

The road to COPENHAGEN



**Clear and
present danger**

President Mohamed Nasheed

Clean revolution

Loud and clear

Seal the deal!

Concerted effort

Last resorts

TUNZA

the UNEP magazine
for youth. To view current
and past issues of this
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Partners for Youth and the Environment



UNEP and Bayer, the German-based international enterprise involved in health care, crop science and materials science, are working together to strengthen young people's environmental awareness and engage children and youth in environmental issues worldwide.

The partnership agreement, renewed to run through 2010, lays down a basis for UNEP and Bayer to enlarge their longstanding collaboration to bring successful initiatives to countries

around the world and develop new youth programmes. Projects include: TUNZA Magazine, the International Children's Painting Competition on the Environment, the Bayer Young Environmental Envoy in Partnership with UNEP, the UNEP Tunza International Youth/Children's Conference, youth environmental networks in Africa, Asia Pacific, Europe, Latin America, North America and West Asia, the Asia-Pacific Eco-Minds forum, and a photo competition, 'Ecology in Focus', in Eastern Europe.

Just say no!



We all agree that recycling is a good thing. But while transforming, say, a newspaper into an egg carton saves on pollution, landfill and raw materials – not to mention carbon emissions – recycling processes still gobble up precious resources like energy and water. And no matter how diligently we recycle, it's still just a dent in the mountain of waste we're constantly generating.

The concept of precycling helps tackle the problem of over-consumption before it begins, avoiding the need to recycle in the first place. Precycling means stopping to think, before you buy: Do I really need this item? What effect did/will its production have on Earth? What do I already have that might be altered? And so on. Eventually, if enough people stop buying stuff, other people will have no incentive to make it.

Here are a few ideas to start with:

- Try to buy products with minimal packaging, and opt for recyclable packaging – paper and glass rather than plastic, for example. Let manufacturers and shops know you prefer less packaging.
- Carry reusable shopping bags and smaller cloth bags for weighing produce.
- Try mending or buying second-hand items before purchasing a new product. If you must buy new, go for high quality, so that it lasts longer.
- Rent or lease products, especially appliances and electronics, rather than buying them. Research has shown that when responsibility for products ends with the manufacturers, they have an incentive to make them more sustainable.
- Carry a kit with utensils, cloth napkins, and a drinks bottle and/or cup when going out to avoid producing waste when eating out.
- A borrower be: pool some tools, toys or books with your neighbours and start a community lending library.
- Buy food in large sizes or in bulk to decant into smaller reusable containers as needed. This saves on individual packaging and money.
- Grow your own vegetables and herbs.

Need inspiration? Watch the 20-minute animated film *The Story of Stuff* (www.storyofstuff.com), a look at the realities of the production, consumption and waste cycle.

EDITORIAL



Just three short months are left of what may well prove to be the most important year in history, culminating in what is probably the most crucial international meeting to date. For the Copenhagen Climate Change Conference, which takes place in December, and the negotiations that are preceding it all year, will decide the future both of humanity and of the planet itself. Reaching an ambitious and comprehensive agreement there on reducing global emissions of carbon dioxide (CO₂) and other greenhouse gases may well be the last chance that the world has of avoiding not just dangerous, but catastrophic, climate change.

The world financial crisis has made reaching agreement harder, as national leaders think of their economies first. But in fact it should make it easier, for the answers to the financial and climate crises – and to the energy crisis fast coming up behind them – lie in the same direction. Clean technology, and particularly renewable energy, offers the most promising prospect for producing a sustainable and growing world economy. It already constitutes a \$4.5 trillion market, while last year investments in renewable energy for the first time exceeded those in fossil fuels and nuclear power worldwide. Green technologies are also labour-intensive, providing plenty of good employment, much more than is offered by more traditional technologies. The International Labour Organisation says that projected investments in renewable energy alone could create another 20 million jobs by 2030, with another 12 million arising from producing biomass for energy and related industries.

For the last year UNEP has been calling for a Global Green New Deal, where stimulus packages are targeted at providing jobs and sustainable growth through greening the world economy. Some countries, most notably the Republic of Korea, have wholeheartedly embraced the concept and others have devoted varying proportions of their recovery packages to it. But much more needs to be done, and a strong enough agreement in Copenhagen could itself provide an enormous stimulus by pointing countries and economies towards a new, low-carbon future. Governments must 'seal the deal' on climate in December, and then move on to building a prosperous green future.

A warming world **for real**



Banson



Alex Webb/Magnum Photos



Last year was one of the 10 warmest worldwide since modern records began more than 150 years ago. The Arctic sea ice shrank to its second lowest extent on record, only just failing to beat the previous year.

South America suffered its worst weather disaster of recent times, with flooding affecting 1.5 million people in Brazil. Heavy rains drove some 10 million people in India from their homes. The United States was hit by Hurricane Ike, its third most destructive one after Katrina in 2005 and Andrew in 1992. And Cyclone Nargis, which devastated Myanmar, was the worst to hit Asia for 17 years.

By contrast, Argentina, Chile, Paraguay, Portugal and Uruguay all experienced their worst droughts in decades. And Australia has now been gripped by one for an unprecedented 12 years.

In other words, it was a pretty normal year in what is now a rapidly warming world. We are already getting more of the same this year, and can expect it next year and for all the years thereafter, as climate change brings more storms, droughts and floods and changes the face of the Earth.

It is all happening faster than anyone expected. Take that sea ice, for example. Professor Mark Serreze of the US National Snow and Ice Data Center – one of the world's leading authorities – says that if you had asked him just two years ago

how long the ice would last before it all melted in summer, he would have said 2070 or 2100. Now he estimates that the Arctic will be ice-free in September as early as 2030, and some experts reckon it could happen by 2013.

It was 2007 that changed his mind. That year the ice cap abruptly shrank 25 per cent more than its previous record low, taking it down to levels that had not been expected to occur before 2050. And, as we have seen, last year was not much better.

The Greenland ice sheet is also melting much faster than expected as its glaciers have started racing towards the sea. So are mountain glaciers worldwide – their average rate of melting and thinning doubled in just two years between 2004 and 2006. The ice shelves that border the Antarctic Peninsula are rapidly disappearing, and the massive ice sheets that cover the 'frozen continent' are also beginning to melt. Partly as a result of all this, the world's seas are now rising twice as fast as they did, on average, during the 20th century.

And disturbing changes are beginning to take place in the hottest parts of the world as well as in the coldest ones. The tropics, for example, are expanding, having widened by about 220 kilometres since 1970. This is threatening to drive deserts into fertile ground in more temperate areas. There are signs, for example, that the northern edge of the Sahara may leap across the Mediterranean into southern Europe.



Stuart Franklin/Magnum Photos

All this is happening after comparatively modest increases in temperature from global warming. So far these have only risen by about 0.7°C. But we are already committed to much more warming because the greenhouse gases that we have already released require decades to take full effect. In fact, our past emissions have already committed us to another 0.5°C of warming, even if we stopped all emissions of greenhouse gases tomorrow. That, some experts believe, would be enough to bring severe drought to the US grain belt, which helps feed more than 100 countries around the world.

Indeed, Britain's prestigious Hadley Centre for Climate Prediction and Research has forecast that drought will spread across half the Earth during the 21st century, with extreme drought affecting a third of the planet, and agriculture becoming impossible in many currently productive areas.

Of course, an immediate halt in emissions is impossible, and so temperatures are bound to go on rising, bringing us perilously close to the 2°C that scientists estimate is the absolute maximum that should be permitted if the world is to have a fighting chance of avoiding catastrophic climate change (for projections of the possible consequences of each degree of temperature rise see pages 22-23).

Whether the world succeeds in limiting the increase to this crucial maximum will largely depend on the outcome of vital negotiations in Copenhagen in December 2009.

SEAL THE DEAL!

THERE'S NO TIME TO WASTE
Planet Earth needs our attention



CLIMATE CHANGE AFFECTS US ALL. Rising temperatures and more frequent floods, droughts and storms are impacting millions of people's lives. Nine out of every ten such disasters are now related to global warming. Those are scary facts.

On 7 December 2009, world leaders will gather in Copenhagen, Denmark, to respond to one of the greatest challenges facing humanity: climate change and sustainable economic growth. But how to protect the planet and create a green economy that will lead to long-term prosperity?

The negotiations in Copenhagen must answer this question. Our existence depends on it.

Reaching a deal by the time the meeting ends on 18 December will depend not only on political negotiations but also on public pressure from around the globe. Public support must be galvanized.

The UN-led Seal the Deal campaign aims to motivate political will and public support for a comprehensive global climate agreement in Copenhagen in December.

YOU can join the Seal the Deal campaign. Sign an online, global petition which will be presented to world leaders, reminding them that they MUST negotiate a fair, balanced and effective agreement in Copenhagen, and that they must seal a deal to power green growth, protect our planet and build a more sustainable, prosperous global economy for the benefit all nations and all people.

Find out more and make YOUR voice heard at
www.sealthedeal2009.org

Clear and present danger

The Maldives emits so little CO₂ that it rounds down to '0 per cent' of the world's total, but this low-lying archipelago of 1,190 coral islands is among the world's nations most vulnerable to global warming: it would become uninhabitable if sea levels rose by less than a single metre. Faced with such an impending crisis, many would start looking for somewhere to run.

MALDIVES PRESIDENT MOHAMED NASHEED – who, at 42, is one of the world's youngest leaders – is not just standing his ground, but challenging nations around the world by pledging to make his country carbon neutral by 2019.

The Maldives is not the first country to announce such an ambition: Costa Rica, Iceland, Monaco, New Zealand, Niue and Norway also have plans. But, if successful, it will be the first to achieve it. Its strategy requires a combination of 155 1.5-megawatt wind turbines, half a square kilometre of solar panels and a biomass plant that will burn coconut husks. Extra power will be stored in batteries for back-up. This renewable electricity will also power all the islands' vehicles, including watercraft, while the nation aims to offset emissions from aviation by purchasing European Union emissions trading certificates and destroying them. It will cost the Maldives \$110 million a year to implement its plan, but the island nation will start recouping its investment within 10 years.



Reinhard Dirscherl/WaterFrame/Still Pictures

Ulsteinbild/Topfoto

You've had positive reactions to your announcement worldwide. How have people back home received the news?

President Nasheed: Since announcing the carbon neutrality goal a little over two months ago, the Maldives has witnessed something of an environmental enlightenment. Maldivians are discussing and debating the environment far more than they used to. The media features environmental stories more regularly than before and civil society groups are raising awareness about the importance of protecting the environment.

For World Environment Day on 5 June, the Maldives held a children's festival in which children could voice their concerns over the environment. This is just one example of the many public activities that are now taking

place in the Maldives. These sorts of events are important because only with the help of local people can the country make a success of its environmental policies.

Why does the Maldives want to be the world's first country to go carbon neutral when the islands will be among the first to be affected by sea-level rise? Why aren't you devoting your efforts toward adaptation or evacuation instead?

President Nasheed: The average height of the Maldives is a mere 1.5 metres above sea level. And so we are very vulnerable to climate change and rising sea levels. Scientists warn that sea levels could rise by a metre this century. For the Maldives, climate change is no vague or distant irritation,

but a clear and present danger to our existence.

Maldivians have lived in the Maldives for thousands of years. And we don't want to trade in paradise for an environmental refugee camp. For these reasons, we are investing money in improving the sea defences around our islands – building water breakers, sea walls and revetments as well as ensuring we protect our coral reefs as best we can. Last year, the Government warned that future generations of Maldivians may have to seek a new homeland if nothing is done to stop the carbon pollution that is driving global warming.

It is not too late to save the Maldives. If the world wakes up to the climate crisis and makes a real commitment to combating carbon emissions, the Maldives can enjoy a future in the

22nd century. Nations must agree to a tough, binding agreement drastically to cut greenhouse gas emissions at the United Nations Climate Conference in Copenhagen this December. Nothing could be more important because climate change not only threatens the Maldives, it threatens us all. The Maldives is a front-line country in the climate change battle. But history shows us that if you can't protect the front line, the battle will soon be lost. If the world can't save the Maldives, tipping points might push climate change beyond man's control.

How can the efforts of a tiny country like yours be adapted to large, rich countries?



President Nasheed: The Maldives is a small country. And our contribution to global greenhouse gas emissions is negligible, at less than 0.1 per cent. We have not been part of the climate change problem. But we are determined to be part of the solution.

We believe that the Maldives can lead the world by example. That is why the Government announced in March this year that the Maldives will become the world's first carbon-neutral country within a decade.

It will not be easy to make the Maldives carbon neutral. Generating renewable energy through solar and wind doesn't come cheap, particularly in a country where the population is scattered across far-flung islands. But going carbon neutral is possible and where there is political will, there is a way.

I hope the Maldives' carbon-neutral example will help persuade other countries to follow suit. By successfully decarbonizing our local economy, the Maldives can demonstrate that going green is not only possible but also profitable.

I also hope our example can inspire concerned citizens and activists in other countries to lobby their governments for greater cuts in greenhouse gas emissions. If a relatively poor developing country like the Maldives can go carbon neutral, what excuse can wealthy nations have for refusing to do the same?

You are hoping that a carbon-neutral Maldives will draw more eco-tourists to the islands, but won't that cause more carbon emissions?

President Nasheed: Our carbon-neutral plan envisages the total decarbonization of the Maldivian economy. We will stop burning fossil fuels and instead generate power with the raw materials the Maldives has in abundance: the sun, the sea and the wind. We are harnessing pyrolysis technology to dispose of our waste in environmentally friendly ways. And we hope to gradually replace petrol and diesel boat and car engines with green technology.

Aviation is trickier. Wide-bodied commercial aeroplanes need kerosene to fly. Until someone invents bio-kerosene, aircrafts will continue to burn fossil fuels. The Maldivian economy is, and will continue to be, heavily dependent on tourism. The vast majority of holiday-makers come from Europe and East Asia, so reducing the number of flights to and from the Maldives would be devastating for our economy and our people.

Going carbon neutral does not mean your country never produces any CO₂ emissions. What it means is that you are not a net contributor to global emissions. In effect, the country does not emit more CO₂ than it absorbs. In order to ensure that the Maldives becomes carbon neutral, we'll need to offset the greenhouse gas emissions produced by aircraft flying here. One option under consideration is for the Maldives to enter the European carbon trading certificates market and buy permits to pollute. If we buy

these permits, this means that European polluters, such as factories and cement works, will have to pollute less. By entering into this scheme, the pollution caused by tourists travelling to the Maldives can be offset by European polluters emitting fewer greenhouse gas emissions.

What are your first practical steps towards going carbon neutral? How long will it be before you achieve your first milestones?

President Nasheed: We have set out a vision for the country, based on an initial eco-plan drawn up by climate and energy experts Mark Lynas and Chris Goodall. We need to turn that vision into a carbon-neutral reality. In April, we established a Presidential Advisory Council on Climate Change, made up of 15 environment and energy experts, who will provide the Government with advice on how to reach the carbon-neutral target. This expertise will help us draw up a detailed roadmap for reaching carbon neutrality in 10 years.

The Maldives is also pressing ahead with numerous environmental projects and reforms. For instance, the Government intends to privatize the state-run electricity firm STELCO, and we are looking for international companies with experience in renewable energy production to bid for the contract. A \$10 million photovoltaic solar panel project is currently being implemented in and around the capital city of Malé and a local firm is developing concentrated solar power in island communities. Technology companies are researching the potential use of wind power, and investors are experimenting with biochar to help dispose of waste and allow Maldivians to grow more local produce.

We are also working hard to protect our marine life. In March, the Government banned shark hunting. Earlier this month, we created three marine protected areas to preserve whale sharks and manta rays.

We are determined to reach our carbon-neutrality target. Some people might say, because the Maldives is a small country, that our efforts are a mere drop in the ocean. But I hope our example creates a ripple of hope that forms a current of change, to protect this planet for all our grandchildren.



Concerted effort



Travelling the world playing concerts is an essential, if gruelling, aspect of being a big-name band. And the environmental impact is high – something the UK megaband Radiohead both acknowledges and seriously tries to tackle.

With its big, textured, moody sounds, Radiohead has become one of the world's best known and critically acclaimed acts – with seven albums, three Grammy wins and countless accolades. But popularity has its price: a

newspaper-sponsored audit found that the 2003 album *Hail to the Thief* – including CD production and a world tour that played to 545,000 fans in Europe, Japan, Australia and the United States of America – emitted 7,500 tonnes of CO₂, which is equivalent to a year's emissions from 1,400 cars. And that's before taking the band's road travel or entourage into account.

While such figures aren't unusual for a such a high-calibre act, they shocked Radiohead's front man Thom Yorke, who has long been concerned with environmental issues. He threatened to quit touring if it couldn't be made greener. 'The

What can wedge analysis do for us?

Scientists say humanity will have to cut its CO₂ emissions by 80 per cent by 2050 if the world is to have any hope of avoiding dangerous climate change. But how is this dramatic change – perhaps the most challenging in the whole of human history – to be achieved?

Experts agree that there is no silver bullet, that no single source of energy can be pressed into service to replace the fossil fuels that give rise to the emissions. Instead, the job can only be done by employing a whole range of solutions – including using energy more efficiently wherever it is needed. Ecologist Stephen Pacala and physicist Robert Socolow have come up with a simple way of describing this, known as 'wedge analysis'.

Key to wedge analysis is the 'stabilization triangle'. The triangle is formed by drawing a line on a graph representing how CO₂ emissions will rise if the world continues on its

present path, and another one showing the track they will need to take if emissions are to be stabilized at a relatively safe level. A 'business-as-usual' scenario could see CO₂ emissions doubling to reach more than 60 billion tonnes a year by 2050, whereas they need to fall and stabilize at under 15 billion tonnes annually. This establishes the size of the triangle, which is then split into different-sized 'energy wedges', each representing a partial contribution to meeting the target.

Organizations and governments are increasingly using wedge analysis to address the CO₂ emissions problem. The 'Climate Solutions Model' is an example developed by WWF, the global conservation organization, and based on existing low-carbon technologies. It recognizes that some will be able to expand faster than others: by the time hydrogen starts to make a difference in 2040, for instance, wind and geothermal energy would already be firmly established.



Katie Friesema

way that tours are structured now is a ridiculous consumption of energy,' he said. 'I think touring is a necessary part of what I do, but I find the consequences unacceptable.'

The band took up the challenge. Before embarking on a tour supporting the 2008 album *In Rainbows*, it commissioned Oxford company Best Foot Forward to perform a carbon audit on two past tours. It turned out that more than 80 per cent of Radiohead's emissions resulted not from its own travel, but from the thousands of fans flying and driving (and idling in traffic) to and from shows. So Radiohead took the tour mainly to city-centre

venues with easy access to public transport. On its website, it asked audiences to avoid flying, to carpool or take public transport where possible. And it went so far as to post an online carbon calculator allowing fans to enter the starting point of their journey, the concert date and venue, and then explore different transport options – car, bus, bike, plane, train, underground railway, walking, even ship – to find those with the lowest impact.

The worst offender for the band's own emissions was shown to be international air travel and air-freighting their 20 tonnes of gear – sound equipment, lighting and so on – between countries. So Radiohead set itself a 'no air-freight' policy, but then discovered that shipping – while 93 per cent more energy-efficient than air freighting – meant it would take too long for crucial equipment to reach its destination. So they hit on the idea of assembling two identical sets of equipment on either side of the Atlantic and planned the tour so that the US equipment could be shipped to Japan while the band toured Europe.

Radiohead has also pledged to use rail and road whenever possible and to avoid unnecessary flights. Instead of making a live television appearance on the popular US show *Late Night with Conan O'Brien*, for example, it sent a pre-recorded clip from London. Even the light show uses energy-saving LEDs, and on the band's social networking site, a crew member reports to fans on each tour venue from a green perspective, including recycling facilities, transport links and so on.

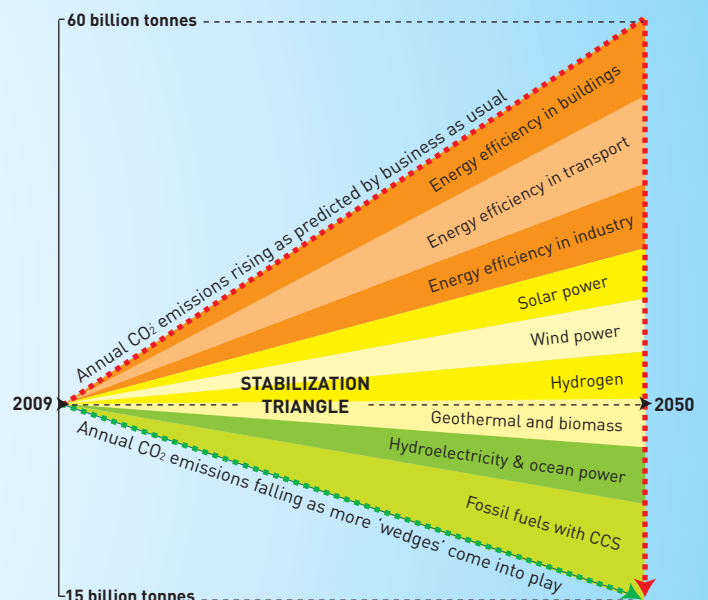
The results of all this have not yet been assessed, but Radiohead says it will continue to keep its operation as low-carbon as possible, and hopes that the investment in greener touring will inspire and pave the way for others.

In this model, around 40 per cent of the task to 2050 will have to be achieved through improvements in energy efficiency across industry, buildings and transport – for example by heavily insulating all new and existing buildings, upgrading power plants with energy-saving technologies and increasing the number of kilometres that vehicles, including aeroplanes and ships, get from each litre of fuel.

WWF reckons another 43 per cent could come from renewable technologies. Producing hydrogen this way could provide 11 per cent, while 10 per cent could come from wind, and solar technologies could contribute 8 per cent. Geothermal, biomass and hydroelectricity could also have a significant role, with ocean power making a much smaller contribution.

Fossil fuels continue to be the single largest source of energy in 2050 in the WWF model – with a wedge one-sixth of the stabilization triangle. But the fossil-fuelled power plants included are assumed to be fitted with carbon capture and storage (CCS) – which, it is expected, will reduce their CO₂ emissions by 90 per cent.

Wedge analysis: a simplified diagram based on WWF's Climate Solutions Model



Facing extinction

'We could have saved ourselves, but we didn't... What state of mind were we in, to face extinction and simply shrug it off?'

It's a question from the future that is on-screen today, asked by a bewildered lone survivor (played by Oscar-nominated actor Pete Postlethwaite) in a tower high above a scorched Earth in 2055, as he flips through archival footage from 2008: news reports about freak storms and heat waves, melting Arctic ice, floods, droughts – the all-too-familiar evidence of global warming.

In *The Age of Stupid*, film maker Franny Armstrong explores the human side of climate change through the stories of real people – among them a mountaineer in the Alps who has watched the ice receding over decades, and an oil palaeontologist in New Orleans who lost everything to Hurricane Katrina. But despite its bleak view of the future, the film shows that humanity still has a choice. The world now has the science and technology to avoid the film's apocalyptic scenario – but seems to lack the will. It is this, as Armstrong explains to TUNZA, that the film sets out to galvanize as the world approaches December's crucial climate change negotiations in Copenhagen.

TUNZA: Who does *The Age of Stupid* try to reach?

Franny: Our ultimate aim is to keep the planet habitable for future generations – for ourselves, even – and to be part of that massive change. To do that, we need to influence policy makers and concerned citizens – intelligent people who can see what's happening, and want to be part of turning the ship around before it's too late. We don't care about the sceptics.

TUNZA: What would success look like?

Franny: Success to me is that we, the species, come together, make the right deal in Copenhagen, and then start making massive emissions cuts so that

we can continue to live on our planet. Nothing else counts.

TUNZA: What do you think is the most effective thing for young people to do?

Franny: Politicians are the people charged with making the right deal at Copenhagen, which will decide all our futures. So it's very important that all people put pressure on their governments – however they are able or feel inspired to do so – and let them know that unless they make the right deal, we won't vote for them anymore. At the moment, the best deal on the Copenhagen table – that proposed by the European Union – would give us only about a 50 per cent chance of averting runaway climate change, but we could give ourselves a much higher chance. We're not waiting for any new technology or greater understanding or anything – the only thing holding us back is ourselves. Surely our elected leaders should be maximizing our chances of survival? What else are they there for?

TUNZA: What about efforts to plant trees, or reduce personal emissions?

Franny: There are a million solutions. Obviously we need people planting trees, designing new wind turbines, campaigning, walking their kids to school rather than driving them, and so on. Everybody needs to rearrange their lives to deal with this new reality.

But in these months leading up to Copenhagen, the number one priority is to pressurize the politicians, because this is our last chance to make an international deal. If we don't, it's going to be much more about

adaptation, because it basically means we are committed to runaway climate change. And we will all be facing those horrors together.

TUNZA: Some say the film isn't positive enough to encourage action.

Franny: They might be right. But we've been seeing hundreds of emails, if not thousands, from people inspired into action – everything from cancelling flights to insulating houses to changing jobs. Lots of people sit around, don't they, being negative about everything, saying: 'This won't work, that won't work...' But we did our best to make our film as inspiring as we could. Somebody said the other day, 'It's a film that makes you ask: "What is my role on this planet?"' I think that's a good way of looking at it.

TUNZA: Can you tell us about the Not Stupid campaign?

Franny: We want the film to reach millions who wouldn't otherwise be reached, inspiring them to become active citizens and involved in the Copenhagen process. So, in answer to the question 'What can I do?', we're providing information, tools, ideas and strategies on our Not Stupid website (www.notstupid.org) – everything from reading lists to how to talk to climate sceptics, from direct-action protest to rethinking consumerist behaviour, and spreading the word on the internet. The aim is to turn 250 million viewers into activists, all focused on Copenhagen.

TUNZA: *The Age of Stupid* cites successful direct action campaigns – civil rights, votes for women – asking for



Spanner Films

THE AGE OF STUPID



The Age of Stupid/Spanner Films

something positive. What positive outcome does the Not Stupid campaign seek?

Franny: I think the wasteful consumer society we've ended up with is very unhappy. One where we share the world's resources fairly and don't overconsume – but live within the ecological limits of the planet – would be happier and much more fulfilling. Aspire to happiness and less suffering for more people – you can't get more positive than that!

TUNZA: But life needs to go on, and people want to enjoy it...

Franny: Does it? If you are aware that this is the only thing that counts, I think it's quite depressing to feel you're doing something completely pointless – or contributing negatively. If, basically, we're all running over a cliff, what's the point of spending these last few years, when we can still act, doing anything except helping us to stop? Obviously your response will vary depending on whether you're 15 in Mumbai or 60 in London, and who you are and what resources you have. It's up to everybody to reassess their own lives. But all the happiest people I know are working on climate change. Personally, I feel very optimistic. I think these months leading up to Copenhagen will define our generation, the way other generations were defined by ending slavery, getting the vote for women, or civil rights. In the West, our generation has grown up in a time of plenty, with no world wars. Earlier generations had bigger things than we did to overcome. But now we've got the biggest of them all. This is our moment. We can still turn it around.

ACTION!

'Because of deforestation, floods and landslides were killing people in my region of Bondowoso, East Java. So I asked myself, what can I do? First I bought seeds, prepared and planted them. Then I wrote to the Government, who sent money for more seeds and to develop an education programme. I partnered with the Government and social organizations to help raise environmental awareness in the community, including teaching children and young people how to plant trees. Since 2005, I've initiated the planting of 30,000 of them, with help from family, social organizations and owners of unproductive lands. With education and help, people can learn to change their attitudes.'

Veni Sevia Febrianti, Indonesia

NOT stupid!

In January 2008, Jake Voelcker gave up his job as a web designer and started a business refurbishing and selling second-hand bikes. It wasn't just his lifelong love of cycling that prompted him to open his shop Jake's Bikes in the British city of Bristol. Once a volunteer at the Centre for Alternative Technology in Wales, Jake is fulfilling his passion for energy efficiency, recycling, low-carbon transport and raising environmental awareness. Even the shop is low-carbon: staff work mainly with hand tools, use low-energy light and no heat, reuse and recycle materials, and move things around using bike trailers, not vans.

Distribution revolution

Missed *The Age of Stupid* at the cinema? In May 2009, Team Stupid launched Indie Screenings. Individuals and groups anywhere can purchase an inexpensive one-time licence to screen the film (subtitled in 32 languages) in any venue – even their own living rooms – giving everyone the opportunity to spread the word. www.indiescreenings.net

ACTION!


'While researching sustainable transport for the Green Campus Initiative at the University of Capetown, I discovered that 52 per cent of the resources used in the city are spent on transport – and that many students commute alone in cars. So I coordinated RideLink, a secure, web-based carpooling tool, for students and staff. They simply log on and enter details of where they're going and when, and RideLink hooks them up with a lift. We launched the site in January 2009, and it's been a success, with more than 600 users. However, many still haven't signed up, so we continue to promote it. We also promote cycling with ads that can be attached to bikes, saying things like 'Petrol price hike? Ride a bike!' Offering practical alternatives while raising awareness seems to be a good strategy.'

Simon Sizwe Mayson, South Africa

Loud and clear




Imagine the cacophony if the world's 3 billion people under 25 years old – nearly half its population – spoke up together. Young people all over the world are preparing to do just that as momentum builds towards the 15th Conference of the Parties (COP-15) of the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen, Denmark, in December 2009. At COP-15, world leaders will meet to negotiate the successor to the Kyoto Protocol, with the goal of agreeing to new binding agreements to prevent runaway climate change. As those with the most to lose, youth are gathering forces to let their leaders know that their future – and that of Earth – must not be compromised.




In March 2009, 12,000 young people from each of the 50 United States as well as other countries flooded into Washington, DC, for Power Shift '09, demanding green jobs, a rapid transition away from dirty energy, and climate legislation in line with scientific requirements that we could bring to Copenhagen. The gathering, organized by Energy Action Coalition, included a 3,000-person rally on the Capitol Lawn and the largest climate change lobby day in US history. Since Power Shift, the participants have returned home to continue organizing activities around climate legislation and green jobs. In the months leading to COP-15, Energy Action Coalition will keep urging youth to push for a bold, equitable, science-based international climate treaty, both with a delegation in Copenhagen and at home. We feel a distinct obligation as US youth to take responsibility for climate change at home and on the international stage.

WHIT JONES, UNITED STATES OF AMERICA, ENERGY ACTION COALITION




In the summer of 2009, my father Charles Scott and I are riding connected bikes the length of mainland Japan, from the northernmost point of Cape Souya to the southern tip at Cape Sata, a 4,700-kilometre, two-month journey. Working with UNEP, the aim is to generate publicity to encourage awareness and action on climate change, especially in these months leading to COP-15. Along the way we're also raising money to support the Billion Tree Campaign – UNEP's effort to plant 7 billion trees by the end of 2009, one for each person on the planet.

SHO SCOTT (8), JAPAN




I am working together with East African youth to secure better representation at COP-15 by taking a team of African youth leaders to Copenhagen as part of the Energy Crossroads network (www.energycrossroads.org). Our goals are to spread awareness, develop solutions and empower youth to take the lead on implementing mitigation and adaptation measures in local communities.

MICHAEL PLESNER, DENMARK, ENERGY CROSSROADS




SustainUS – a non-profit organization of young people advancing sustainable development and youth empowerment in the United States – is sending a delegation of 24 US youth to Copenhagen, as well as helping Arctic explorer Will Steger take another dozen. To encourage other international youth, we have written a training manual (www.sustainus.org/docs/Youth%20Guide.pdf) to help prepare young people from any developing countries who have not yet been able to send a delegation to the climate change negotiations, especially important because some of the negotiation is about adaptation funding for their countries. We try to raise money to fund youth delegations from developing countries, and offer support to them both in Copenhagen and beforehand.

KYLE GRACEY, UNITED STATES OF AMERICA, SUSTAINUS



With a group of youth activists belonging to different organizations – such as GEO-TUNZA Ecuador, Energy Ethics, CAJU Peru and others – I am working to engage a committed group of South American young people in the months leading to COP-15. We aim to gather a Latin American youth delegation to attend COP-15, and exchange information and skills needed to make a difference there. Before and up to COP-15, we also plan to reach out to the public in South America to help increase general understanding about the international climate change process.

JUAN CARLOS SORIANO, PERU



British rower and UNEP Climate Change Ambassador Roz Savage is rowing solo across the Pacific to inspire people to walk more and drive less. The campaign, called Pull Together, challenges supporters to match her daily 10,000 oar strokes with 10,000 steps, logging them online. Then, on 24 October, Roz and thousands of supporters will start marching the more than 967 kilometres from London to Copenhagen to deliver the results, a symbol of their commitment to reducing global CO₂ levels.

www.rozsavage.com

In 2008, five members of the Australian Youth Climate Coalition (AYCC) – including me – travelled 23,500 kilometres from Australia to Poznan, Poland, and we did it by land rather than flying. We crossed 11 countries in 40 days by train, bus, taxi, tuk-tuk and boat, eventually joining 500 other international youth climate activists at COP-14.

It wasn't just a stunt to save carbon emissions – though we did save about 40 per cent by not flying. We wanted to demonstrate that not flying is difficult, time-consuming and expensive, emphasizing the need to improve our low-carbon infrastructure.



For COP-15, we're mobilizing for 5,000 youth and others from all over the globe to travel overland to Copenhagen – an action we're calling Convergence. To start, there's a zero-carbon bicycle caravan (www.zerocarboncaravan.net) from the United Kingdom, and youth from Japan catching the trans-Siberian railway. We're also seeking funding for youth from Africa and South America, discussing free transport with rail organizations, and investigating cargo ships. Youth from Togo to Canada to Costa Rica to Sweden and beyond are volunteering.

Once in Copenhagen, we will as usual be involved in the Conference – meeting with government delegates and reporting on progress via blogs and social networking – as well as participating in external social-movement mobilizations, such as Friends of the Earth International's 'Flood for Climate Justice' (www.foei.org/en/what-we-do/un-climate-talks/global/the-flood-is-coming).

Copenhagen will be the greatest convergence of young people on any political issue in history. As we ask our leaders to make decisions that reshape our way of life, let's take this opportunity to prove youth really care.

ANNA KEENAN, AUSTRALIA, AYCC/CONVERGENCE
anna.keenan@YouthClimateCoalition.org

With the goal of doing something concrete – and FAST – the Indian Youth Climate Network has organized Agents of Change to get students and young professionals involved in serious lobbying, campaigning and direct action to influence political decisions leading up to Copenhagen.



Right now, in partnership with UNEP's South Asian Youth Environmental Network, we're also assembling delegates to join the Asian subcontinent youth delegation to COP-15, which will have representatives from Bangladesh, Bhutan, India, Myanmar, Nepal, Pakistan and Sri Lanka. Once chosen, delegates will learn how to develop policy priorities, lobby, and engage others in international climate policy. We're also assembling a team in India to keep local and national media outlets informed, run constant campaigns in schools and communities, and organize regional and national days of action and a petition campaign, generally creating a groundswell of awareness and urgency around COP-15.

RUCHI JAIN, INDIA, INDIAN YOUTH CLIMATE NETWORK

At COP-14 in Poland, the Alliance Of Small Island States (AOSIS) proposed strong emissions reduction targets and called for serious action. When this show of leadership went largely unheard, the 500-strong international youth delegation developed Project Survival, a major campaign that added our voices to theirs and supported these often under-resourced government delegations. We shared the plight of these nations with the media, engaged with the negotiations and offered policy and administrative support. As we worked, we learnt more about the dire situation faced by these countries.

The project continues around the world. In the Pacific, Australian youth are working from Pacific islands like the Solomons, especially focusing on climate-change policy. Our work is bringing greater equality to the Copenhagen negotiations and a greater chance for a strong agreement on climate change.

WENDY MILLER, AUSTRALIA, AYCC

The African continent is the one most vulnerable to climate change. Yet of 500 youth delegates in Poznan, just four – including me – were African, a noticeable gap at high-level meetings to which youth representatives were invited. So I have started to work with 350.org to help get more African youth involved in the international climate process.

350.org is hosting a worldwide series of summits where youth climate organizers can learn all they need to know to mobilize their own communities and hold their politicians accountable. Within this, it has made a special commitment to empower young Africans to work as climate advocates and activists, and to send a strong African delegation to Copenhagen. Efforts have included a summit in Johannesburg in June 2009, attended by hundreds of sub-Saharan African youth, followed in Turkey by a three-week Climate Advocacy Institute, attended by hundreds more from North Africa and the Middle East.

We hope this work helps build capacity and allows African youth to spread the word that climate change is not just a rich countries' issue.

ELY KATEMBO, DEMOCRATIC REPUBLIC OF THE CONGO,
350.org

UNEP is organizing 1 million young people to march through 100 capitals in September 2009 to deliver a petition to global leaders. The petition asks – on behalf of the world's 3 billion young people – for a definitive climate deal in Copenhagen. The petition was developed online and finalized in August 2009 at UNEP's Global Townhall, which convened 750 children and 250 youth in Daejeon, Republic of Korea, to discuss climate change problems and solutions. The Townhall also saw the launch of Unite for Climate (www.uniteforclimate.org), a social networking platform where young people can learn and share thoughts about climate change and the action needed to combat it.



TUNZA answers your questions

Q Why is the involvement of young people in the Copenhagen meeting important, and how can they be involved in its decision-making process?

A Copenhagen is the last government-level meeting in the calendar before the world climate agreement must be renewed and the strength of worldwide measures to tackle global warming will be determined. Young people and future generations are the ones who will either suffer or benefit from the decisions made, and it is crucial that their voices are heard. Though they will not make the final call, youth will play a role and will become involved by sharing their thoughts and ideas with the ministers and delegates present. We can only hope that the governments will listen to these opinions, will take them into consideration when negotiating and will make sincere and meaningful decisions.

Q What concrete actions should young people be taking to show the world that they want a deal in Copenhagen? What should they press governments to do?

A It is important that the young people participating in the Copenhagen meetings show that they are committed: if they aren't, they won't be taken seriously. They must show that they are actively involved by getting acquainted with the negotiations and preparing for them. They should discuss their points of view with each other and within their communities to raise awareness and mobilize others at school, in clubs, and at religious or community centres, etc. Once they have shown that they want a deal in the December meetings, they should become part of government delegations and press them to reduce carbon emissions by agreeing to strong measures on tackling climate change.

Q What is the relationship between poverty and global warming, especially in developing countries, and how will the Copenhagen negotiations address this?

A Although climate change does not directly cause poverty, it will impact the poorest disproportionately. Most of the world's poorest people rely on their environment to survive. But as extreme weather, changing temperatures, floods and droughts increase, crops will fail: in some African countries yields could fall by 50 per cent by 2020. So survival, particularly for the poorest, will become more difficult and more urgent. This extremely important topic will be discussed in Copenhagen and, it is hoped, will be addressed by setting strict targets for emissions cuts to reduce climate change and introducing measures to promote economic development through adapting to it.

Q Taking care of our beautiful planet starts with individual action. So, what actions should individuals take to make it a better place?

A Individual action is the starting point for reducing our negative effects on the environment, and if everyone does their share, it will be easier to mitigate climate change.

Q & A

People can do small things to reduce their carbon footprint, to save energy, and also to save money, such as buying organic and local food products, unplugging 'stand-by' appliances, recycling, choosing to use public transport or biking or walking, and finally, energy-proofing their home by insulating it well, closing windows, shades and curtains when it's cold, turning off lights and heating when they are not needed, and switching to energy-efficient light bulbs. Indeed, personal action can reduce up to half humanity's emissions.

Q What will be the consequences for today's young people if strong measures on tackling climate change are not agreed this year?

A Today's young people, along with future generations, will be those most affected. Even if strong measures are taken to substantially reduce emissions, the greenhouse gases that have already been released will remain in the atmosphere for long periods, and some global warming is now inevitable. So what will happen if strong measures are not taken? The consequences of global warming cover a broad spectrum, including extreme weather, rising sea levels, diminished harvests, spreading diseases, disruption of water supplies, loss of biodiversity and much more. The longer we wait to establish strong measures, the harder it will be to tackle climate change.

Plastiki

Explorer and environmentalist **DAVID DE ROTHSCHILD** (pictured) – the youngest Briton to have traversed both poles – thought up the *Plastiki* after reading a UNEP report on the problem of marine waste. Recently named a UNEP Climate Hero, he plans to sail this 20-metre catamaran, made of 12,500 reclaimed plastic bottles and recyclable plastic, approximately 10,000 nautical miles from San Francisco, California, to Sydney, Australia. He wants to demonstrate how rubbish can be a resource, draw attention to ocean ecology and help people rethink how we currently use, reuse and ultimately dispose of plastics. **MARTIN METZ**, a university student from San Francisco, has spent a year helping to construct the craft and spreading the project's message to his peers.

I first heard of the *Plastiki* in 2008 when David pitched the idea to San Francisco Mayor Gavin Newsom, for whom I was working as an intern. The conversation made me ask: 'When I throw something away, what am I really throwing away?' I immediately volunteered for the *Plastiki* team.

Upcycling

We built the *Plastiki's* rigid skeleton, ribs and bulkheads using a fully recyclable material called self-reinforced polyethylene terephthalate (srPET), which is made from virgin plastic (something we hope to soon change). But, as srPET isn't buoyant, we also filled reclaimed 2-litre plastic bottles, collected from San Francisco recycling agencies, with dry ice, sealed them to make them seaworthy and fastened them to the hull.

The *Plastiki* interrupts the typical life cycle of a product that ends up in landfill, creating a new role for one-time-use items by 'upcycling' them as valuable resources. With innovation and creativity, upcycling can be as simple and beautiful as making a kite from sewn-together crisp packets (an art piece conceived by a fellow student), or as complex as the breakdown and recomposition of chemical compounds for reuse in what David calls 'smart products', those that can be either indefinitely recycled or returned to nature without harm.

Whirlpool of rubbish

Seeing 'waste' as a resource is only common sense at a time when we are drowning in our own garbage. Increased production, efficient distribution and high consumption have led to the Great Pacific Garbage Patch, an area of floating trash in the middle of the Ocean estimated to be twice the size of Texas.

The *Plastiki* will visit this patch, which is just one of the world's many concentrations of marine debris. The waste – 80 per cent of which has been washed into the sea from land – is trapped by strong ocean currents, and ranges from plastic bags and bottles to refrigerators. Once in the water, plastics harden in the sun and eventually shatter into microscopic bits. In some areas, these 'blooms' of plastic particles are denser than the natural ones made up of plankton. The particles are eaten by sea creatures, so chemicals from plastics also end up in our food.

Creative reuse

Part of my job is to take the *Plastiki's* ideals into the community. At the University of San Francisco, my professors, fellow students and I founded a group called Help the *Plastiki* Set Sail. Community design and architecture students are building their own miniature one-man *Plastiki* to race in San Francisco Bay. Environmental studies students are researching ecological and environmental issues for each of the islands along the vessel's route. And we hosted an exhibition on the 'Art of Reuse' to showcase projects exemplifying waste as a resource. I hope the project will help lead to people valuing natural resources and becoming thoughtful and creative about the waste they create.



Photos: Luca Babini

Beyond learning

'Generating energy sustainably is critical in today's world of increasing population and climate change,' said Hans-Dieter Hausner, Bayer Australia/New Zealand Senior Country Representative, to the 25 students (from Australia, China, India, Indonesia, New Zealand, Philippines, Republic of Korea, Singapore and Thailand) gathered at the University of Auckland, New Zealand, for the UNEP-Bayer Eco-Minds Youth Forum 2009.



Eco-Minds/Bayer

Eco-Minds 2009 Pathfinder Award recipients, from left: Gerard Penecilla, Alex Readford, Cindy Marattanachai, Desideria Murti and Daniel Scott.

UNEP's Regional Director, Dr Young-Woo Park, agreed: 'Sustainable energy use represents perhaps the greatest challenge to the world right now for two reasons: climate change and the fact that 2 billion people still don't have access to electricity. Both, left unresolved, represent a serious hurdle to the UN's poverty-related Millennium Development Goals.'

The Eco-Minds Youth Forum, as Mr Hausner pointed out, 'is not just about learning'. Participants were divided into multiple-country groups to come up with sustainable energy solutions, not just for their own countries but for the Asia-Pacific region as a whole.

Pathfinder Award-winning team member Dan Scott from New Zealand told TUNZA how his group's strategy 'consists of three components: diversifying energy sources to include more renewable technologies; moving to a long-term mix of them; and pushing for increased energy efficiency.' He

added: 'Although very conceptual, our strategy would ensure the minimum environmental impact from energy supply in the future.'

Gerard Penecilla from the Philippines takes up the story: 'We had to develop a strategy for a low-carbon future based on sustainable technologies, while thinking about the economic, social, environmental, technological and political challenges and opportunities.'

'I learnt a lot from Eco-Minds,' said Desideria Murti from Indonesia, another member of the winning team. 'I'll stay in touch with my fellow participants. Through networking and friendship we can help foster a spirit of sustainability.'

'This requires a coordinated effort across the international community,' added Australian Alexander Readford, 'so it's critical that we understand the concerns of other countries.'

REDD for go!

What forests take from the air, they can also put back. As trees grow, they absorb CO₂ and store it as carbon. But when felled and burned or allowed to rot, they release it back into the atmosphere: some 20 per cent of all CO₂ emissions result from forest degradation and destruction. So reducing these twin perils is a vital part of combating climate change.

And there are some signs that this is being addressed. Paraguay has slashed deforestation by more than 80 per cent since the 1980s and is committed to zero net deforestation by 2020. Brazil says it will cut deforestation rates in Amazonia by 70 per cent by 2020,

while Indonesia has promised to stop turning virgin forest into plantations in Sumatra.

Many of the world's forested countries are poor. They need to generate wealth and reduce rural poverty, and find it hard to police conservation laws. But Costa Rica points a way forward. It was once a deforestation hotspot: its forest cover fell from 80 per cent in the 1950s to just 21 per cent in 1987. But it has reversed the trend – and got it back to 50 per cent – by paying farmers to protect the forests, and generating income from the millions of tourists who come to see the forests and their wildlife.

International negotiators are now working on a mechanism to 'reduce emissions from deforestation and forest degradation in developing countries' (REDD) – to be included in a new international climate treaty – which would involve developed nations paying developing ones to conserve forests and the services they provide.

Youth involvement in REDD

Gemma Tillack (Australia) and Kyle Gracey (United States of America) are members of the International Youth Delegation, a growing coalition of young people from around the world who participate in international climate negotiations. 'The next climate treaty

David Larsen/africanpictures.net/Still Pictures

ALL CHANGE

As temperatures rise, life is changing for all the **Arctic's indigenous peoples,** including the 150,000 Inuit who live in Alaska, Greenland and Canada. Devin Aviugana, a 17-year-old Inuk who grew up in the Canadian territory of Nunavut, describes what it means to him.

REPULSE BAY, a small northern community of about 900 people on the Arctic Circle, was a great place to grow up. Children wander the town freely and the view is spectacular – no trees in the way. The tundra and ice is where my traditions and heritage come from. I appreciate all the land gives me, be it food, shelter or clothing.

But climate change is affecting the Inuit lifestyle. This is very traditional: our main means of survival are fishing and hunting caribou, seal, and whale for food and clothing. About three years ago, I noticed the ice taking longer to form and melting faster. Only a few years ago, when hunting, we never worried about the ice being too thin, but now we have to be careful, whether we're walking or travelling by snow mobiles. Then, last summer, the ice in the Bay, which usually breaks up and floats away, melted before the currents could take it.

Our community is being affected by these changes. No one can trust their knowledge about ice or weather conditions, making hunting, fishing and travelling to other communities difficult. Only the most experienced elders can tell when the wind will pick up or that a storm is coming.



I've talked to two of our elders about this: Semi Malliki, who teaches us survival skills and how to make traditional Inuit tools, and Cecilia Angontialuk, who teaches Inuit singing and is also a good storyteller. 'In my youth, the seasons were different,' said Cecilia. 'Today, the land does not smell the same because of the oil and gas.' Semi told me how Inuit were more environmentally friendly when he was younger. 'We hunted more instead of buying expensive imported food. We used dog teams, not polluting snow mobiles. We didn't waste anything. Dog teams don't need oil or gas. You just feed them, and they reproduce – you don't have to buy a new one.'

The elders find the concept of climate change difficult, but they do know that it's different from when they were young, especially the changes in ice and temperature. They worry that Inuit will someday not be able to hunt on the ice.

My generation worries about the future. We understand that, for our people, climate change doesn't just mean physical change to the environment. Everything changes with time, of course – but while the people of Repulse Bay may now work in offices or garages, our traditions are so culturally and emotionally significant that without them, we would not survive. If carbon emissions are not controlled, the landscape and wildlife will continue to be affected, and the Inuit culture could die.

must help developing countries reduce their emissions from deforestation and forest degradation while also helping indigenous peoples and other communities who live in and depend on forests,' they explained. 'A REDD mechanism could make this happen. So in April, our Youth Forests Group – whose members work on forest protection at home or have studied forest issues – submitted a position paper on REDD.

'We said that REDD won't work if it is just used as a way for developed countries to offset their emissions, or if it subsidizes logging operations and the conversion of forests to tree crops. Instead, it must ensure that developed

countries give financial support to developing ones to protect their healthy forests and allow their degraded ones to recover, while also making deep, early and long-lasting cuts in their own emissions. REDD should also protect the integrity of ecosystems and the rights of indigenous peoples and forest communities – especially in preventing them from being displaced from their forest homes.

'We hope our statement will help guide our countries as they create plans to conserve forests. Our vision is that an international deal on climate can also improve the well-being of forest creatures and communities.'



Clean revolution

Last year, for the first time ever, more money was invested worldwide in renewable sources of energy than in the fossil fuels that have powered economic growth for more than 200 years.

No one would have predicted this development a few years ago. But the investment has soared more than fourfold in just five years, from around \$35 billion in 2004 to \$155 billion in 2008, with a further \$35 billion spent on big hydroelectric dams.

'Recent growth has surpassed all predictions, even those made by the industry itself,' says Mohamed El-Ashry, Chairman of the Renewable Energy Policy Network for the 21st Century.

'Remember the internet? Green tech is bigger,' adds John Doerr, probably the world's leading venture capitalist. 'This could be the biggest economic opportunity of the 21st century.'

Jianhua Qiu/UNEP

Wind gets up

On average, the world's wind power capacity has doubled since 2005. In China it has done so every year for the past five years: by next year it should have 30,000 MW capacity up and running – the target it had set itself to meet in 2020. Germany already gets almost 15 per cent of its electricity from the wind: its northern state of Schleswig Holstein expects to generate all its electricity from wind by 2020.

Texas, traditionally the home of big oil, is now the wind capital of the United States of America, with 30 per cent of the country's total wind capacity; six states now have more than 1,000 MW of installed capacity.

Britain already has the world's largest amount of offshore wind farms and aims to add enough to supply every home in the country. And Unst, its most northerly island, has successfully used wind energy to produce hydrogen, which supplies energy when the wind is not blowing.

Rising sun

Every year the equivalent of 90,000 billion tonnes of coal lands on the Earth's surface in the form of solar energy. It is distributed free; you can tap into it wherever you are without the need for costly transmission lines – though you have to pay for the installations that capture it.

Solar photovoltaic (PV) cells, which turn solar energy directly into electricity, are the fastest growing of all the renewable technologies. Over the past five years, annual production has soared sevenfold. In China the rise has been more dramatic: in 2005 PV cells with a capacity of less than 100 MW were produced. Just two years later this jumped to 1,088 MW, making China the world's largest manufacturer. And it is expected to multiply tenfold again by 2015.

Costs are tumbling, halving in Germany between 1997 and 2007 and continuing downwards. Solar PV already produces 1 per cent of the country's electricity; some experts predict that it could provide 12 per cent of Europe's total by 2020.

New technologies offer enormous promise. New 'thin film' panels are expected to produce 100 times as much power as conventional ones at a fraction of the cost. Flisom, a Swiss firm making them, claims that within a decade the sun will be producing electricity at half the price of coal, gas or nuclear power.

Solar water heaters are already economic. In China, 10 per cent of households have them. In Israel this rises to 90 per cent and they have recently been made compulsory for new homes in Hawaii.

Dammed difficult

Hydroelectric power is much the largest source of renewable energy; it already produces about a fifth of the world's electricity. But the big dams used to generate most of it have often caused social and environmental problems, while failing to be economically viable. People have been displaced and not properly resettled. River flows are altered, causing erosion and damage to wildlife; sediments that used to nourish downstream ecosystems pile up behind the dams, shortening their useful lives; and they often release greenhouse gases as vegetation rots under water.

In 2000, the World Commission on Dams proposed a comprehensive series of guidelines, but too many projects disregard them in favour of the quickest and cheapest approaches. Small community-scale dams are often much more beneficial than large ones, and the World Bank estimates that 70 per cent of their global potential remains unexploited.

Time for tide

Tides have been producing power for more than 40 years at La Rance in Brittany, where the world's largest tidal barrage has been supplying around 200,000 homes with electricity since 1966. Another, much smaller, barrage generates power in Canada's Bay of Fundy, which has the biggest tidal range in the world.

The United Kingdom is considering building a giant barrage across the mouth of the River Severn to generate 5 per cent of the country's electricity, but some environmental groups



Jean Gaumy/Magnum Photos

are resisting the plans because of their effect on wildlife. Less intrusive options include building a series of lagoons in the estuary. In fact the country is already generating power from the tides, using a totally different technology that, instead of trapping water in a lagoon and letting it pass through turbines, draws its energy directly from the tidal stream. Sea Gen, operating in Northern Ireland's Strangford Lough, is a bit like an upside down windmill with its blades turning under water in the tidal currents. It is the first device of its kind anywhere in the world, but such tidal power could provide at least a fifth of the United Kingdom's electricity; some experts reckon that Scotland's Pentland Firth alone could generate enough for a quarter of UK needs.



Banson

Other installations are being developed to harness the power of the waves, but with mixed results. The world's first commercial-scale wave-power station – the Pelamis Project off the coast of Portugal – used three flexible hydraulic 'sea-snakes' which bob up and down on the waves to drive an electricity generator. But after just two months, it had to be taken out of service and dismantled because of technical problems.



Stuart Franklin/Magnum Photos

Reflecting glory

In 212 BC, when Roman ships besieged Archimedes' hometown of Syracuse, he used mirrors to concentrate the sun's rays on the ships' sails and set fire to them. The same principle is now being used to superheat water to produce steam that drives electric turbines.

The first plants were built in California's Mojave desert 20 years ago, but cheap oil killed off their development. Now 60 plants are being built, or are on the drawing board, worldwide. Spain opened a plant in the Andalusian desert in 2007 and plans to finish another two by 2011. Another is operating in Nevada, United States of America.



Banson

More ambitiously, plans have been laid for a chain of concentrated solar thermal plants across the deserts of North Africa that could be in operation by 2019, providing Europe with 15 per cent of its energy. Unlike PV cells, however, such plants need to be in bright sunshine, and some people warn against dependence on other countries for energy.

Super smart

Some renewable energy – especially wind power – is variable, and this is often raised as a major objection to it. But electricity grids can help to compensate for this. 'Smart grids' can adjust and even out demand by varying the amount of electricity required, for example, by electric appliances. And high-voltage direct-current transmission lines – which lose only 3 per cent of energy per 1,000 kilometres – can help create 'super grids' linking up different renewable sources across a continent, compensating, for example, when the sun goes down on Spanish solar installations, with tidal power from Britain or wave energy from the Atlantic.



Banson

Last resorts



By Fred Pearce

Sunshades in space; man-made volcanoes; giant egg whisks cruising the oceans; windmills that clean the air... Welcome to the wacky world of geo-engineering. Much of it sounds nuts. But one day, say scientists, we may need all these technologies to save the planet. Think of the planet as your home: the sensible thing is not to set it on fire in the first place. But if it does go up in flames one day, you must be able to call the fire brigade.

The atmosphere is heating up as we fill it with gases that trap the sun's heat – gases we create as we generate energy. We know how to generate energy in other ways, but 20 years after scientists sounded the alarm, we are still adding more of the heat-trapping gases every year, and the warming is getting dangerous.

Nature already soaks up about half of our CO₂ (if it didn't, we would all have fried long ago), and the quickest and most obvious way to help nature fulfil its role is to stop destroying the world's forests and plant more trees. Trees are made of carbon sucked from the air, so every tree that grows is cooling the planet.

Clever thinking

Another smart idea is to make biochar. If we grow plants to suck up carbon, then harvest them and heat them to make a kind of charcoal, that 'biochar' could be buried, keeping the carbon out of harm's way and helping new plants to grow by improving the soil.

At the more extreme end, we could shade ourselves from some of the sun's energy by putting a giant sunshade in

space. But this interplanetary parasol would have to be hundreds of kilometres across, so it might be easier to send up billions of small super-light sunshades (A), each about the size of a newspaper. But the bad news, says Roger Angel of the University of Arizona who proposed the idea last year, is that accomplishing Operation Sunshade would take thousands of space launches and trillions of dollars.

Or how about Operation Volcano? Sometimes, when volcanoes erupt, they throw so much dust and other particles into the stratosphere (the top of the atmosphere) that the sun is partly blotted out and the world cools down. After Mount Tambora erupted in Indonesia, 1815 became known as 'the year without a summer'.

The equivalent of a Pinatubo eruption every couple of years could cool us by around half a degree, calculates Tom Wigley at the US National Center for Atmospheric Research in Boulder, Colorado. Nobel prize-winning chemist Paul Crutzen says tiny sulphate particles scatter the sunlight best. Every commercial aircraft could be equipped with a sulphate sprayer, and Operation Volcano would make a permanent veil of dust in the stratosphere.

A neater idea is to make the planet's surface whiter so that it reflects more of the sun's rays right back into space. One way of doing that is to make more clouds – or even just whiter clouds. Clouds are nature's shades, and they get whiter and more reflective if they have more water droplets in them. Could that be arranged? Stephen Salter of Edinburgh University says yes, we should make fleets of ships equipped to send ocean spray high into the air (B). He has built a

prototype that looks like a giant egg whisk – the real things would be 70 metres high.

Wigley's colleague John Latham calculates that were Operation Sea-spray to put 50 cubic metres of water into the air every second of every day, doubling the number of droplets in the world's clouds, the planet might cool by 2 or 3°C.

But there are some potentially big problems. First, shading the Earth would change a lot of things apart from temperature. Past volcanic eruptions, for instance, have stopped the Asian monsoon, the annual rains that grow the crops that feed more than 2 billion people in India and China. Repeating that would not be clever.

Then, you would have to keep spraying for hundreds of years. If you stopped, the world would warm by several degrees within a few months. 'It would be far more dangerous than the warming it was designed to stop,' says geo-engineering expert Tim Lenton of the University of East Anglia.

And third, any amount of shading would only buy us a few years. One day we would have to stop the emissions regardless.

So why not just get on and do it now?

As well as stopping the heat-trapping gases getting into the air in the first place, it might also be a good idea to try and suck more of them out of the air.

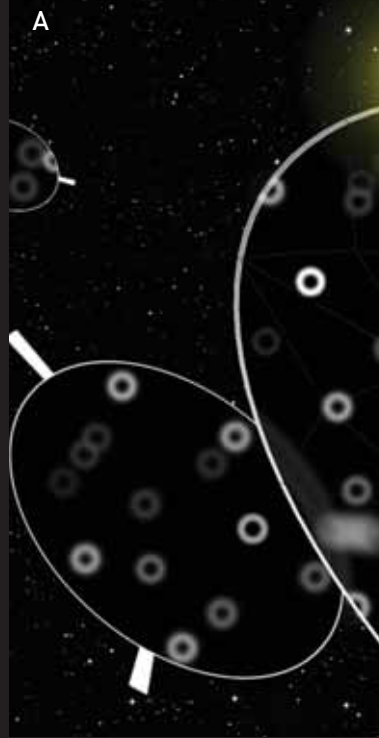
Some scientists think the oceans, where plants like plankton soak up at least as much CO₂ as forests, can be persuaded to capture more carbon. There is talk of fertilizing the oceans so that more plankton grows and the water soaks up more gas from the atmosphere. In some parts of the oceans, iron is a good fertilizer: when scientists sprayed iron into the water (C), plants quickly grew. But so far the evidence is that it is only a temporary effect.

Step forward Klaus Lackner of Columbia University in New York. He says that for every power station filling the air with CO₂ we need another factory sucking the gas out again (D). He has designed a kind of windmill that could clean the air by blowing it across a chemical like sodium hydroxide that absorbs CO₂.

The technology is being developed to reduce emissions from power stations before they go up the chimney. So why not clean the ordinary air, too? One answer is that CO₂ concentrations in ordinary air are about a thousand times lower than in waste gases, so the technology is not so easy. But it could be done.

Like most of the 'geo-engineering' technologies, cleaning up the air is likely to cost more than preventing the pollution in the first place. But the bottom line is that if one day the world gets into a real jam, we are going to need to reverse global warming fast. Very fast. So maybe we do need to train up the geo-engineers as an emergency service for the planet.

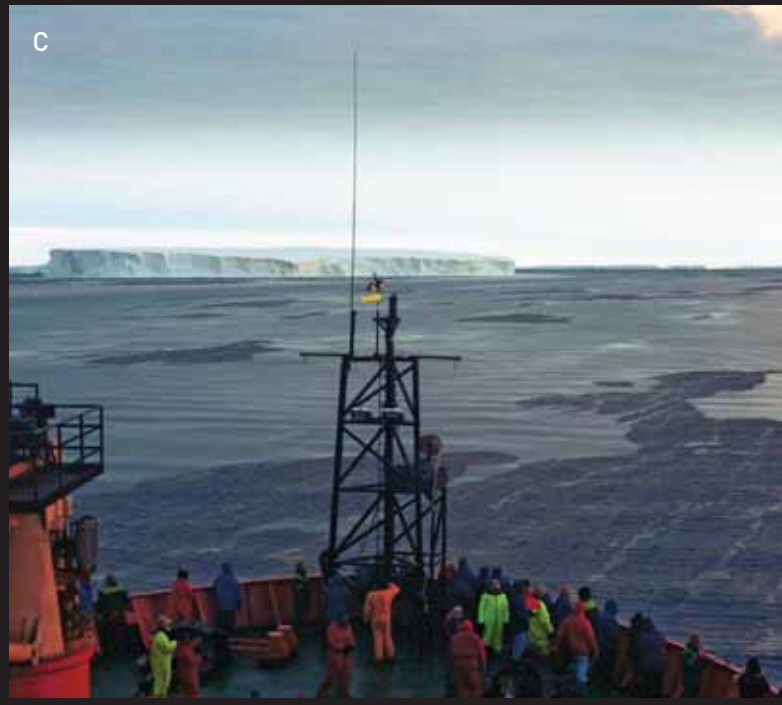
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John MacNeill



Ken Buesseler/Woods Hole Oceanographic Institution



Global Research Technologies



6 DEGREES

+0-1 degree



Roslyn Goodman/UNEP/Topham

As we move towards the +1°C world, rising temperatures are already seriously affecting sensitive ecosystems, including the Amazon, while warmer waters are causing corals to eject the microscopic algae that live in their tissues and keep them alive. Over the last 40 years the Arctic has lost 400 cubic kilometres of ice: replacing its sun-reflecting whiteness with dark sea which absorbs heat and increases warming. Many experts believe that the Arctic has tipped into irreversible decline: some predict that it will be free of ice in summer within the next decade. Sea-level rise threatens half a million people in small island states, like the Maldives. And just 1°C of warming could cause droughts that would devastate the US Mid-West, the world's food basket.

+1-2 degrees



Damrong Juntawonsup/UNEP/Topham

Many animal and plant species will not be able to adapt to a rise of this magnitude: the humid tropics alone could lose up to a third of species. The oceans, which absorb half of all our CO₂ emissions, are becoming more acidic – endangering the survival of species at every level of the marine food chain. Warmer temperatures should increase agricultural production around well-watered northern regions – as opposed to the dry Mid-West – but would mainly hit food production in many of the world's poorest countries. Some areas could experience constant water shortages: Peru's capital Lima, for instance, depends on natural meltwater from the glaciers of the surrounding mountains for its supplies, and these are unlikely to survive. In Europe, water and agricultural problems could grow in the summer months as the probability of extreme heat waves sharply increases, reducing river flow, damaging crops and causing forest fires. Global warming approaching +2°C could push Greenland's glaciers into unstoppable melting, leading to their complete disappearance within 140 years, which would commit the world to a sea-level rise of up to 7 metres and cause the inundation of some of the world's major coastal cities.

+2-3 degrees



Vu Danh Viet/UNEP/Topham

The United Nations sets +2°C as the upper limit, and crossing it could lead to the Earth's carbon cycles beginning to break down, locking the globe into runaway global warming, and moving the world towards +3°C by 2050. A rise of 3°C is predicted to bring about intolerable drought and searing temperatures in Amazonia, resulting in forest fires, arid soils and ultimately its complete destruction. Worldwide, up to half of existing plant and animal species could become extinct. Rice, maize and wheat yields throughout the tropics could fall sharply. The vital Asian summer monsoons could become more irregular – failing to arrive one year, and causing devastating floods the next. Mountain glaciers feeding the continent's key rivers – the Indus, Ganges and Brahmaputra – are unlikely to survive, putting many areas at risk of serious water shortages. Melting from Greenland's glaciers and Antarctic ice caps could raise sea levels by up to 1 metre, making extreme flooding around the world much more likely. The Earth's soils contain more than twice the carbon now in the atmosphere (about 1.6 trillion tonnes) in the form of slowly rotting vegetation. A 3°C increase could speed up this decay enough to cause the soils to release more CO₂ than they absorb.

Stable weather patterns, reliable water sources, healthy rainforests and seas, and a diversity of plants and animals have allowed our species to flourish. Now, all are threatened as our greenhouse gas emissions warm the planet far faster than ever before: we have raised average global temperatures by 0.7°C, mostly since the 1970s. The United Nations' Intergovernmental Panel on Climate Change (IPCC) suggests that at this rate, global warming of up to 6°C is possible by the end of the century. Mark Lynas, author of *Six Degrees: Our Future on a Hotter Planet*, uses the latest climate science to show what each step on the way would mean.

+3-4 degrees



WILDLIFE/H Schweiger/Still Pictures

Runaway greenhouse gas releases from the Earth's soils could force 4°C of warming by 2075. Starvation could threaten the majority of Earth's population as droughts dominate southwestern North America, Central America, South Africa, West Africa, the Mediterranean, Southeast Asia, Siberia and Australia. Warmer ocean waters would rapidly melt the Antarctic ice sheets, raising sea levels by up to 1 metre every 20 years, threatening coastal communities across the world. At +4°C, the Arctic's ice may fail to form even during the polar winter. Ninety per cent of the 9 million square kilometres of permafrost – permanently frozen soil – in the far north may gradually thaw, releasing around 500 billion tonnes of carbon into the atmosphere and forcing a further degree of warming.

+4-5 degrees



Paul S Masaka/UNEP/Topham

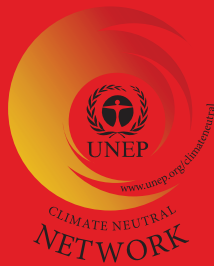
At +5°C, the Earth would change beyond recognition. Rainforests would have dried up and burned down. The seas would rise by more than 5 metres, inundating vast areas and continuing to do so as Antarctica melts and any remaining ice sheets vanish from the poles. With the tropics far too hot to support most food crops or marine life, and the subtropics suffering perennial drought, the 'belt of habitability' would recede towards the poles. Most people on Earth would find the struggle for food, water and living space becoming very serious indeed. The oceans could begin to release methane – 20 times more powerful as a greenhouse gas than CO₂. Stored deep in the ocean at very cold temperatures, this methane may be expelled from the sea bed by the warming waters: just a small disturbance on the sea floor could set it racing for the ocean surface with explosive force. Regular methane releases of this kind could easily force the planet towards another degree of global warming.

+5-6 degrees



Tim Alipato/UNEP/Topham

Scorching heat waves and massive hurricanes are likely to be familiar at +5°C and beyond. Regions that saw agricultural production rise at the earlier stages of warming would see it fall heavily. Warmer oceans would make further outbursts of methane more likely, continuing to push global warming to great heights. If a large quantity of this gas were to somehow ignite, it would explode with a force many times greater than the world's entire supply of nuclear weapons. This is very unlikely, but events of this kind are thought to have occurred 251 million years ago at temperatures similar to a +6°C world, leading to the destruction of all but 5 per cent of the species roaming the Earth.



In February 2009 the City of Copenhagen became the 100th participant in UNEP's Climate Neutral Network, a growing body of countries, cities, organizations and corporations publicly committed to creating a carbon-neutral future.

As the United Nations Climate Change Conference draws near, it's time to get involved by pressurizing governments and authorities to join the City of Copenhagen in making their own pledges for carbon neutrality. But individual lifestyle choices are also critical if we are to shrink our collective carbon footprint.

What YOU can do

Environmentally friendly homes, with good insulation and efficient appliances, cut energy use by at least 75 per cent – and using small-scale renewable sources like solar panels, ground-source heat pumps and even wood-burning stoves can make them zero carbon.

The best way of reducing transport emissions is to travel less. When travel is necessary, public transport is best: petrol-driven cars are up to five times less energy efficient than buses and trains. And avoiding air travel as well could bring total reductions of as much as 80 per cent in the average carbon footprint from transport.

It is also possible to make big, if less direct, cuts in the carbon used to make goods – mainly by buying less 'stuff', reducing food waste and basing a healthy diet on locally produced, seasonal food.

The clock is ticking....

07.12.09 København