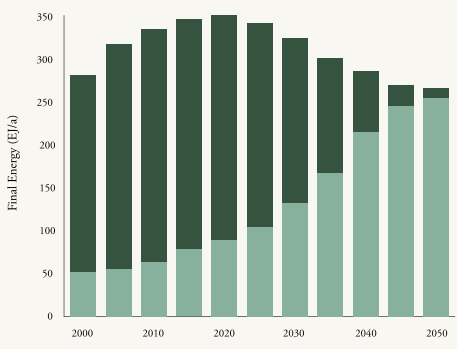
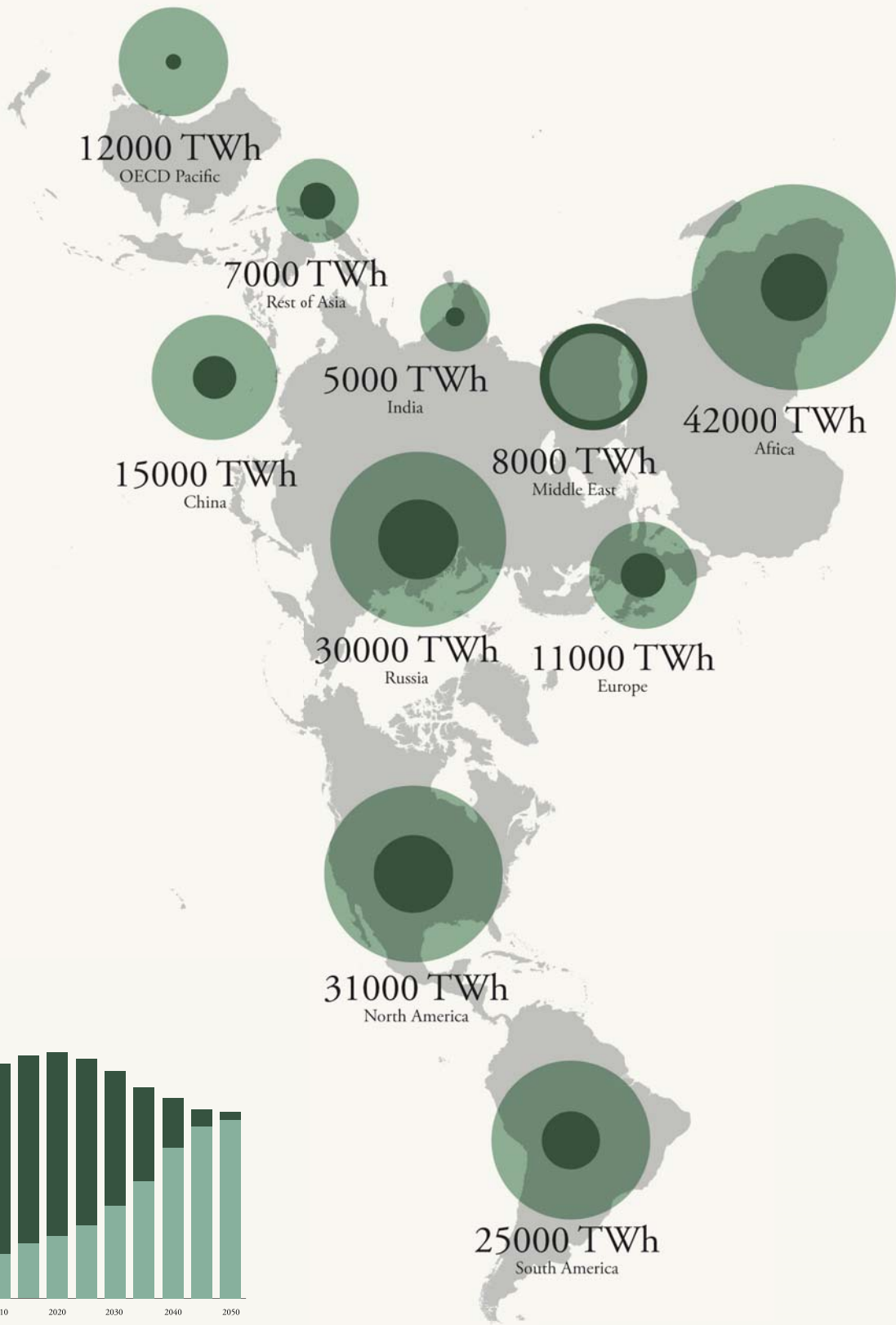


Figure 3: World Energy Supply
 Source: The Ecofys Energy Scenario, December 2010

- Fossil Fuel Supply
- Renewable Energy Supply

Map 4: Fossil Fuel and Renewable Energy Potential

This OMA map is an artists' impression showing the abundance of Renewable Energy potentials. It is not intended to claim exact values for renewable energy potentials but represents a rough estimate based on landmass.

100% POSSIBLE

Switching to a fully renewable energy supply by 2050 is achievable, but there are challenges to overcome.

The global energy crisis is a daunting challenge. Yet we do not have to look far for the solutions. Energy derived from the sun, the wind, the Earth's heat, water and the sea has the potential to meet the world's electricity needs many times over, even allowing for fluctuations in supply and demand. We can greatly reduce the amount of energy we use through simple measures like insulating buildings, recycling materials and installing efficient biomass stoves. Biomass from waste, crops and forest resources has potential to provide a renewable source of energy – although this raises significant social and environmental issues, which we will discuss later in this report.

Around the world, people are taking steps in the right direction. In 2009, China added 37GW of renewable energy, bringing its total renewable capacity to 226GW – equivalent to four times the capacity required to satisfy the total peak electrical power consumption of Great Britain¹¹ or over twice the total electric capacity of Africa!¹² In Europe and the U.S., more than half of all new power capacity installed in 2009 came from renewable sources. In the developing world, more than 30 million households have their own biogas generators for cooking and lighting. Over 160 million use “improved” biomass stoves, which are more efficient and produce less greenhouse gas and other pollutants. Solar water heating is used by 70 million households around the world. Wind power capacity has grown by 70 per cent, and solar power (PV) by a massive 190 per cent in the last two years (2008 and 2009). During the same period, total investment into all renewables has increased from about \$US 100 billion in 2007 to more than \$US 150 billion in 2009¹³.

But the pace of change is far too slow. Non-hydro renewables still only comprise a mere 3 per cent of all electricity consumed. Huge quantities of fossil fuels continue to be extracted and used, and global carbon emissions are still rising. Government subsidies and private investments in fossil fuels and nuclear power ventures still vastly outweigh those into renewable energy and energy efficiency, even though the latter would give a far greater long-

term return. While thousands of houses throughout the world, especially in Germany and Scandinavia, have been built to “passive house” standards that require almost no energy for heating and cooling, many more construction projects follow old-fashioned, energy-inefficient designs.

Moving to a fully renewable energy future by 2050 is a radical departure from humanity's current course. It is an ambitious goal. But WWF believes that it is a goal we can and must achieve. This conviction led us to establish a collaborative partnership with Ecofys, one of the world's leading climate and energy consultancies. We commissioned Ecofys to assess whether it would be possible to secure a fully renewable, sustainable energy supply for everyone on the planet by 2050.

The Ecofys scenario, which forms the second part of this report, is the most ambitious analysis of its kind to date. It demonstrates that it is technically feasible to supply everyone on the planet in 2050 with the energy they need, with 95 per cent of this energy coming from renewable sources. This would reduce greenhouse gas emissions from the energy sector by about 80 per cent while taking account of residual land-based emissions from bioenergy production.

The task ahead is, of course, a huge one, raising major challenges. However, the scenario Ecofys has mapped out is practically possible. It is based only on the technologies the world already has at its disposal, and is realistic about the rate at which these can be brought up to scale. Although significant investment will be required, the economic outlay is reasonable, with net costs never rising above 2 per cent of global GDP. The Ecofys scenario accounts for

projected increases in population, long-distance travel and increased economic wealth – it does not demand radical changes to the way we live.

The scenario detailed by Ecofys for this report is not the only solution, nor is it intended to be a prescriptive plan. Indeed, it raises a number of major challenges and difficult questions – particularly for a conservation organization like WWF – which we will discuss in more detail on the following pages. To realize our vision of a 100 per cent renewable and sustainable energy supply, we need to further advance the Ecofys scenario; and we propose some of the social and technological changes that could help us do this.

In presenting the Ecofys scenario, WWF aims to show that a fully renewable energy future is not an unattainable utopia. It is technically and economically possible, and there are concrete steps we can take – starting right now – to achieve it.

11. Figures for UK energy demand come from the National Grid's website: <http://www.nationalgrid.com/uk/Electricity/Data/Demand+Data/>
12. EIA World Electric Data 2006 <http://www.eia.doe.gov/iea/elec.html>
13. Renewables 2010 Global Status Report, REN 21.

“WE CAN REDUCE OUR RELIANCE ON FOSSIL FUELS BY 70% BY 2040”*

* Source: The Ecofys Energy Scenario, December 2010