

## Kick the habit!

Techno-genius

Unlocking the future

Lights out

Counting carbon



CO<sub>2</sub>

Low-carbon chic

Making a stand

Every little helps

## TUNZA

the UNEP magazine for youth. To view current and past issues of this publication online, please visit [www.unep.org](http://www.unep.org)



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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.



## COOL & COOLER

**COOL:** Substituting your petrol-powered lawn-mower for a hand mower. A standard mower pollutes as much in one hour as a car driven anything from 200 to 500 kilometres, so switching to pushing power is a great way to trim your emissions, your waist and your grass all at once.

**COOLER:** Organic power. If cutting the lawn makes you feel sheepish, take inspiration from the parks of Curitiba in Brazil or Fort Saskatchewan in Canada, and break new grazing ground. In Canada, 50 sheep maintain 8 hectares of parkland – could some rabbits keep a small lawn in check?

**COOL:** Sitting down and reading your favourite environmental magazine, TUNZA, in a cosy café that serves coffee in a ceramic mug.

**COOLER:** Carrying your own mug to use for take-away coffees, cutting down on disposable paper or plastic cups.

**COOLEST:** Enjoying a cuppa while seeing how our world will look if the polar caps melt. The 'Global Warming mug' sports a map of the world which diminishes as hot liquid is poured into it, simulating sea-level rise.

**COOL:** Putting your computer to sleep rather than just turning off the monitor.

**COOLER:** Turning your computer all the way off when you've finished using it.

**COOLEST:** Switching to a laptop, which uses about half the energy of the equivalent desktop PC.

**COOL:** Making your calls from a water-powered phone. Motorola have teamed up with Angstrom Power to manufacture a mobile that runs on hydrogen fuel cell technology.

**COOLER:** Reliving your childhood with Horizon Fuel Cell's H2 racer – a mini model hydrogen car that runs on solar-generated hydrogen – while dreaming of driving off into the sunset when they develop the real thing.

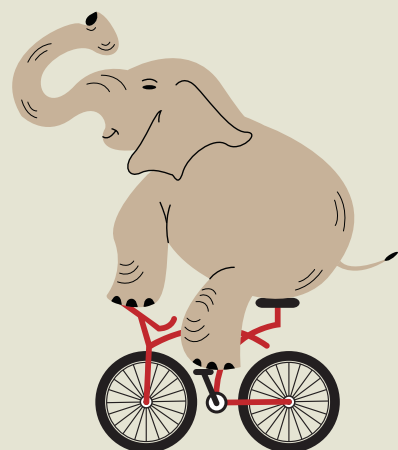
# EDITORIAL

It's been quite a party. For the past couple of centuries – and particularly over the past 60 years – we have been squandering the planet's vast treasury of ancient sunlight. Coal, oil and gas – fossil fuels made from life that flourished in the sun of prehistoric times – took many millions of years to form, but we have been burning them up in one massive binge. They have brought previously unimaginable prosperity and mobility to a minority of the Earth's people, and changed the very face of the planet, covering it with settlements that shine with light in the night sky. But now the party is ending.

Concern is growing that production of oil, the most important and versatile of the fossil fuels, may soon peak – turning what was for so long a cheap and abundant source of energy into an increasingly scarce and expensive one. If so, there will be widespread economic dislocation, for nothing else is yet ready to take its place. Even more importantly, the carbon dioxide released when the fossil fuels are burned is even now irrevocably changing the climate. Global warming is already occurring far faster than expected, and the world's scientists have repeatedly warned that unless we rapidly start to kick the carbon habit, and reduce emissions, dangerous climate change will be unavoidable.

It is falling to our generation to undertake this task, the most fundamental transformation ever attempted in the way we use resources. By 2050 the world will have to be emitting no more than half as much carbon dioxide as now. And far greater cuts than that will have to be made by those who have benefited most from the fossil fuel bonanza – the industrialized countries and the wealthy in developing ones – in order to leave room for the poor to develop. And we will need to stop and reverse deforestation, the second biggest emitter of carbon dioxide.

It's a tall order, but it can be achieved, even using technologies that we already have to hand. Clean, renewable sources of energy are rapidly developing, and can both tackle climate change and lift the poor out of their poverty. Above all, there is tremendous scope for dramatically cutting the waste of energy. Practical steps are spelled out in this issue of TUNZA, but – in the end – it begins with us. Let's make a start this World Environment Day.







K. Tanumitardja/UNEP/Topham

The world's governments are acting to reduce emissions. The first agreement, the Kyoto Protocol, is now in force. And last December, on the Indonesian island of Bali, governments agreed to start talks on a new, tougher, deal. But progress is slow, while scientists have been surprised by the speed of climate change. So we all have to act. Now.

For most of us the biggest emissions are from energy used to heat or cool our homes. So adjust the thermostat a bit towards whatever the temperature is outside. If it's winter, put on a thick pullover; wear shorts in summer. In cold climates, stop heat leaking out by insulating your roof, windows and walls. If it's hot, keep the sun out by closing the windows and darkening the room till the sun passes and there's a breeze, then open the windows to catch it.

Your next biggest contribution is probably from travelling by car – maybe a sixth of your total. So do it less. Walk to school or college or the shops if you can. Or go by bus or train. Or share a car. People in some cities can get by OK without a car at all. But if your family needs one, next time make it a small, energy-efficient vehicle, like a hybrid. Check it out – car manufacturers now provide details of CO<sub>2</sub> emissions per kilometre travelled. But don't rush. Making a car creates about the same emissions as driving it for two years. So keep the old one as long as you can.

Next up are all the gadgets in the home. The big five domestic power guzzlers are refrigerators, tumble driers, computers, lighting and washing machines. Don't use a tumble drier unless you really need to. Hang washing outside to dry. And run the washing machine at a lower temperature, like 30°C. Never run half loads.

Laptop computers use only about half as much energy as PCs. And you can cut use further by using the sleep function. Remember anything on standby is using electricity all the time. Believe it or not, a typical TV on standby has as big a carbon footprint over the year as a typical person in Burundi. So turn it off, especially at night. And don't forget that chargers such as those for mobile phones or laptops use power even if the gadget is not connected. A good rule is that if the plug gets even slightly warm, it is using power. So unplug it.

# Kicking the habit

Fred Pearce

## THE SCIENCE IS NOW CERTAIN.

We are warming the atmosphere in ways that are dangerous – for some people now and for many more in the future. It is not just a question of temperature; some might like it warmer. But it is weird weather. There are more droughts in some places, more floods in others. Farmers don't know what crops to plant, or when. Amazingly, there could be no ice in the Arctic Ocean in summer within 10 years. As the world's ice caps melt, sea levels rise. And this is just the start of it.

That's the bad news. The good news is we can all do something about it.

We shouldn't be surprised about global warming. For 200 years, scientists have known that certain gases in the atmosphere, like carbon dioxide, trap the sun's heat and warm the air. Put

more of them up there, as we are doing, and it's not hard to work out that the world will warm. We produce these gases in large amounts by burning fuels made of carbon – like coal, gas and oil – and by destroying forests. They are made of carbon, too, and their destruction causes about a fifth of the emissions.

We all contribute. Whenever we plug in a computer, or climb into a car, or heat our homes, or buy food, we are using energy made from burning carbon.

Everyone is not equally to blame, of course. If you live in Europe or North America or Australia, your contribution will be about three times higher than if you live in China, 10 times that in India, and up to 100 times that in Africa. Though, even in poor countries, rich people emit a lot of carbon.

Energy-efficient light bulbs? Of course. And even better, LED (light-emitting diode) bulbs are on the way. We can also save energy by sharing things – from car journeys to expensive kit that you don't use often, like power tools – and by recycling or selling stuff when we've finished with it.

As well as using less energy, we can try to use electricity that isn't made by burning carbon fuels. Many of us tap into the grid, so it can't be done directly. But some power companies offer green tariffs, where you pay a bit extra. They spend the premium on putting up wind turbines or whatever. But check what you are buying – you may just be subsidizing the electricity company to meet its legal obligations!

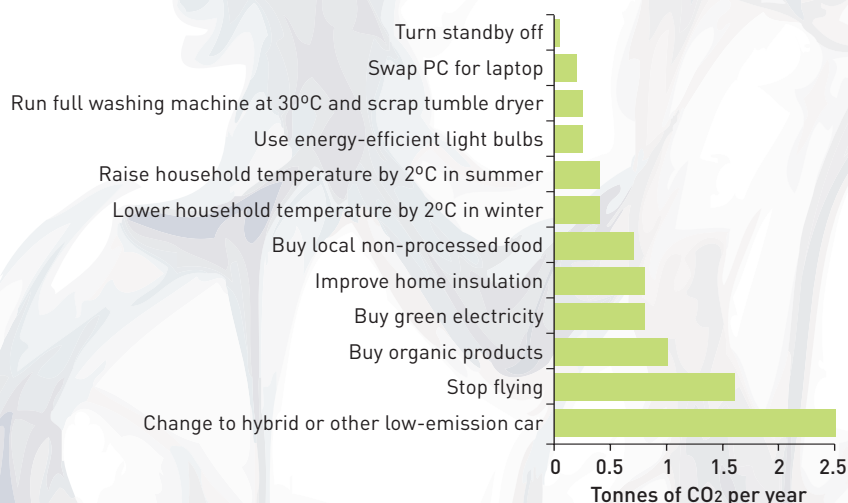
Don't forget food. Your diet may be responsible for a fifth of your emissions. Making fertilizer uses a lot of energy; so does transporting food around the world. Raising farm animals can be energy-intensive, too. And they produce methane, another global-warming gas. Buying organic avoids the fertilizer. Going veggie is good, though dairy products are no better in this respect than meat. Buying local cuts out the food miles.

In these ways, most of us can at least halve our personal emissions without really changing our lifestyles. There is one exception: flying. For people who take one or two short flights a year, flying is less than a tenth of their total emissions. But a return flight between, say, Europe and the United States of America will make you responsible for the same emissions as running a car all year. For frequent fliers – whether jet-setting business people or those addicted to bargain breaks on budget airlines – air journeys are much their biggest contribution to warming the planet.

If you have to fly, then check out the companies that for a few extra dollars will offset your emissions by planting trees or investing in green energy like wind or solar power. This is second best, but if you fly, you should do it.

Of course, all this will only work if millions of us act. But millions of us now care about the climate. So we could. We should. And, as the doctor said, it won't hurt that much.

## Potential CO<sub>2</sub> savings YOU can make



## Unlocking the future

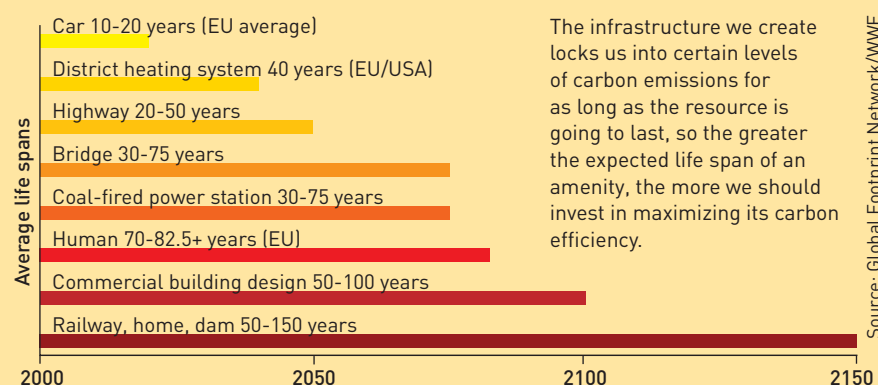
During the Oil Age of the last half century, the world became hooked on cheap oil. Worse, it has acted as if it would flow forever, locking us in to a future of high consumption, although increasing scarcity and growing climate change are rapidly dictating otherwise.

Out-of-town shopping centres that require cars and stifle local high streets, the concentration into fewer and larger hospitals and schools, the proliferation of motorways at the expense of rail, the building of coal-fired power stations – and many other outdated policies – all hamper personal attempts to kick the carbon habit. A decision to walk or bicycle is frustrated, for example, if the nearest shop, school or doctors' surgery is too far away. And every time an energy-inefficient new building is put up, a new airport is constructed, or a new fossil-fuelled power plant is built, the high-carbon infrastructure is perpetuated for the many decades of its future useful life.

So besides individual action to shrink carbon footprints, there has to be a bigger effort to decarbonize national and regional infrastructures. Several countries have made a good start on one of the most effective ways of doing this, promoting the spread of decentralized renewable energy by offering households generous 'feed-in' tariffs for any surplus electricity they generate and can sell to the grid: they have helped Germany, for example, to become the fastest-growing market for solar cells in the world – in 2007 alone it installed more than the United States has done in its entire history.

Other measures include policies to revive high streets, open local schools and clinics, revive public transport, build high-speed railways and encourage innovation to concentrate on making products for the very different world that will soon be upon us.

### Life spans of people, products and infrastructure



# Lights out

Few inventions have benefited humanity more than the incandescent light bulb. But almost 130 years since Thomas Edison first made it practical for widespread use in 1878, it is now on the way out.

'Incandescents use technology invented during the age of the steam engine,' says the Irish Environment Minister John Gormley. And they are just about as efficient. Only 5 per cent of the energy they consume is turned into light; most escapes as heat. The International Energy Agency estimates that a worldwide switch to efficient lighting would cut global electricity use by almost a tenth.

Ireland will phase them out by January 2009. Brazil and Venezuela, the first countries to announce a ban, will follow by 2010. Australia, Canada, the United Kingdom and the United States of America are not far behind.

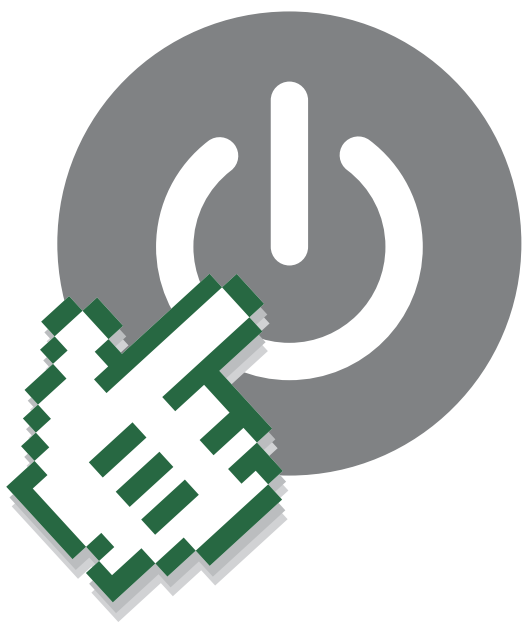
For now, the most available alternative is the compact fluorescent bulb, or CF, which uses a fifth of the energy and lasts 10 times longer, saving the energy used in making new ones. Indeed they save up to 2,000 times their own weight in greenhouse gases.

But, in fact, they are likely just to be a staging post. Light-emitting diodes (LEDs), are even more efficient (developers plan to make ones 16 times better than traditional bulbs by 2010), last even longer than compact fluorescents and are likely to be illuminating the world before long.



Zack Pedrick

# Flicking the switch on **STANDBY**



The TV remote control first appeared in the 1950s under the slogan 'Lazy Bones'. As technology was refined, over time, the little red standby light became commonplace – and welcomed as convenient. But now we are on standby overload: many appliances in our homes stealthily suck energy all day, every day.

Some manufacturers have all but eliminated an accessible, definitive 'off' feature. 'Idle', 'stand-by' and 'sleep' amount to the same thing – the appliance is still using electricity.

The world's standby products, using up to 10 per cent of household energy consumption, are together estimated to be responsible for 1 per cent of global CO<sub>2</sub> emissions. It's costing both us and the planet – financially and environmentally.

To make matters worse, our addiction to consumer electronics is growing fast. The European Union predicts, for example, that by 2020 British use of home entertainment products and computers could account for up to 45 per cent of home electricity consumption. Forecasts like this are spurring the EU to tackle standby: its 27 member countries recently adopted a framework directive on ecodesign in Energy-using Products that should stimulate a switch away from it.

And there are new gadgets to make it convenient to switch off. For example, remote controls have been introduced to switch off several devices at once – providing a modern eco-friendly retake on 'Lazy Bones'.



# Q & A

**Q. What sort of impact would the use of biofuels make in the bid to reduce CO<sub>2</sub> emissions? Is the balance between the environmental costs of their production and transformation on the one hand, and the reduction of CO<sub>2</sub> emissions on the other, a useful contribution?**

**A.** Bioethanol and biodiesel were originally hailed by some as a way of both reducing emissions from cars and helping to diversify rural livelihoods, and Brazil has an impressive record of producing fuel from sugar. More recently, concerns have mounted that growing biofuels can cause the felling of forests, releasing more CO<sub>2</sub> than they save, and is driving up world food prices. Hopes are now focusing on a 'second generation of biofuels' using wood, grasses and other plants that grow on marginal land. Biofuels come in many forms, and we need standards and certification schemes to make sure that the ones we use are sustainable.

**Q. Realistically, what are the chances that we will be able to keep climate change under the 2°C threshold over the next 50 years?**

**A.** It will be hard, especially as past emissions have already committed the world to an increase of 1.1°C. But we have to make every effort to achieve this goal, as it is our best chance of avoiding dangerous climate change. And it can be done if governments and people set about the task with real urgency and commitment.

**Q. There are lots of things going on with solar and wind energy. But why are there so few schemes aimed at harnessing tidal or wave power, and is there a future for using this renewable source of energy?**

**A.** Solar heat and wind power are both relatively cheap forms of renewable energy, are distributed widely – and for free – by nature, and can be exploited on a small scale. So it is not surprising that they have been the first renewables to take off. Tide and wave power are restricted to relatively few places, and require much bigger installations. But, however belatedly, they are now beginning to receive serious attention. We will need them, as well as solar and wind power, if we are to meet our goals.

**Q. Historically, a high proportion of global CO<sub>2</sub> emissions has been caused by a small number of industrialized countries. How can the behaviour of these countries be changed, and is it possible to stop developing countries from forming carbon-based economies?**

**A.** The fact is that the developed world has a carbon-based economy, consuming enormous amounts of natural resources and generating vast amounts of detrimental waste, but that does not mean the developing world has to follow the same path. There is a better choice: an environmentally sustainable process with better economic and social outcomes. But it will only become a reality through partnerships, cooperation, investment and the transfer of appropriate technologies.

**Q. We understand there has to be action on climate change, and that public participation is key to any realistic solution. Will UNEP play a role in this?**

**A.** World Environment Day 2008 is devoted to kicking our carbon habit, and this is just one of UNEP's activities to increase public awareness and understanding of climate change, and to mobilize people to take concrete action. Others include our Billion Tree Campaign, which catalysed the planting of 1.5 billion trees in 2007 and was relaunched in 2008 to encourage the planting of another billion. UNEP has also started the Climate Neutral Network to help countries, cities and corporations achieve zero-carbon status and is taking the lead in greening the way the UN works.

**Q. What practical things can everyone do to kick the carbon habit? And how can they ensure that governments and businesses do so too?**

**A.** By leading by example and engaging in a lifestyle that will not compromise the ability of future generations to live a decent life, including recycling and reusing; changing to energy-saving appliances including light bulbs; switching off electrical devices; and walking, cycling and using public transport. Governments need our support to put policies to protect the planet in place. Businesses require consumer pressure to focus on environmental sustainability.

**Q. How can developing countries with few resources play their part in the challenge of halting climate change?**

**A.** The impact of climate change on the poorest and most vulnerable regions of the world is likely to be devastating. But developing countries must also act to tackle the causes of climate change, and minimize the consequences. The international community must help to build their capacity to meet the challenges through training, education and awareness-raising; sharing knowledge and expertise; providing tools for impact assessment; and, of course, with funds.

# Green cities

Imagine a zero-carbon city with all its power provided by the sun, the wind and recycled waste – in a desert where summer temperatures hit 50°C. Its car-free streets are shaded, and its 50,000 residents whizz to work on a light rail system or in personal, driverless rapid transit pods – both emission free. Instead of power-hungry air conditioning, the buildings, all less than five storeys high, are cooled by wind towers that catch breezes while expelling heat. Ninety-nine per cent of the city's waste is used to make energy or compost, while residents use water desalinated with solar power and recycle all their waste water.

Far off in the future? No. This is Masdar – which the United Arab Emirates is about to start building on 7 square kilometres just outside the city of Abu Dhabi. Due to be completed in 2012, Masdar – 'the source' in Arabic – is aiming to be the world's first sustainable city, and a centre of clean energy research and development.

It is in a race with Dongtan, now being built near Shanghai on an island the size of Manhattan in the mouth of the Yangtze River, the first phase of which is due to be completed in 2010. The Chinese eco-city will produce its own energy from the wind and sun, biofuels and recycled city waste, and grow organic food. Cars will be banned from the city centre and public transport will run on hydrogen fuel cells. By 2040 it is expected to be home to half a million people.

## CHANGE OF HABITAT

In 2008, for the first time, humanity will become an urban species, with half of the world's 6.6 billion people living in towns and cities. By 2013 those 3.3 billion urban dwellers will have grown to 5 billion. Even now, although cities take up only 3 per cent of the world's land, they consume 75 per cent of its energy and produce 80 per cent of its greenhouse gas emissions.

Yet cities offer great potential for sustainable living. As they are densely populated they can have efficient public transport systems, and shops, schools and medical services within walking distance of homes. It is easier to use energy efficiently through district heating schemes, and even shared walls help save energy. And cities have the resources and people to finance and implement green policies.

Indeed almost a thousand towns and cities worldwide have already made big reductions in their carbon emissions.

## PEOPLE MOVERS

Curitiba, in southern Brazil, was decades ahead of the game. In 1972, its government closed the boulevard Rua Quinze de Novembro to all traffic, planted flowers, and opened it up again two days later as a pedestrianized urban area. And that was only a start in what was to become a byword for environ-



Inkognitoh/Flickr



Hiromi Watanabe Courtesy Emilio Ambasz

mentally friendly urban planning. Its buses alone replace 27 million car trips per year and its people emit only two thirds of the quantity of carbon dioxide emitted per capita in other similar Brazilian cities.

In London, drivers entering the centre of town pay a congestion charge of \$16 a day – which funds public transport improvements. This has reduced traffic volumes by 21 per cent, increased cycling by 43 per cent, and produced an almost unprecedented shift towards public transport.

Paris will soon have a system of 2,000 rentable electric cars to reduce the need for residents to have cars of their own – and already offers 10,000 bicycles for hire at 750 points all around the city. It aims to reduce car traffic by 40 per cent by 2020. DeutscheBahn operates a similar bicycle service



in six German cities, and Copenhagen provides bicycles for free.

Other cities run their public transport on CO<sub>2</sub>-saving fuels, including a totally biodiesel bus fleet in Graz, Austria, and a biogas-fuelled commuter train that runs between Sweden's Linköping and Västervik. But Bayamo, in Cuba, may have the most 'organic' solution of all. The city – where in 2004 only 15 per cent of commuters had access to motorized vehicles – started a horse-drawn carriage service, which now meets 40 per cent of local transport needs.

And the best excuse for a street party may be in Bogotá or Seoul, which have car-free days: the one in the Korean capital takes as many as 2 million cars off the road.

## HEAT AND LIGHT

Buildings are the largest source of CO<sub>2</sub> emissions, and governments are now beginning to address them. The United Kingdom has ambitiously set out to make all new homes carbon neutral by 2016, and is to build 10 zero-carbon 'ecotowns'. And France has gone further, deciding that all buildings must be carbon positive – producing more renewable energy than they consume – by 2020, and is embarking on a programme of modifying 400,000 existing homes a year to reduce their energy consumption by more than two thirds.

In 2000, Barcelona made it compulsory to use solar energy to supply 60 per cent of hot running water in all new or renovated buildings, making it the first European city to have a solar thermal ordinance and inspiring more than 60 other municipalities throughout Spain to adopt similar measures.

Sydney, Australia, is constructing a facility that will turn food and other wastes into biogas to generate enough electricity for 3,000 homes. Latrines that produce biogas, piped to homes and schools as a low-emission fuel, are being introduced in the giant Nairobi slum of Kibera.

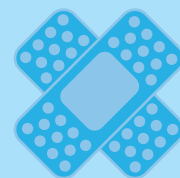
And in Växjö, southern Sweden, wood waste from local sawmills is used to produce both electricity and heat for buildings, reducing – with the help of many other energy-efficiency measures – the city's per capita CO<sub>2</sub> emissions to less than 3.5 tonnes a year – compared to the European average of about 10 tonnes.

## URBAN ALLIES

Forty of the world's largest cities have joined up to force the pace on cutting carbon emissions and tackling climate change, by sharing best practice, jump-starting clean technologies and jointly procuring green goods. In many ways they are often ahead of national governments.

UNEP's Executive Director Achim Steiner says: 'A city can only be truly successful if it can convincingly demonstrate its green credentials by recognizing its natural assets, creating efficient water, energy and transport infrastructures, and protecting its citizens in the face of present and future impacts of climate change.'

# How high is your carbon awareness?



**1. You have replaced all the old incandescent bulbs in your house with compact fluorescent bulbs. You have friends over for movie night and pizza. As you move between the kitchen and the living room should you:**

- a) Turn off the lights even when leaving for just a few seconds
- b) Turn them off if you'll be gone for more than 3 minutes
- c) Keep them on if you'll be back within a quarter of an hour

**2. The demand for fruit and vegetables out of season can enlarge our carbon footprint. On average, kiwi fruit flown from New Zealand to Europe produces CO<sub>2</sub> emissions totalling how many times its weight?**

- a) 2 times
- b) 5 times
- c) 8 times

**3. You're having a can of soda while watching your favourite TV programme. If you recycle it, it will save enough energy to power your television for:**

- a) 30 minutes
- b) 3 hours
- c) 30 hours

**4. You want to green your garden to fit in with the rest of your lifestyle. Which of the following should you increase if you want your garden to absorb as much CO<sub>2</sub> as possible?**

- a) Bedding plants
- b) Trees
- c) Grass

**5. That pile of dirty laundry is mounting up. What is the most eco-friendly way of getting those clothes clean?**

- a) Washing them in the machine at 30°C
- b) Dropping them off at the dry cleaners
- c) Boil them in a huge pot of water

**6. Which country gets the greatest percentage of its electricity from energy generated by wind turbines?**

- a) Ireland
- b) Denmark
- c) Germany
- d) Finland

**7. The average wind turbine has a working lifespan of about 20 years. Over this period how much more energy will it generate than was used in its manufacture?**

- a) 15 times
- b) 25 times
- c) 35 times
- d) 45 times

**8. 'Ok! I admit it – I almost never turn the computer off...it just seems to take forever to start up!' How many trees are needed to absorb the CO<sub>2</sub> emitted by your ever-glowing machine over a year?**

- a) 50
- b) 150
- c) 370
- d) 500

Answers: 1-b, 2-b, 3-b, 4-b, 5-a, 6-b, 7-c, 8-d

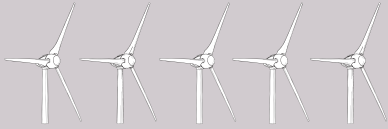
# Good ideas

TUNZA asked our readers, 'What are YOU doing to help lower CO<sub>2</sub> emissions?' Your responses were inspiring, and hopefully will motivate others to follow your lead.



I am implementing a mobile vermicompost box programme in my community. We pick up small containers in scrapyards, make an opening in them, add earthworms and distribute them to houses, where people add kitchen waste daily. At month's end, we collect the compost, and either redistribute it for gardening or sell it to nurseries. Using organic compost reduces the need for fossil-fuel fertilizers, which emit CO<sub>2</sub>, and recycles organic waste, which prevents methane emissions. Growing produce at home reduces food miles too.

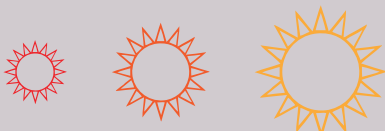
**Ruchi Jain, India**



At Fordham University in New York, we constructed six 3-metre-tall mock wind turbines and a display explaining how wind power lowers CO<sub>2</sub> emissions. The turbines are so convincing that quite a few faculty and students think we're generating wind power! And the project prompted students to consider their carbon footprint. We're now receiving many press inquiries and requests to exhibit the project throughout the country. **Anne Bertucio, United States of America**



To convince young people to protect the Earth, they must be given direct experience of the natural world. That's why I lead bushwalks for teenagers at Wollangarra (Aboriginal for 'young people in high places'), a remote outdoor education centre in Victoria. Our visitors live without electricity and eat home-grown, organic vegetarian food. Immersing people in nature changes their attitudes and behaviour, including the lowering of their CO<sub>2</sub> emissions. **Clare Easton, Australia**



My organization, Jeunes Volontaires pour l'Environnement, promotes solar cookers, simple to make from cardboard and aluminium foil. In Togo's Vo prefecture, for example, women now use sunlight to boil water to make it safe, and to cook food, while reducing CO<sub>2</sub> emissions as fewer trees are felled for firewood. As women are the ones using the technology and teaching others, it has greatly improved their quality of life and position in society. Even the chief asks their advice on environmental matters! **Rik Jacquemyn, Togo**

# EVERY LITTLE HELPS



Environmental action can be as simple as planting a tree, or as grand as speaking at an international climate conference. But young people from all cultures and walks of life are taking Earth's health into their own hands.

'Our future is at stake. History will judge whether you did enough to give us a planet worth living in. As you make these decisions, take a moment to reflect on why you are here. Are you here for us, your children? As emerging leaders, [young people] are mobilizing the public, building powerful movements, and forging international coalitions. We are already inheriting the consequences of your choices. The world is watching. The youth are rising. Join us.'

So spoke the world's youth – represented by Anna Keenan, Karmila Parakkasi, Whit Jones and Bambou Chieppa – drawing tears and applause in the plenary meeting of the United Nations Framework Convention on Climate Change (UNFCCC) conference in Bali, Indonesia. Here, in December 2007, the governments of more than 180 countries discussed the future of international negotiations on reducing greenhouse gas emissions and slowing – and adapting to – climate change.

The statement was drafted by a group of more than 200 young people from 30 countries, developed and developing. Young people now often attend such international conferences but they achieved particular momentum in Bali. Photos of young activists featured in international news outlets including the BBC and *Washington Post*. UNICEF gave its blessing, dubbing it the 'launch of the global youth environment movement'.

At its roots are ordinary individuals and groups doing their bit. But now, said Jairus Josol, Philippines delegate and member of UNEP's Southeast Asian Youth Environment Network, 'individuals are networking and exchanging ideas. Owing to their various backgrounds, each has something valuable to bring to the table.'



Robert vanWaarden/vanwaardenphoto.com

The group convened in Bali as a self-organized delegation, meeting daily in the 'youth bunker' – a makeshift space under a stairwell in the conference centre – to discuss strategy, make plans and write press releases. The UNFCCC offered support, recognition and the opportunity to address the plenary. Besides working together on the statement, the young people carried out demonstrations – including presenting the Fossil of the Day Award to countries they felt were blocking negotiations – and made statements to the press. They also helped open up the conference to the world, updating those back home through blogs, online video and emails.

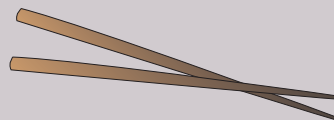
Individual countries' youth delegations had their own agendas, too. Adam MacIsaac of the Canadian youth delegation said: 'Our presence ensured that Canadians knew what their Government was doing in Bali, and that our Government negotiators heard young Canadians' concerns. What we want is an international consensus to eliminate fossil fuels in our lifetime. As young people we must work hard together so that runaway climate change will not be part of our future.'

But what can youth really achieve at events like this? 'We can act as a moral conscience,' said Richard Graves, of SustainUS, a US youth organization. 'Youth are asking world leaders to listen to the generation that will suffer the consequences of today's decisions. This is an issue of intergenerational justice.'

**Curious about the growing youth climate movement?**  
Visit [www.youthclimate.org](http://www.youthclimate.org)  
and <http://itsgettinghotinhere.org>



Students at my high school regularly convene with other schools to find solutions to problems. My committee, focused on global warming, decided to afforest Turkey's public schools. We raised funds through corporate sponsorship, and collected money at fairs and from fellow students. Then we asked the Turkish Afforestation Foundation for advice on what to plant. So far we've afforested eight schools that had no trees or plants. We involved the students in the planting, explaining how it would both help the immediate environment and slow global warming. **Dmitri Tasmali, Turkey**



In Japan, it's becoming cool for young people to carry their own chopsticks to use at restaurants instead of accepting disposable ones. More than 90 per cent of disposable chopsticks in Japan are made from trees in China, a country facing severe deforestation and desertification. One university eco-group sells cotton cases to encourage this practice, and restaurants even discount meals when people bring their own. Each person can make a difference with a tiny effort!  
**Midori Kitahashi, Japan**



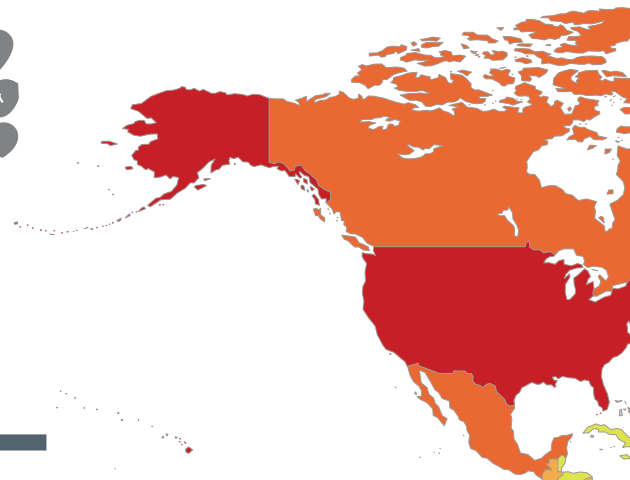
Pongal, a harvest festival celebrated in South India, is an important tradition for Tamils there. On the first day, people clear out their homes and burn the discarded items on a ritual bonfire. This releases CO<sub>2</sub>, and some items such as plastic bags and rubber tyres also release toxic gases. My fellow forestry students and I led a campaign in our town, Mettupalayam, explaining the dangers and asking people to reuse or recycle the waste instead. They responded well, and the municipality even helped us gather the dangerous waste. We hope to spread the word further next year via the media and more campaigns. **Karthikeyan Natarajan, India**



As an architecture student, I specialize in sustainable management. So I was alarmed at the amount of paper and cardboard my 400-person department consumes – between maps, models, sketches and so on, 7.7 tonnes per year! So I presented a list of strategies, including printing on smaller sheets, using both sides, cutting up maps to reuse as sketchbooks, using digital models when possible, and reusing cardboard. All that's needed is awareness, and my fellow students and teachers have now started to act. On average, making a tonne of paper produces a third of its weight in CO<sub>2</sub> emissions, and Peru alone has 22 such departments. Clearly we students can make a significant impact simply by changing our habits. Getting the word out to other schools is my next step. **Carlos Bartesaghi Koc, Peru**



# Counting carbon



**Total annual CO<sub>2</sub> emissions, including land-use change (tonnes)**

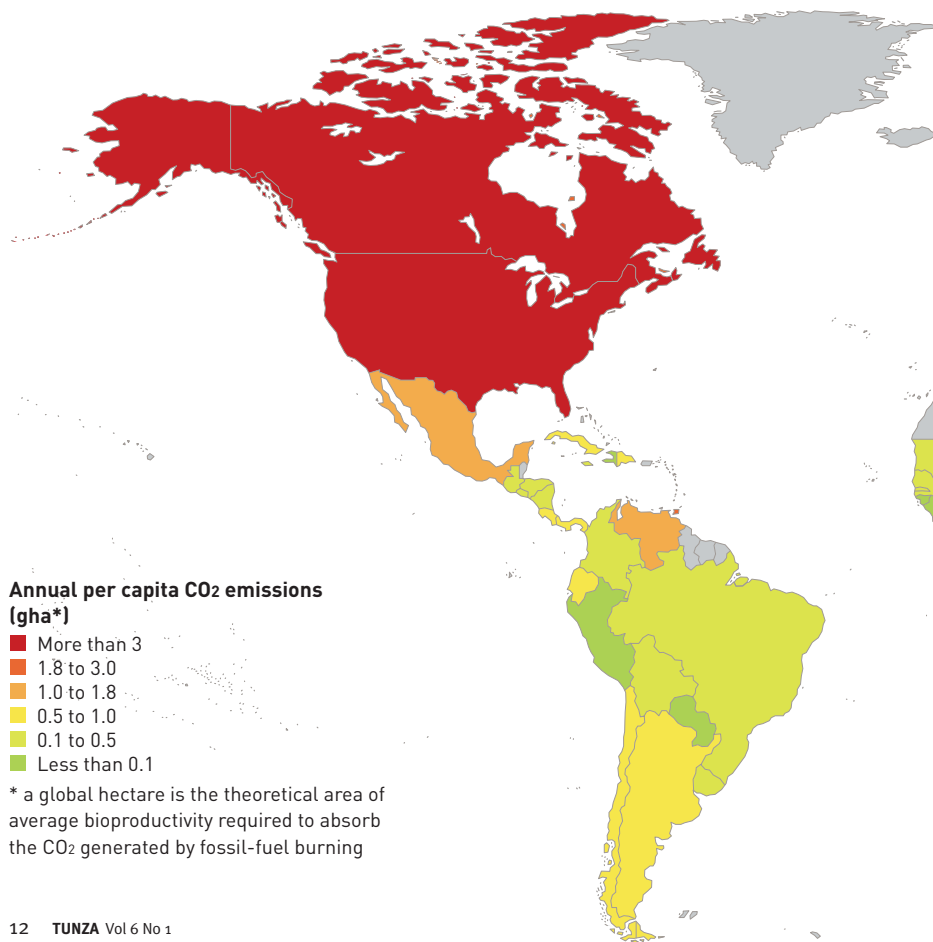
- More than 1 000 million
- 100 million to 1 000 million
- 50 million to 100 million
- 25 million to 50 million
- 10 million to 25 million
- Less than 10 million

Data for the following countries exclude land use: Armenia, Azerbaijan, Belgium, Brunei Darussalam, Eritrea, Georgia, Kazakhstan, Kyrgyzstan, Luxembourg, Macedonia, Mauritania, Moldova, Tajikistan, Turkmenistan, UAE, Ukraine, Uzbekistan

Climate change is already taking place – faster than expected – and human activities are to blame, emitting greenhouse gases that act like a steadily thickening blanket around the Earth. Most of these gases have always been there, keeping the planet about 20°C warmer than it would otherwise be and making it habitable. But it's not surprising that the world is getting warmer as our emissions increase greenhouse gas concentrations in the atmosphere.

Carbon dioxide (CO<sub>2</sub>) is the most important of these gases, responsible for about 70 per cent of human-induced warming so far. For thousands of years its concentration remained more or less steady, at around 280 parts per million (ppm). Widespread burning of fossil fuels – from the coal-powered Industrial Revolution to the Oil Age of the last 60 years – has changed this. In the last 300 years humanity has put about an extra 600 billion tonnes of carbon (in the form of

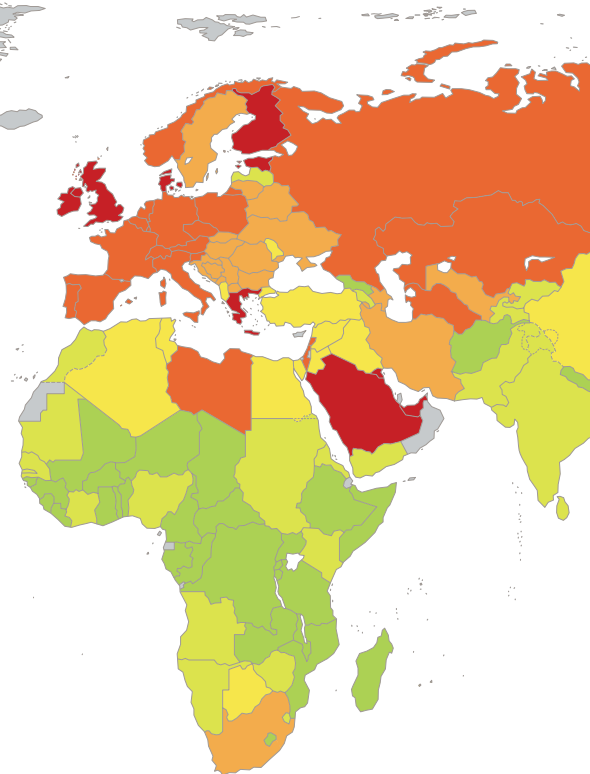
## 2. Per capita CO<sub>2</sub> emissions



**Annual per capita CO<sub>2</sub> emissions (gha\*)**

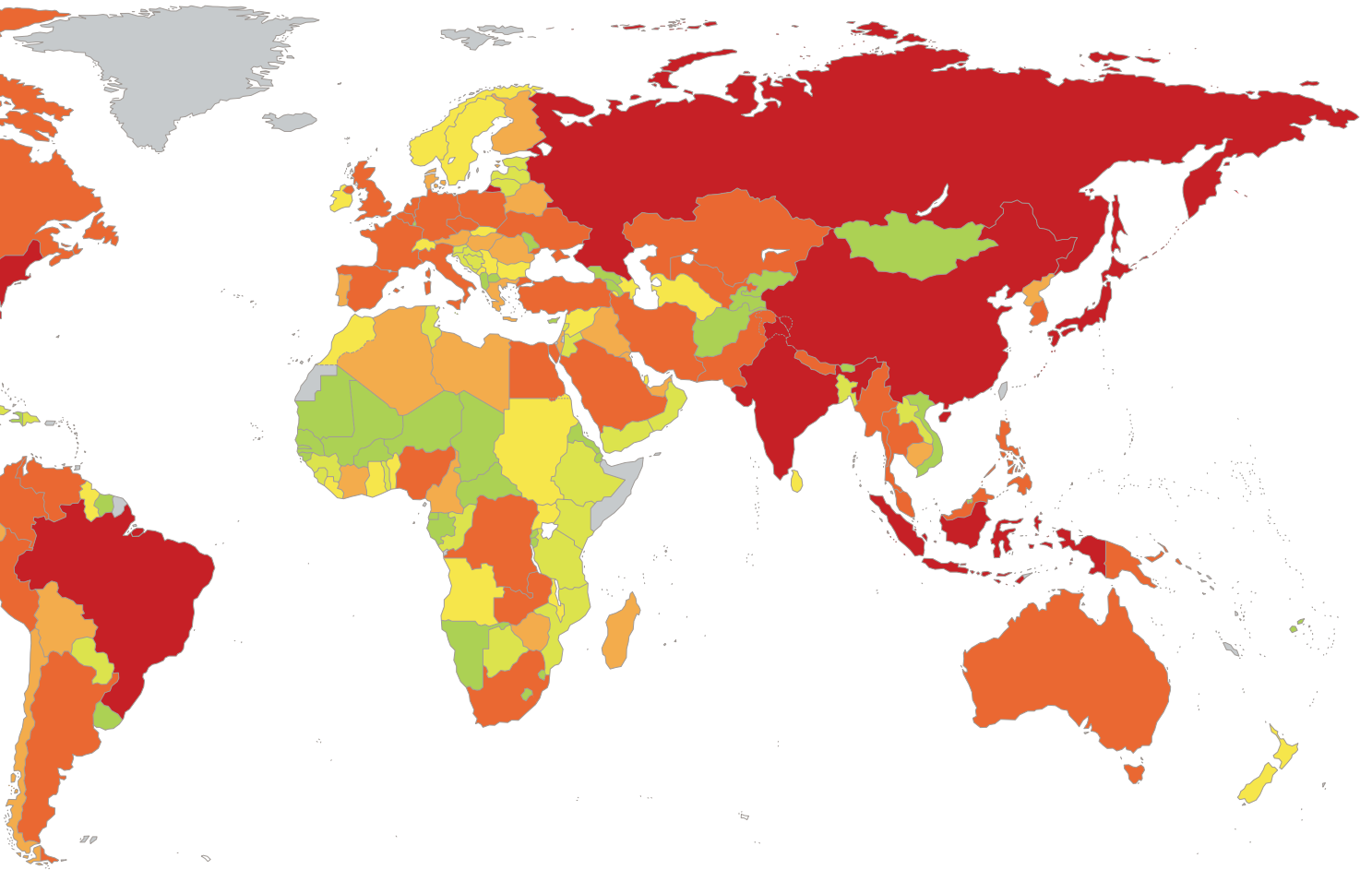
- More than 3
- 1.8 to 3.0
- 1.0 to 1.8
- 0.5 to 1.0
- 0.1 to 0.5
- Less than 0.1

\* a global hectare is the theoretical area of average bioproductivity required to absorb the CO<sub>2</sub> generated by fossil-fuel burning

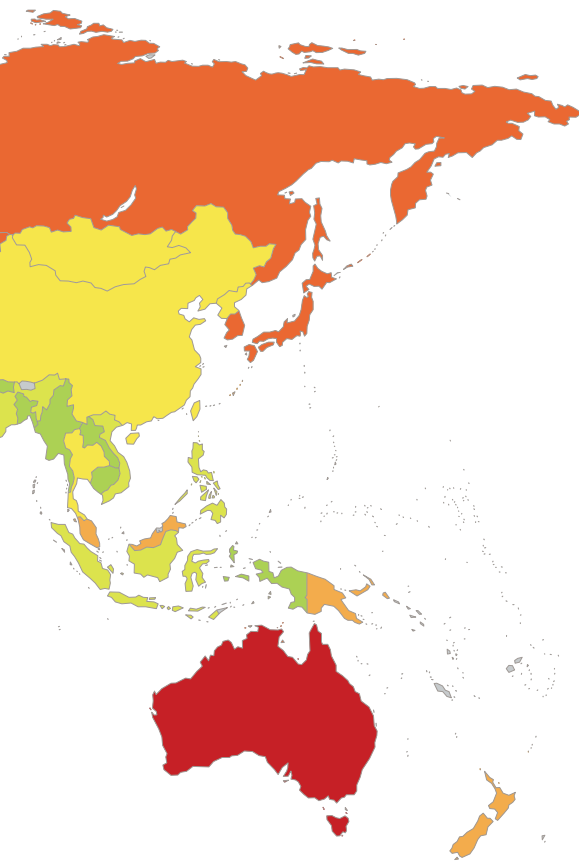


Source: Global Footprint Network/WWF

# 1. CO<sub>2</sub> emissions including land-use change



Source: World Resources Institute



CO<sub>2</sub>) into the atmosphere from fossil fuels, and added more from felling forests. CO<sub>2</sub> concentrations have increased by more than a third to about 380 ppm and their build-up is accelerating.

These two maps show where the greatest emissions come from. The United States of America and China vie to be the country responsible for the most (Map 1). Indonesia and Brazil head the league table for the greatest emissions due to changes in land use – overwhelmingly deforestation – which now contributes about a fifth of the total worldwide.

But this tells only part of the story. A fairer yardstick is to look at the amount countries emit in terms of their populations. Map 2 uses a per capita measure to determine each person's carbon footprint, taking account not just of the amount of CO<sub>2</sub> an individual is responsible for in his or her own country, but of what is emitted in the production and transport of goods made abroad but consumed by each person back in their homeland (for example, computers made in India but used in France add to French footprints). This is then expressed as the area of land of average productivity needed to absorb each citizen's CO<sub>2</sub> emissions. The world average is 1.06 hectares per person, but this masks huge differences. The average African's CO<sub>2</sub> emissions require just 0.26 hectares of 'average' land to be absorbed, the average Russian's requires 2.64 and the typical North American's needs 5.66.

Emissions will have to be cut by at least half by 2050 if the world is to have a chance of avoiding dangerous climate change. But those with big footprints will have to cut the most if climate change is to be tackled fairly, or even effectively.

# Titanic

## struggle

If you'd never heard of Leonardo DiCaprio and happened to run across his website, you might think you'd found a conservationist, not one of Hollywood's most celebrated stars. Its front page carries pictures of a coral reef, a rainforest canopy and a gorilla, not flashy clips from his latest blockbuster. Its news queue asks visitors to 'Take action: sign our no plastics pledge'. And a line of text in the corner quietly announces the international release of a film called *11th Hour*, a feature-length documentary about the ecological devastation caused by global warming.

And actually – though his acting is famous over most of the world – you'd be at least half right. For his environmental activism, like his film stardom, is well over a decade old, even though he is still only 33. He first gained critical acclaim with his portrayal of an autistic boy in 1993's *What's Eating Gilbert Grape?* – a performance that won him his first Oscar nomination at 19. But it was only three years later that he established the Leonardo DiCaprio Foundation to foster awareness of issues like global warming, renewable energy and the preservation of the Earth's biodiversity, long before they became frequent front page news.

Romantic leads in *Romeo + Juliet* (1996) and *Titanic* (1997) established him as a heartthrob and A-list actor, and more recently he's won respect for roles like millionaire Howard Hughes in *The Aviator* (2004) and an African mercenary in *Blood Diamond* (2006), both of which garnered Oscar nominations for Best Actor. But in between he has continued his green campaigning. He chaired the US Earth Day celebration in 2000 and interviewed President Clinton on primetime television

about his policies and how US citizens and companies might be encouraged to adopt greener ways.

'Enough is enough,' he said in his Earth Day speech. 'We must move environmentalism from being the philosophy of a passionate minority to a way of life that automatically integrates ecology into governmental policy and normal living standards. We are entering an environmental age whether we like it or not.'

Next he pioneered the increasing trend for Hollywood stars to drive Prius hybrid cars – and helped greatly to raise the car's profile – buying it not just for himself, but for several members of his family. 'We have the technology to make every car produced in America today just as clean, cheap and efficient,' he said.

It all began by watching television; it was through the small screen that he first experienced Earth's beauty and fragility while growing up in urban Los Angeles. 'From a young age I would watch documentaries about rainforests in Brazil,' he says. 'As I grew up, I learned more and more about the human impact on our planet, and wanted to do something about it.'

He made *11th Hour* – which he produced, co-wrote and narrated – to try to move environmental thinking into the mainstream. It is his third environmental documentary, preceded by two short films for a web audience: *Global Warming* in 2001 and *Water Planet* in 2004, both still available on his site. To his surprise, requests poured in to use the films in schools around the world.

*11th Hour* takes a more cinematic approach to environmental issues than Al Gore's movie, *Inconvenient*





*Truth*, illustrating its points with dramatic footage of Earth's natural wonders, floods and hurricanes, heavy industry and so on. Its pace is fast and the soundtrack features such bands as Sigur Rós and Coldplay. But its core consists of interviews with more than 50 leading experts including physicist Stephen Hawking, Nobel Peace Prizewinner Wangari Maathai, former President of the Soviet Union Mikhail Gorbachev and broadcaster David Suzuki. They offer insights into the history of humanity's relationship to Earth, the state of the oceans, land and air, and the political, social and technological challenges – as well as hopes – that lie ahead.

The message is that we now know that seeing the environment as a limitless resource is misguided, and this mindset must change if we are, ultimately, to survive. The film emphasizes that 54,000 species a year are becoming extinct because of Earth's collapsing ecosystems, and warns that *Homo sapiens* – that's us – is also an endangered species. It is humanity's 11th hour, not the Earth's; the planet will continue to exist whatever we do to it.

A campaign, 11th Hour Action, aims to 'engage and activate youth in taking leadership in the sustainability movement'. DiCaprio says: 'In the United States we are the ones who should be setting an example. We are one of the largest democracies in the world – and also the largest polluter. If we don't take any action then how can anyone else be expected to?'

He is now producing a television show, *Eco-Town* – which follows a tornado-devastated Kansas town as it rebuilds itself as a 'model of green living' – in between acting in the seven feature films he has lined up for the next two years. And his online sites continue to serve as a resource for action and education, including a new YouTube channel, linked to the documentary, that invites citizens to share videos about what they're doing to help the Earth.

'We need to get kids young,' says DiCaprio. 'That's where it started with me. What's exciting is that this generation gets to completely change the world.'

# Anatomy of a climate change campaign

**C**limate change is the most urgent issue of my generation. That's why my peers and I want to learn as much as possible about the environment. Education is key to informing, exciting and inspiring others to action.

Towards the end of 2007, four friends and I decided to carry out an ambitious two-year nationwide climate change campaign starting in 2008. This might sound daunting, but we are all active members of Fältbiologerna (Nature and Youth Sweden) – the biggest Swedish youth-run voluntary organization for nature studies and environmental protection. Founded in 1947, it today has 2,000 members aged 7 to 25 from all over the country.

In March 2008, the 30 Fältbiologerna members who volunteered to run this campaign travelled by train to Malmö to attend a weekend-long planning meeting. Actually, while organizing the campaign was the meeting's ultimate goal, first on the agenda was getting a clear understanding of climate change – because without real knowledge, we won't succeed.

A researcher from our local university talked to us about the facts and myths of climate change, the science, and possible solutions. Afterwards we pooled our collective knowledge with a mapping exercise, writing down problems and solutions on a big sheet of paper. With the central problem being 'climate change', and 'cause X' being 'CO<sub>2</sub> emissions', we listed the various sources for 'cause X', such as 'burning fossil fuels' and 'deforestation'. And then we worked our way backwards: why do we need fossil fuels? For vehicles, heat, and so on, until ultimately we hit causes like consumption, lifestyle, values and attitudes.

It might sound simplistic, but this useful tool helps figure out realistic ways of helping to slow climate change. The next step was to think up strategies based on what we'd mapped – action plans that can run the gamut from petitioning city councillors to invest money in cycling infrastructure to running a neighbourhood cycling campaign.

On the final day, we synthesized all this information to brainstorm ideas for our campaign, as well as discuss practicalities such as who would lead which activity, funding, and scheduling. Here are some ideas we came up with:

**Balloon action:** We'll ask people to blow up a balloon with the CO<sub>2</sub> from their lungs and write a message on it, to deliver to the government. Examples of messages could be: 'Close down domestic airlines', 'Research renewable energy', etc.

**Bike tournament:** Organize a cycling group to ride from city to city in Sweden over two summer weeks, performing plays and singing songs about lowering CO<sub>2</sub> by using alternative transport.

**Climate-friendly food:** Encouraging school cafeterias and restaurants to serve locally produced, vegetarian food.

There are many more, of course. But will our campaign influence the way people think and act in daily life? It's hard, but not impossible. The first step is to make sure that everyone understands exactly what the challenge is, then convince individuals that their actions count, even though the problem is so big. Our campaign will try to demonstrate that everyone can contribute something – that it's possible to achieve real change when all sectors of society act together. And we'll try to get this across in an interesting and entertaining way, showing people that helping the planet can be positive, fun and desirable!

Sara Svensson is on the Tunza Youth Advisory Council representing Europe.

# Low-carbon chic

## terra grass chair



Lawn furniture with a difference. The cardboard chair is assembled and filled with soil and seeds, to grow its own cool, comfortable upholstery. It's biodegradable, will last as long as it's maintained (like any lawn) and even absorbs CO<sub>2</sub>.

[www.lazyboneuk.com](http://www.lazyboneuk.com)

## the worm condo



Sharing your kitchen with 20,000 worms may have no immediate appeal, but they live in a compact container, don't smell, and turn your kitchen scraps into valuable fertilizer. While they are at it, they combat climate change because they cut down on emissions of CO<sub>2</sub> from lorries transporting waste from your home and fertilizer to your door, and reduce pollution by methane, an even more potent greenhouse gas, emitted as the food rots.

[www.composters.com](http://www.composters.com)

## the trikke



It rocks to roll. Propelled by its rider's rocking motion, it can reach 30 kilometres per hour, climbs kerbs, folds for easy commuting and can even go uphill.

[www.trikkestore.no](http://www.trikkestore.no)



## wind-up watch

Old-time timekeeping. A browse in a second hand or junk shop – or in the attic – might just yield a truly retro watch. No batteries to replace and create unnecessary rubbish. Chic, and keeps good time, too.

## leather bag



On the outside, it's made of recycled leather belts. On the inside, it's lined with recycled silk ties. And with care, you might be able to pass it on to your kids. Truly the epitome of eco-chic.

[www.ecocentric.co.uk](http://www.ecocentric.co.uk)

## the velomobile



The healthiness of a bicycle meets the shelter of a car, and you get to lie down as you pedal. The velomobile recumbent bicycle fully encloses the rider in a pod of fibreglass or other material, whizzes around at up to 48 kilometres per hour on flat terrain, and is becoming increasingly popular in Europe and North America.

[www.leiba.de](http://www.leiba.de)

## the XO laptop



Children in Brazil, India, Nigeria, Peru, Thailand and Uruguay are now getting this green low-energy laptop which includes a web browser, a word processor, and music and art programmes and games. It can be recharged with a variety of contraptions, including a solar panel, hand-crank, foot-pedal and pull-string, as well as a regular plug-in adaptor.

[fuseproject/www.laptopgiving.org](http://fuseproject/www.laptopgiving.org)

It's becoming smart to be sustainable, cool to be carbon-neutral. And it's becoming easier too. More and more environmentally friendly products are hitting the market, as producers and consumers become increasingly concerned about climate change.

Goods ranging from wastepaper baskets made of recycled newspaper to sofas made of plastic bottles, from low-energy kettles to water-saving showers, from toxics-free computers to electric toys without batteries, are increasingly cropping up in stores and homes. And so are smarter, quirkier sustainable goods, demonstrating that kicking the carbon habit does not have to be sad. Here are a few among many that make it possible to be both chic and cheerful about doing something for the planet.



## solar grill

Barbecues without smoke or charring. The curved sheet of metal concentrates the sun's light onto the food, heating it evenly on all sides. Nothing burns, and you don't even have to flip the burger!

[www.tammock.ch](http://www.tammock.ch)

## self-sufficient am/fm radio



This covers all the energy bases with a solar panel, a hand-crank that provides at least an hour of listening with a minute of winding, and a mains adaptor when all else fails. All this, and an LED flashlight too.

[Freeplay Energy PLC/www.freeplayenergy.com](http://Freeplay Energy PLC/www.freeplayenergy.com)

## cyclotron guitar

It strikes a right-on righteous chord, made from sustainable maple and recycled plastics.

[www.simonleeguitars.com](http://www.simonleeguitars.com)



## dutch cargo trikes



'Rickshaw' comes from *jinrikisha*, Japanese for human-powered vehicle. A traditional form of non-polluting transport in Asia, bicycle rickshaws have now turned up in some Western cities. And a variation in the Netherlands is doing some of the jobs of family car. The tricycle has a large, sturdy box tucked between the wheels, used to haul everything from groceries and packages to several children strapped into its specially designed seats.

[www.bakfiets.nl](http://www.bakfiets.nl)

## the eco-media player



Cranked, but not cranky, the multi-tasking media player was invented by Trevor Bayliss, the guy who came up with the wind-up radio. It plays movies, FM radio and MP3s, stores and displays photos, stores files, recharges your mobile phone and even records sound. And just a minute of winding gives 40 minutes of audio play.

[www.ecocentric.co.uk](http://www.ecocentric.co.uk)

## tara tiny electric car



Now being produced, the Indian four-seater electric car has a top speed of 69 kilometres per hour and costs just \$2,500. It produces no exhaust fumes, and is truly green if recharged using power generated from renewable sources.

[Tara International](http://Tara International)

## solar rucksack



Made from recycled plastic bottles, it provides energy while you are being energetic. Its 200-gram built-in solar panel charges most small electronic devices – like cameras, mobile phones or MP3 players – in two to four hours.

[www.esc-outdoor.co.uk](http://www.esc-outdoor.co.uk)

## the eco-sneaker



Eco-sneakers lower the footprint of footwear with organic cotton uppers and soles made from 100 per cent recycled rubber tyres, which avoids burning the tyres and releasing CO<sub>2</sub> and dioxins, or dumping them in piles, which often catch fire.

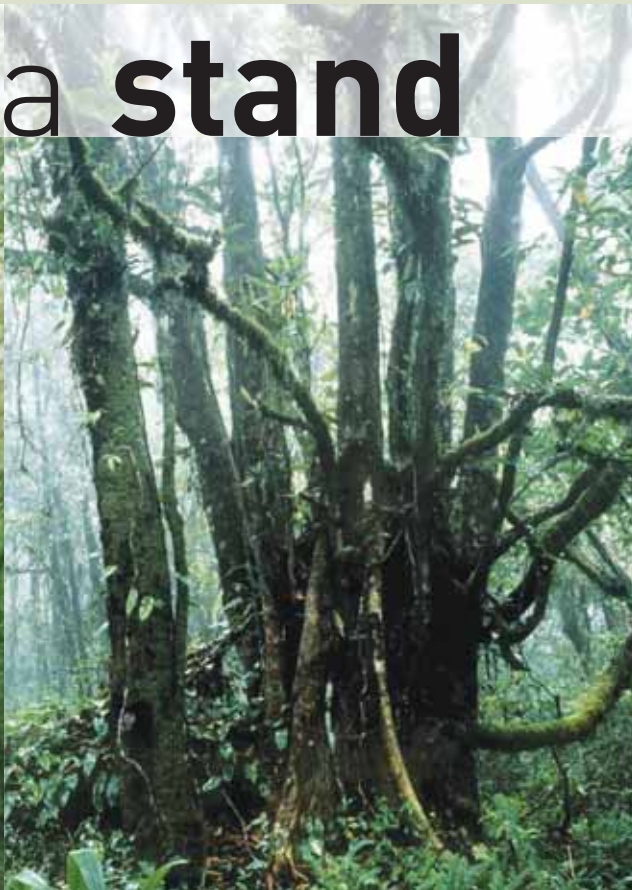
[www.planetshoes.com](http://www.planetshoes.com)



# Making a stand



J. Sencoski/UNEP/Topham



B. Buranabunpot/UNEP/Topham



**L**ITTLE REMAINS of the Earth's original undisturbed forest. About half has been felled altogether, and of the half that is left, only a fifth has not been altered by people.

This matters to the climate because cutting down trees is the second biggest cause of increasing carbon dioxide in the atmosphere after the burning of fossil fuels: it is responsible for about a fifth of humanity's emissions. Trees absorb and store enormous amounts of carbon from the air, and felling them does not just stop them from doing this crucial job. Whenever forests are disturbed – whether by natural fires or by clearing land for timber, agriculture or building roads – they release their stored carbon into the atmosphere.

Forests also host much of the planet's biodiversity, purify air, trap and release rainwater, stabilize soil and provide livelihoods for billions of people. And that's not to mention valuable products like food, rubber, timber and medicines.

## A LONG HISTORY

Deforestation has been going on for a long time, first denuding what are now the developed countries of the world. Ninety-five per cent of the forests that covered the United States of America have been cut down since the first European settlers arrived; outside the Russian Federation, only 1 per cent of Europe's original forest remains; and countries as widely dispersed as China, Haiti, Afghanistan and Nigeria have similarly lost much of what they had.

## ONGOING LOSS

What is left is falling fast. Over 92,000 hectares of Canada's temperate and boreal forests are being felled each year, as are 2 million hectares of the forests of the Russian Federation, which hold almost half of the northern hemisphere's terrestrial carbon. And the Food and Agricultural Organization of the United Nations estimates that 13 million hectares of the planet's tropical rainforests are being lost annually too, contributing two thirds of the CO<sub>2</sub> emitted by all deforestation.

## MULTIPLE CAUSES

There are many causes of this destruction, including agriculture, timber, oil extraction, the building of hydroelectric dams and mining, and associated roads and infrastructure. As the world eats more and more meat, some 70 per cent of the deforested area of the Amazon is now used for cattle ranching, and much of the rest is due to crops – especially soya – grown for animal feed.

The world's second largest rainforest – in the Congo Basin – like others is logged for its valuable hardwoods, which also opens it up for agriculture and for hunting wild animals for bushmeat. And vast amounts of forest in Southeast Asia are being cleared to cultivate oil palm, whose fruit yields a cheap vegetable oil used widely in foods such as cakes, potato crisps and margarines, and a host of other products including soaps, cosmetics and printing ink.





A. Bieber/UNEP/Topham



R.A. McLaughlin/UNEP/Topham



K. Schultz/UNEP/Topham

### THE BIOFUEL PROBLEM

The rush to produce biofuels – ironically to replace oil, and so combat climate change – is making things worse because oil palms are the most efficient and cost-effective source. As demand grows, cultivators have also been felling peat swamp forests – trees growing on deep layers of dead vegetation too wet to decompose. Southeast Asia’s peat lands are thought to contain up to 21 per cent of global land-based carbon stores, and cutting down their trees sets off a whole chain of activities that release it. The logging emits CO<sub>2</sub>, as do draining and burning the land to clear it and the wildfires that take hold of the dry peat. Indonesia is estimated to emit 6.5 times as much CO<sub>2</sub> from degraded peat swamps as it does from burning fossil fuels, making it one of the world’s largest emitters.

Yet, as environmentalists have long argued, forests are more valuable standing than cut down. The World Bank has estimated that tropical forests are worth five times as much intact as felled. And the services provided by Canada’s boreal forests – like storing carbon and filtering water – are calculated to be worth about 2.5 times as much as all its forestry, hydroelectricity, mining and fossil-fuel extraction combined.

### RECENT PROGRESS

Governments have been slow to reach international agreement on reducing deforestation so as to save the climate. The biggest breakthrough so far came in December 2007 during negotiations in Bali over the future of the

Kyoto Protocol. Developing countries clearly signalled that they were ready to take action, and the delegates agreed that they should be compensated for the income they lose through deciding not to fell forests.

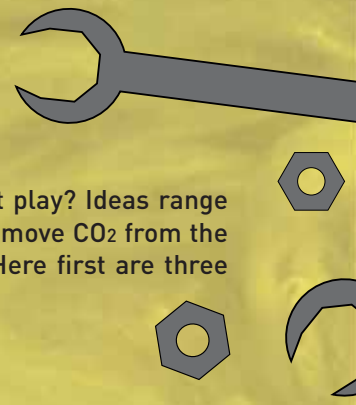
This groundbreaking plan for ‘reducing emissions from deforestation and forest degradation in developing countries’ (REDD, for short) – originally put forward by Costa Rica and Papua New Guinea – grants standing forests an economic value. It could make a big difference. It could increase developing countries’ contribution to combatting climate change, make it possible to agree more ambitious worldwide targets for cutting CO<sub>2</sub> emissions and lower the cost of meeting them, and buy time for developing the technology to combat climate change.

### UNRESOLVED ISSUES

Many questions remain – over, for example, how the scheme will be enforced and financed – and nations are only now working out the details and designing the precise mechanisms that will be used. There is also concern that the scheme may take the heat off the overriding need for developed countries to reduce their own CO<sub>2</sub> emissions from burning fossil fuels or, indeed, their demand for timber and other products from felled forests. It will all take time to work out, but at least the world is finally beginning to accord forests the economic and environmental value they deserve and starting to tackle deforestation’s big contribution to global warming.

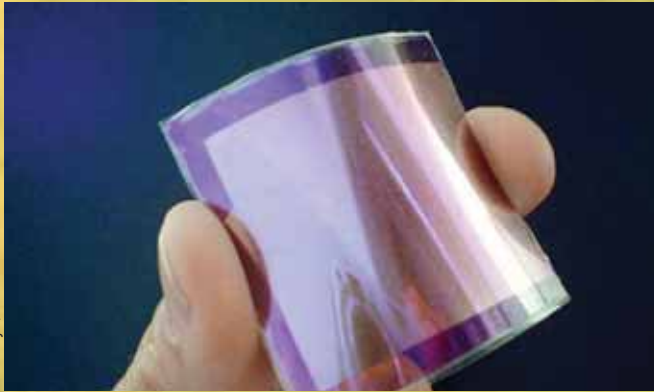


# Techno-genius...



Technology will be needed to help the world kick the carbon habit. But how big a role will it play? Ideas range from improvements in renewable energy and energy saving to giant schemes to physically remove CO<sub>2</sub> from the atmosphere. Some seem wholly beneficial, others appear to have dangerous side-effects. Here first are three ideas being developed for improving existing technologies.

## Sunny ink



Nanosys/handout

The sun may provide its energy for free, but solar cells are still a relatively expensive way of generating electricity because they cost a lot to make. Now a Californian company says it has made a breakthrough that will make clean solar power as cheap as electricity generated from highly polluting coal.

Late last year, Nanosolar – based in Palo Alto near San Francisco – started producing and exporting its revolutionary solar panels. Wafer-thin, flexible and light, they have been made possible by developing a special photovoltaic ink printed on a thin aluminium sheet. Nanosolar is now planning to build factories in California and Germany and rapidly to become one of the biggest solar manufacturers in the world.

Sceptics doubt that the planned low cost can be quickly achieved, but there are plenty of investors backing the firm, including Larry Page and Sergei Brin, the founders of Google, which wants to make renewable energies cheaper than coal.

## Concrete results



www.geopolymer.org

Concrete, the world's commonest building material, is responsible for a massive 8 per cent of the planet's emissions of CO<sub>2</sub>. It uses Portland cement, which is made by heating

limestone and other materials to over 1,400°C, producing half a tonne of CO<sub>2</sub> per tonne of cement – not counting a further third of a tonne from burning fuel to heat the kilns and to transport the raw materials.

Geopolymer concrete, developed as a fire-retardant in passenger ships and Formula 1 cars, could change that. It is made by combining alkali with silicates (containing silicon and oxygen) and aluminates (containing aluminium and oxygen), both of which can be recycled from industrial wastes, to cause a chemical reaction called polymerization, which binds molecules without giving off CO<sub>2</sub>.

It is already proving useful in applications from garden patios to motorway sound barriers. As a new material, we can't be sure how well it will hold up when under pressure for decades, though it performs well in short-term durability tests.

## Slimy science



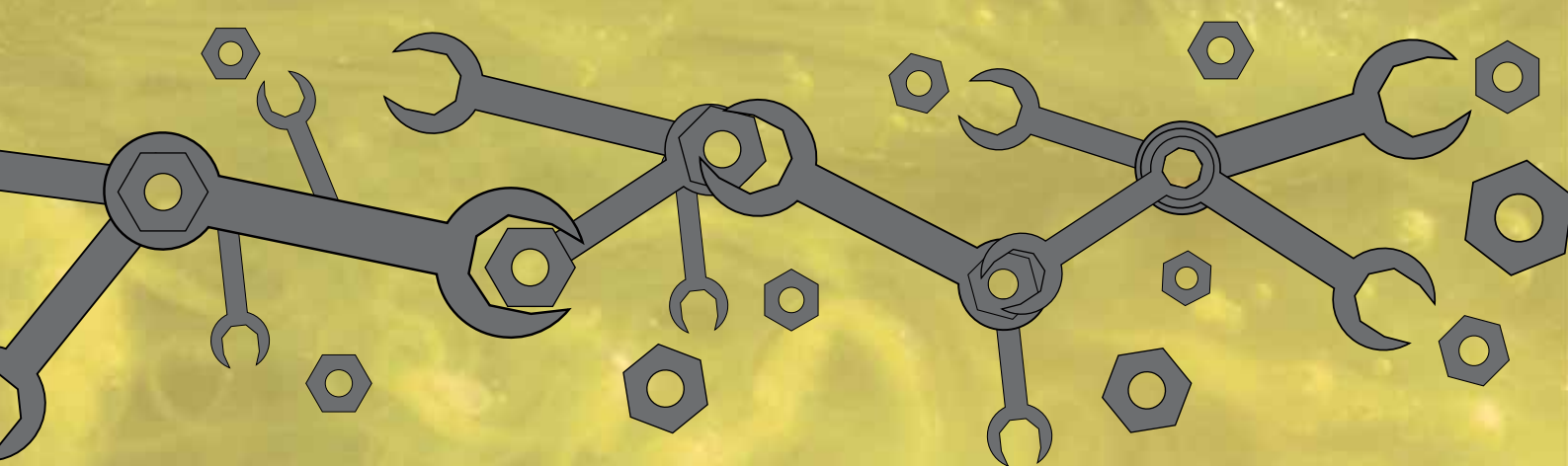
lovelydead/Flickr

Isaac Berzin is really a rocket scientist, but he has had a straightforward idea – to turn the pollution from power stations into a biofuel. The Massachusetts Institute of Technology professor's technology bubbles the gases through clear tanks containing a particularly oil-rich, fast-growing type of algae in water. The algae gobble them up and grow, and are harvested daily and processed to extract the oil for conversion to biodiesel. The leftovers can be used to produce ethanol for more biofuel or used to feed livestock.

Trials have shown that the technology works, and it could produce biofuel from 33 times less land than oilseed rape. The technique removes about 40 per cent of the CO<sub>2</sub> from the emissions, together with 86 per cent of the nitrous oxides.

Burning the biofuel, of course, releases these gases again. So this is not, strictly speaking, a clean-up technology, but a way of more efficiently reducing emissions by reusing the carbon and reducing the use of fossil fuels. It is not a substitute for trapping the carbon and keeping it out of the atmosphere, through carbon capture and storage.





As levels of CO<sub>2</sub> mount in the atmosphere, and climate change occurs faster than expected, some scientists say that whatever is done will be too little, too late, unless humanity actually starts removing CO<sub>2</sub> from the atmosphere. Critics object that ambitious schemes proposed for doing this pose their own dangers to the planet and could distract from the need to kick the carbon habit by reducing emissions. Here are four of the most prominent proposals.

## Synthetic trees

Peter Read, a New Zealand academic, has been proposing for years that plants and trees should be used to clean CO<sub>2</sub> from the atmosphere. They, of course, absorb the gas as they grow. They could then be harvested, turned into biofuels, and burned cleanly in power stations with carbon capture and storage – thus taking the pollutant from the air and tucking it safely away.

Klaus Lackner of Columbia University has gone further, developing synthetic trees which could be thousands of times more efficient. They use absorbent coatings on slats to filter and capture the gas from the air and release it as a pure stream of CO<sub>2</sub>, which can then be stored away. He is working on a device that could absorb nearly 90,000 tonnes annually and, if deployed widely, could thus have a dramatic effect.

The approach offers a way of tackling the vast amounts of carbon emitted from car exhausts and other small sources, to which carbon capture and storage devices cannot be fitted. And, since the excess CO<sub>2</sub> spreads all over the globe, it can be removed from the atmosphere wherever the gas is going to be stored.

Critics say that it may take so much energy to build and operate the synthetic trees that more CO<sub>2</sub> would be released than saved. And of course places must be found to put all the captured gas safely.

## Seeding the seas

In some parts of the oceans the growth of plankton is hindered by a lack of iron in the water. Seeding it with more, experiments have shown, will cause them to grow more, absorbing carbon. Some scientists, and companies, want to do this, arguing that the plankton will carry the carbon safely down to the bottom of the oceans when they die.

Top marine scientists think it is a bad idea. They say it may well not work, that the carbon may not sink down, or stay there if it does. They say it could add to an alarming process by which the oceans are becoming steadily more acid as they absorb carbon from the air. And they fear that it is likely to endanger other ocean life.

## Tubular wells

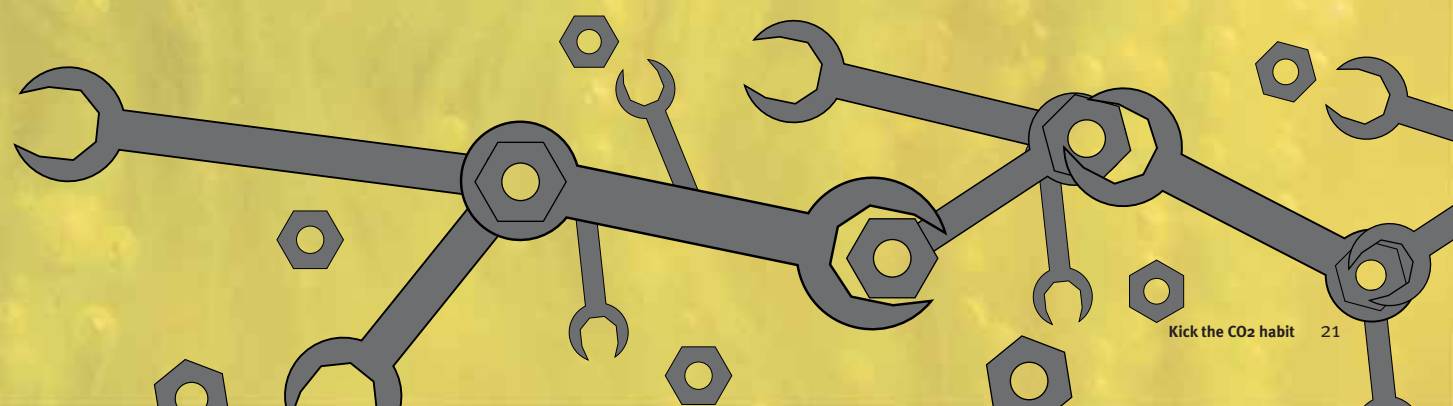
Controversial scientist James Lovelock, the inventor of the Gaia theory, and Chris Rapley, Director of London's Science Museum, have thought up a more sophisticated way of fertilizing plankton. They suggest putting tens of thousands of 100-metre-long pipes in the seas. Wave action and one-way valves in the pipes would cause deep water, rich in nutrients, to well up to the surface, nourishing the plankton.

At least one company is working on the idea. But much the same objections apply as to the iron seeding, with an added complication: the deeper water is also rich in CO<sub>2</sub>, so bringing it up might make things worse.

## Home-made volcano

Yet another, totally different, approach is to try to cut the amount of the sun's energy that reaches the Earth. The most advocated plan – supported by Nobel Prizewinner Paul Crutzen, among others – is to put light-reflecting particles like sulphates into the atmosphere to mimic the aftermath of major volcanic eruptions, which have cooled the Earth.

This however does nothing to reduce levels of CO<sub>2</sub>, so the acidification of the oceans would continue. And dust released by volcanic eruptions has played havoc with rainfall patterns, causing floods and droughts.



# 7 wonders

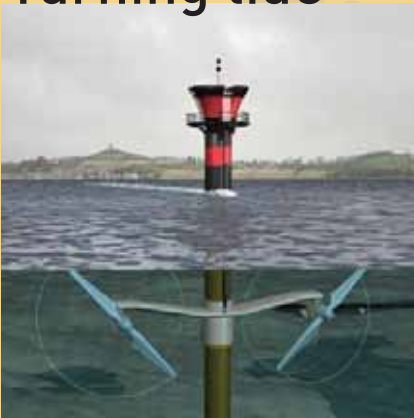
Steam, by the custom of the sea, traditionally gives way to sail – and now something of the sort is happening for real as the cost of fuel rises and measures to combat global warming increase. The 10,000-tonne cargo ship *MS Beluga SkySails* – which harnesses wind power with a giant kite – completed its maiden voyage from Bremen, Germany, to Venezuela, the United States of America and Norway, in March. The 160-square-metre ‘skysail’, controlled by computers, flies up to 300 metres above sea level, capturing the steadier, stronger winds there. It provides 35 per cent of the ship’s power, with a traditional engine doing the rest, and larger kites are being developed to haul much bigger vessels. At present, shipping, which transports 90 per cent of world trade, is responsible for twice the emissions of aviation, and is set to grow by 75 per cent in the next two decades.



[www.skysails.info](http://www.skysails.info)

## Sails force

## Turning tide



SeaGen Courtesy Marine Current Turbines Ltd

It looks like an upside-down windmill, and it could herald a new age of reliable renewable energy. In April the world’s first-ever turbine designed to wrest energy from tidal currents, SeaGen, was installed in Strangford Lough, Northern Ireland. Unlike existing tidal power plants – which impound the rising tide behind a dam, letting the water out through turbines, the 40-metre-long SeaGen sits in the currents, allowing them to turn its underwater sails, with far less impact on landscape and wildlife. Developed by Peter Fraenkel, a British renewable energy pioneer – from a technology he first tried out to pump water on the Nile – the first turbine will produce enough electricity to power 1,140 homes. If all goes well the next step will be to build a ‘tidal farm’ of seven such devices off the coast of Anglesea in Wales, and there are plans for another installation in Canada.

## Magic carpets

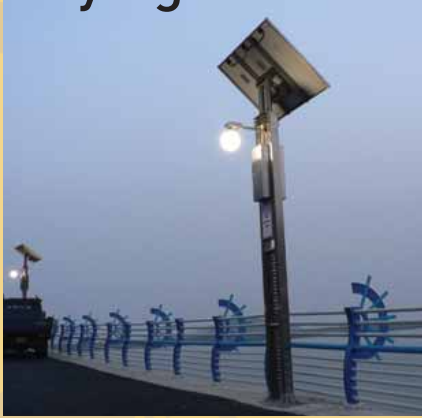
‘You’re a dreamer,’ a fellow CEO told Ray Anderson, the founder and chairman of Interface Inc – the world’s leading carpet tile manufacturer – 14 years ago when he announced plans to make it ‘the first industrial company that, by its deeds, shows the entire industrial world what sustainability is’. Yet since 1996 the formerly petrol-intensive company has reduced its emissions of greenhouse gases by 88 per cent while increasing its sales by two thirds and doubling its earnings, and saving \$372 million by cutting out waste. Anderson insists that the thrust for sustainability is at the heart of the company’s success, and says it might not have survived a recent recession without it. But Interface has not finished. It aims to get all its energy from renewable sources, and for all its raw materials to be renewable, recycled or bio-based by 2020.



[www.thesamplecentre.com](http://www.thesamplecentre.com)



## City lights



Lightron Lighting & Advancement

Even after the sun goes down, it is still lighting streets. Solar street lights – using LED bulbs, which will last for up to 20 years – are being installed in India, Iraq and Nigeria, among other countries. They need little maintenance and do not depend on the expensive infrastructure of an electrical grid. Photovoltaic solar panels on top of the lights absorb energy from the sun, and battery packs store it for later use. When the sun goes down an automatic sensor turns the light on and the streets are lit for the evening; just five hours of sunshine can keep them shining for 12. LED lighting, which is generated from energy-efficient crystals on a superconductor chip, also uses up to 40 per cent less energy than current street lights, but gives twice as much visibility from side to side and eliminates pools of darkness, making the streets safer.

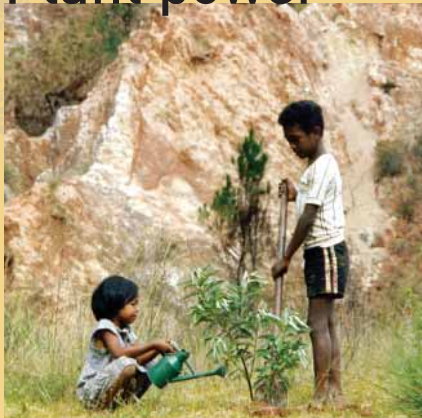
## Race to zero

Four countries from three continents – New Zealand, Norway, Iceland and Costa Rica – are racing to be the first to achieve national carbon neutrality. All have signed up to UNEP's new Climate Neutral Network. Iceland gets 99 per cent of its electricity from geothermal and hydroelectric power, heats only 1 per cent of its homes with fossil fuels, and is now tackling its cars and fishing fleet. New Zealand – on the initiative of its Prime Minister, Helen Clark – aims to generate 90 per cent of its electricity from renewable sources by 2025, up from the present 70 per cent, and to halve its transport emissions by 2040. Norway is aiming to be carbon neutral by 2030. But the most ambitious target of all has been set by Costa Rica – the only developing country of the four – which plans to reach the goal by 2021, its 200th anniversary of independence.



Paul Gipe/Still Pictures

## Plant power

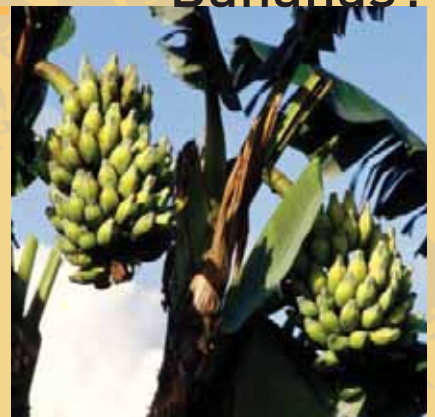


R. Jules/UNEP/Topham

A slight sapling somewhere in the world – most probably a young pencil cedar or African olive tree in Ethiopia – stands as an extraordinary symbol of hope and achievement. It is the billionth tree to have been put in the ground worldwide within a year, since UNEP announced in November 2006 – to some scepticism – that it aimed to catalyse the planting of that number in 12 months. Indeed the target has been well exceeded, with more than 1.9 billion now planted and over another 1.5 billion pledged. Ethiopia – whose famines of the 1980s were partly caused by soil erosion following deforestation – alone counts for more than 700 million. Mexico has planted more than 200 million, Turkey 150 million, and Kenya and Cuba around 100 million. UNEP's Billion Tree Campaign – inspired by Nobel Peace Prizewinner Wangari Maathai – reckons that about half have been planted in small numbers by households or individual people.

Not everyone grows bananas in the heart of the Rocky Mountains, where temperatures fall to  $-44^{\circ}\text{C}$ . But Amory Lovins recently harvested his 28th successive crop at his office more than 2,200 metres up Mount Snowmass, and without burning a gram of fossil fuel. One of the world's earliest, and foremost, renewable energy advocates, he practices what he preaches, using solar power. Lovins – who cofounded the Rocky Mountain Institute in the early 1980s as a 'think-and-do' tank to devise low-energy alternatives – has had a worldwide impact. He has advised 18 heads of state, been named one of the most powerful figures in the car industry after inventing a lightweight hybrid that could cross the United States on a single tank of petrol, and has shown Wal-Mart how to halve its emissions from its massive truck fleet by 2015, saving 690,000 tonnes of CO<sub>2</sub> emissions a year.

## Bananas?



Shahidul Alam/Majority World/Still Pictures



# CO<sub>2</sub>



## Kick the habit!

