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Conservation

Climate change

Sustainability

# Green game-changers

50 innovations to inspire business transformation

## TRANSFORMING BUSINESS FOR GOOD

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WWF is convinced that the business community offers one of the most effective routes to finding sustainable solutions to the world's pressing environmental challenges.

The credit crunch was a stark reminder that living beyond our means leads to unsustainable debt. But there's the ecological crunch too – the use of more natural capital than we can afford. The implications of this are becoming more evident. Through our work with business, we seek to bring sustainability to both the ecological and economic systems.

There's much to gain for everyone in the pursuit of sustainable business solutions. We encourage innovation within the business community, smarter regulation from government and better informed consumers and investors. We're optimistic that these endeavours will help us all flourish within the ecological limits of the planet as we work towards a future in which people and nature thrive.

For further information visit: [wwf.org.uk/business](http://wwf.org.uk/business)



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## 50 INNOVATIONS IN WWF'S 50TH

Think big, think differently and think innovatively to deal with today's economic and ecological challenges! We bring you 50 Green game-changers during WWF's 50th anniversary in support of new business approaches.



*"While business leaders grapple with ways to transform their business to cope with current global challenges, new green business models, services and alliances are emerging in pockets around the globe."*

Dax Lovegrove,  
Head of business and  
industry relations,  
WWF-UK

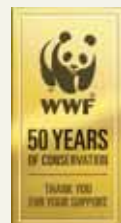
A tough financial climate remains for every business, and all eyes are on world leaders' efforts to restore economic stability. However, many CEOs also recognise that long-term commercial success requires ecological stability too. And that economic growth which further depletes natural capital is ultimately not good for business.

For example, Sky's CEO Jeremy Darroch explains: "If you simply chase growth for the sake of it, without thinking of the broader impacts that brings, then ultimately, that is not going to be sustainable." Paul Polman, CEO of Unilever, echoes this: "We need to grow responsibly, we need to grow differently. The exciting thing about our Sustainable Living Plan is that we aim to double our turnover in such a way that we reduce our overall environmental footprint."

Business and environmental risk management are increasingly converging, as companies recognise the need for radical change in the way business is done. Ian Cheshire, CEO of Kingfisher, notes: "It is our business transformation plan over the next 10 years to fundamentally lower our impact."

Further views of this nature are captured at [wwf.org.uk/talkingtransformations](http://wwf.org.uk/talkingtransformations). They suggest that while we're not yet at a tipping point, the more enlightened business leaders have reached a turning point in thinking differently.

While business leaders grapple with ways to transform their business in order to cope with current global challenges, new green business models, services and alliances are emerging in pockets around the globe.



In this report, we present new innovations and the lessons that can be taken from them. They demonstrate practices that could be scaled up across the private sector, and could lead to benefits in four critical areas:



WE INVITE YOU  
TO SUBMIT CASE  
STUDIES OF YOUR  
OWN TO HELP US  
BUILD OUR  
BANK OF GREEN  
GAME-CHANGING  
STORIES

1. **Dematerialisation** – business products, services or processes that dramatically cut the use of natural resources.
2. **Restorative** – innovations that relate to net positive environmental impacts and the restoration of biodiversity, forests, fresh water systems and marine environments.
3. **Open loop** – where one company’s waste is turned into another’s resource.
4. **Renewable energy and low carbon** – innovations are supportive of a move towards WWF’s call for 100% renewable energy future by 2050.

I hope you enjoy browsing through these Green game-changers. At WWF, we’ll continue to apply what we can from these innovations to our work with business – so we can encourage them to increase the pace at which it makes transformational changes.

Of course, there are many more stories out there of new thinking in action and we want many more submissions from you for our innovation bank – [wwf.org.uk/innovation](http://wwf.org.uk/innovation).

**Dax Lovegrove**  
**Head of business and industry relations, WWF-UK**

## INTRODUCTION

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The purpose of this review is to highlight revolutionary innovations in business models, partnerships, policies, processes and products that can help to accelerate green growth.

Businesses – and the societies in which they operate – face complex, interconnected challenges stemming from unprecedented population levels, increasing consumption, constrained resources and unstable planetary life support systems.

Innovation is an essential driver of economic prosperity and business success, as it creates opportunities for improvements in productivity. But the role of innovation needs to be recast in the context of current challenges – decoupling growth from environmental impacts, funneling investment towards projects that protect and restore ecosystems, and realising new commercial opportunities from emerging markets that embrace the transformational change we need.

In this review we've selected innovative examples of businesses that are working with partners, customers and regulators to reduce the consumption of natural resources, support open loop processes, replenish ecosystems and upscale renewable energy – all with the aim to accelerate the transition to a green economy.

### **Methodology**

The review is based on a market scan including:

- Desktop research, interviews and invitations to submit case studies
- The application of screening criteria (see figure 1)
- Further research to expand on the 50 innovation case studies selected

Each innovation case study contains a definition, details of the innovators, the adopters, the ecological sustainability benefits and commentary on the potential impact if the innovation can be replicated.

Figure 1: Innovation Screening Criteria

KEY QUESTION	CRITERIA	DEFINITION
<b>IS IT RELEVANT?</b>	Genuine environmental sustainability benefits	Does the innovation provide significant benefits across one or more dimensions of environmental sustainability: energy efficiency, the decarbonisation of energy, water-use efficiency, ecosystem health (or services) and pollution?
	Does it focus on the four key areas of environmental benefits?	Dematerialisation – business products, services or processes that dramatically cut the use of natural resource use.
		Restorative – innovations relate to net positive environmental impacts, e.g. the restoration of forests, wetlands, biodiversity and/or watersheds.
		Open Loop – where one company’s waste is turned into another’s resource.
		Renewable energy and low carbon – innovations are supportive of a move towards WWF’s call for 100% renewable energy future by 2050.
	On or close to market	Has it achieved some adoption already, or is it close to reaching the market?
<b>DOES IT HAVE THE POTENTIAL TO BE GAME CHANGING?</b>	Is it scaleable?	The innovation should have the potential to achieve a high level of market adoption.
	Is it lasting?	The innovation should be likely to achieve lasting adoption.
	Is it different?	The innovation should be sufficiently different in nature from existing market offerings.
	Does it have the potential for a high commercial impact?	Does it have the potential to change the competitive landscape (through increased productivity or the introduction of new competitors)?
		Does it have the potential to alter existing markets and create new ones (through the creation of new product categories, or significantly enhanced products that can substitute previous generations of products)?

## SUMMARY

INNOVATION	GEOGRAPHIC AREA	INNOVATION TYPE	MAIN INDUSTRY AFFECTED	PAGE
<b>DEMATERIALIZATION</b>				
Zero packaging and waste store	US	Service	Consumer goods, services & healthcare	15
Peer-to-peer lending websites	US	Business model	Consumer goods, services & healthcare	16
Designing consumer products for remanufacturing	EU	Service	Consumer goods, services & healthcare	17
Water conservation reward scheme	Brazil	Partnership	Financials	18
Drip-irrigation technology for the 'bottom of the pyramid'	India	Product	Food & Beverage	20
Fungal building insulation	US	Product	Construction & building management	21
Customer water conservation partnership	EU	Partnership	Construction & building management	22
Chemical leasing	EU	Business model	Industrial cleaning	23
Fashion exchange	Australia	Business model	Consumer goods, services & healthcare	24
<b>RESTORATIVE AIMS</b>				
'Benefit corporation' laws: a legal framework for hybrid business	US	Policy	All	29
Biorock coral reef restoration	US	Product	Travel & Leisure	30
Costa Rican 'Payments For Ecosystem Services' programme	Costa Rica	Policy	Financials	32



INNOVATION	GEOGRAPHIC AREA	INNOVATION TYPE	MAIN INDUSTRY AFFECTED	PAGE
Wastewater treatment wetlands	US	Service	Utilities	34
Financing system for sustainable watershed management	Ecuador	Policy	Utilities	35
Rwanda: Balancing ecosystem restoration and economic development	US	Service	Financials	36
Global Alliance for Banking on Values	US	Service	Financials	38
Biochar	US	Business model	Food & Beverage	39
Evergreen agriculture	Africa	Service	Food & Beverage	40
Capturing water using renewable energy	EU	Product	Utilities	41
<b>OPEN LOOP</b>				
Industrial symbiosis network from Chinese industrial zone	India	Product	Consumer goods, services & healthcare	45
Upcycled clothes and accessories	China	Partnership	Industrials	46
Industrial symbiosis web platform	EU	Product	Fuels, chemicals & basic resources	48
Polyloom woven products from waste plastic	India	Business model	Consumer goods, services & healthcare	49
Regulation for producers to recycle waste	South Korea	Policy	Consumer goods, services & healthcare	50
Products designed to be remade	US	Product	Consumer goods, services & healthcare	51

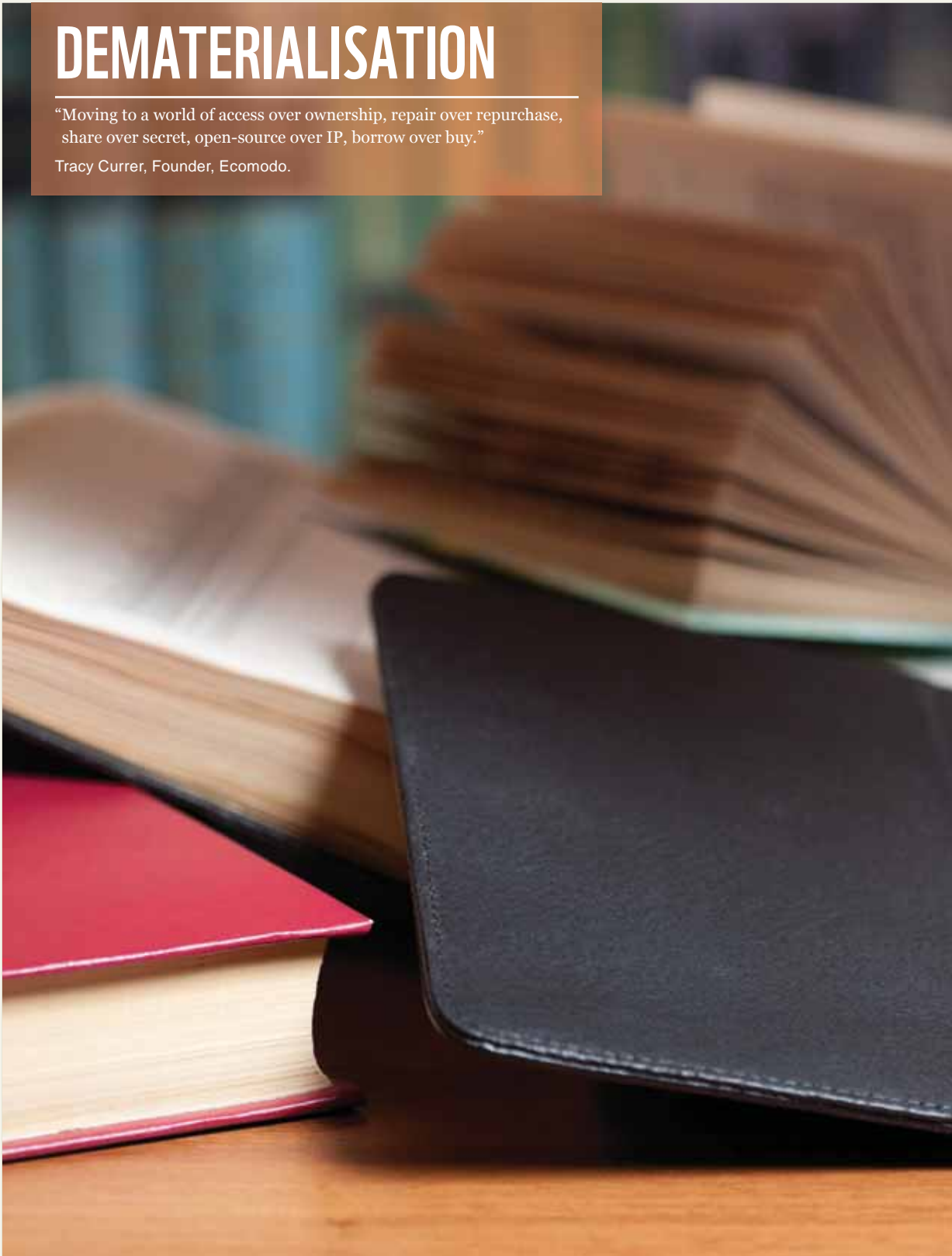
INNOVATION	GEOGRAPHIC AREA	INNOVATION TYPE	MAIN INDUSTRY AFFECTED	PAGE
<b>OPEN LOOP CONTINUED</b>				
Using waste heat to grow tomatoes	EU	Partnership	Agriculture	52
Mining old consumer goods	Brazil	Business model	Industrials	54
Solid waste management models for developing cities	Bangladesh	Business model	Construction & building management	55
Guided busway drainage made from 1.8 million recycled tyres	EU	Partnership	All	56
Open loop water municipal recycling	Singapore	Policy	Utilities	58
Helping waste pickers become entrepreneurs	India	Business model	Utilities	59
Unconventional paper	India	Product	Fuels, chemicals & basic resources	60
<b>RENEWABLE ENERGY AND LOW CARBON</b>				
Ad-funded solar street lights	India	Business model	Consumer goods, services & healthcare	65
Community-owned renewable energy provider	EU	Business model	Utilities	66
Reducing the carbon impacts of what we eat	EU	Service	Consumer goods, services & healthcare	68
Low-carbon real estate user alliance	US	Partnership	Construction & building management	69
China's electric bicycle revolution	China	Product	Transportation/mobility	70
Renewable energy finance schemes for the poor	India	Business model	Utilities	72

INNOVATION	GEOGRAPHIC AREA	INNOVATION TYPE	MAIN INDUSTRY AFFECTED	PAGE
Solar panel group deals for residents	US	Business model	Utilities	73
Solar energy kiosks	EU	Product	Utilities	74
Renewable energy-generating ships	South Korea	Service	Industrials	76
Phone-controlled solar water pump	Kenya	Product	Fuels, chemicals & basic resources	78
Solar thermal and waste heat air-conditioning	China	Product	Utilities	79
100% renewable energy charging for electric vehicles	Australia	Partnership	Utilities	80
Island-wide smart grid	Japan	Partnership	Utilities	82
Renewable energy micro-grids for rural areas	India	Service	Utilities	83
Trans-European low-carbon transport network	EU	Partnership	Utilities	84
Top Runner product standards race	Japan	Policy	Consumer goods, services & healthcare	86
Decoupling revenues from energy supply	US	Policy	Utilities	87
Plant-inspired solar energy	US	Partnership	Telecoms & technology	88

# DEMATERIALIZATION

“Moving to a world of access over ownership, repair over repurchase, share over secret, open-source over IP, borrow over buy.”

Tracy Curren, Founder, Ecomodo.





# Dematerialisation

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The issues around peak oil, peak metals, and peak minerals are increasingly explored. Commodity prices are set to remain high with escalating natural resource scarcity and growing demand from the emerging economies as key contributing factors. Ecological Economist, Pavan Sukhdev is among those who point out that there is not enough metal in the ground to manufacture laptops, televisions and vehicles to meet increasing demand in the East and that our climate couldn't handle it if there were.

From land grabs in Africa to the Arctic, resource-rich and ecologically sensitive regions are under greater pressure. A resource crunch is upon us.

What does this mean for businesses, whose supply chains depend on continual availability of such things? Current resource-efficiency measures are failing to keep up with sheer growth in consumption and the net result remains a requirement for more materials for the supply and demand of goods. It is now time for new disruptive innovations that dematerialise as far as possible, ones that will support companies in becoming less resource-dependent and boost their resilience in these resource-constrained times.

Our increasing access of news, music and literature through information communication technologies in place of printed pages and CDs is an example of service delivery via dematerialised means. Materials chemist, Armin Reller, advises, 'wireless can replace physical things altogether, and for electricity transmission we can replace physical wires with electromagnetic waves, among other things.'

Other examples are taking off through increasing shifts from products to services and emergence of new collaborative consumption models. For many years, ideas of leasing and/or sharing lawnmowers, power drills and clothes in place of current wasteful 'own – rarely use – throw away' models were discussed. Now, these are starting to take off in practice as can be seen in this collection of Green game-changers.

## ZERO-PACKAGING AND WASTE STORE

<b>DESCRIPTION</b>	A food and drink shop where all produce is sold by weight, without packaging. Customers bring in their own containers or compostable containers are available to buy.
<b>WHO ARE THE INNOVATORS?</b>	In.gredients, a store due to open in Austin, Texas in autumn 2011. It will only sell in-season produce. Customers will be able to choose to give some of their purchases to charity.
<b>WHO ARE THE ADOPTERS?</b>	As the store hasn't opened yet, it remains to be seen how customers will respond.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	In many countries packaging waste is sent straight to landfill, wasting raw materials and energy. In.gredients estimate that US landfills take in 700,000 tons of waste every day, and 40% of this is packaging.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Many retailers recognise the need to minimise packaging but none have taken as radical a step as In.gredients – eliminating it all together. If consumers can adapt to the zero-packaging model, and retailers can innovate around potential obstacles such as hygiene, it could be a significant step towards reducing the need for packaging for goods.

## PEER-TO-PEER LENDING WEBSITES

DESCRIPTION	Lending and borrowing goods to neighbours and others via website platforms, helping to reduce the need to buy new goods.
WHO ARE THE INNOVATORS?	US-based start-up company NeighborGoods runs a business model where participants can lend and borrow money and resources within a group. Each group is charged a monthly fee and there are no transaction fees. Ecomodo, Freecycle and Zilok are web platforms that let people loan objects, space and skills to others free of charge.
WHO ARE THE ADOPTERS?	Ecomodo hosts 126 different 'circles' or lending communities across the UK. Groups have signed up to NeighborGoods across the US, with some groups forming in the UK.
WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?	Peer-to-peer lending encourages people to own fewer material goods. They can instead share goods they use infrequently with others in their community.
WHY IS IT POTENTIALLY GAME-CHANGING?	Peer-to-peer lending is one aspect of a wider consumer trend termed 'collaborative consumption' by authors Rachel Botsman and Roo Rogers. Web platforms like Ecomodo and NeighborGoods have the potential to encourage widespread sharing of goods – and to reduce consumption of material goods.



*"NeighborGoods connects people to save money and resources by sharing goods with their friends and neighbours. Our members are sharing over \$3.5 million worth of goods: everything from lawnmowers to power drills to bicycles and video games. By sharing resources, our members are living more sustainably and strengthening relationships in their local communities."*

Micki Kimmel, Founder and CEO, NeighborGoods

*"I've saved \$160. I've helped others save \$210 – and our planet."*

NeighborGoods customer



## DESIGNING CONSUMER PRODUCTS FOR REMANUFACTURING

<b>DESCRIPTION</b>	Consumer products designed to be remanufactured into new products at the end of their initial life-span.
<b>WHO ARE THE INNOVATORS?</b>	Ricoh, an office products firm based in Tokyo, offers a range of 'Greenline' copiers, printers and scanners that have been remanufactured after being used.  Kingfisher, a UK DIY and home improvement retailer, announced in August 2011 that it was developing a drill with recyclable parts that could be returned to the store for remanufacturing.
<b>WHO ARE THE ADOPTERS?</b>	Ricoh sells remanufactured office equipment to businesses and public sector organisations in countries including Germany and the UK.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Ricoh reports that its Greenline office machines produce 40% fewer carbon emissions over their lifetime. Remanufacturing reduces demand for virgin materials and cuts waste.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Remanufacturing products at the end of their life can be a transitional step towards the ideal of an open loop economy, in which products are designed to be returned for remanufacturing or profitably repurposed in a continuous cycle.

## WATER CONSERVATION REWARD SCHEME

DESCRIPTION	Innovative partnership between a brewer, a water utility and retailers in Brazil who have created a bank account that monitors customers' water usage and rewards them when they manage to cut back.
WHO ARE THE INNOVATORS?	On World Water Day in March 2011, South American brewer AmBev launched its Banco CYAN reward scheme in São Paulo as part of its sustainability programme. Partners include water utilities such as Sabesp and CODAU, which provide the customers' water consumption data, and retailers including Submarino, Americanas.com and Blockbuster, which provide the discounts and rewards.
WHO ARE THE ADOPTERS?	Banco CYAN is available to 6.2 million homes registered by Sabesp (Basic Sanitation Company of the State of São Paulo) that means 23.6 million people in 364 cities may be account holders and also to 120,000 homes registered by CODAU.
WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?	Water shortages occur regularly in São Paulo. Water contamination is also a serious issue. Reducing the water consumption of the city's rapidly expanding 18.5 million population is a pressing concern.
WHY IS IT POTENTIALLY GAME-CHANGING?	This innovative approach can be a widely replicable way of encouraging customers to use less water. However, offering customers water-intensive goods as a reward could negate any wider water sustainability benefits. This is part of an integrated approach to water stewardship and the protection of watersheds.



*"When we launched the CYAN Movement in 2010, the goal was to alert society to discuss the importance of the rational consumption of water. With Banco CYAN we hope to encourage the conscientious use of the resource by rewarding those who reduce water use."*

*"Since the creation of Ambev, 11 years ago, our priority is to embed sustainability into the heart of our operations and our environmental impact is falling down year by year. Now we want to engage people to reduce their impacts too. This is the way we work to achieve our dream and be the best beverage company by helping to create a better world!"*

Ricardo Rolim, director of social and environmental affairs, Ambev



© ZIG KOCH/WWF

*Within six months of its launch, Banco CYAN has engaged Brazilian households to save up to 40 million gallons of water. Ambev and its partners hope to extend the scheme across Brazil to encourage more conscious use of this finite resource.*

## DRIP IRRIGATION TECHNOLOGY FOR THE 'BOTTOM OF THE PYRAMID'

DESCRIPTION	Water-saving drip irrigation technology that is affordable and practical for smallholder farmers at the bottom of the pyramid – the largest but poorest socio-economic group of people who live on less than \$2.50 per day.
WHO ARE THE INNOVATORS?	IDEI, an Indian not-for-profit organisation. Driptech, an international water technology firm based in Silicon Valley, California, has offices in Pune, India and Beijing, China. It distributes its drip irrigation products through local governments, NGOs, and the dealer network of Godrej Agrovet in Karnataka and Maharashtra, India.
WHO ARE THE ADOPTERS?	Smallholder farmers in India.
WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?	Water use is unsustainable in many regions. The UN predicts that two-thirds of the world's population will live under water-stressed conditions in 2025. In many developing countries, agriculture uses around 80% of all freshwater. This is mainly used in inefficient flood irrigation. With drip irrigation, water use declines 60%, yields increase 30%, less labour and energy is required to pump water and less fertiliser is needed, according to Driptech. Increased yields mean there's less need to convert wild habitat to farmland. Drip irrigation also reduces the disruption of freshwater ecosystems caused by extracting large amounts of water and fertiliser run-off.
WHY IS IT POTENTIALLY GAME-CHANGING?	Global food security is a serious concern as the world's population grows, and people demand more meat and dairy products, which take a lot of natural resources to produce. Simple agricultural technology like drip irrigation can improve the livelihoods of smallholder farmers, help reduce water stress and improve food security as long as they are part of an integrated approach to water stewardship.

**60%**  
 USING DRIP IRRIGATION  
 CAN HELP REDUCE WATER  
 USE BY 60%, WHILST  
 ALSO INCREASING CROP  
 YIELDS BY 30%

## FUNGAL BUILDING INSULATION

<b>DESCRIPTION</b>	Solid board insulation made from agricultural waste, bonded together by filamentous fungi.
<b>WHO ARE THE INNOVATORS?</b>	Ecovative have patented this insulation material, calling it Greensulate.
<b>WHO ARE THE ADOPTERS?</b>	Greensulate can be used as wall, floor or roof insulation. The material is just reaching the US market in 2011, with support from the New York State Energy Research Development Authority and the US Environmental Protection Agency.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Greensulate requires significantly less energy to manufacture than conventional synthetic insulating foam. Using agricultural waste products means Greensulate manufacturing doesn't depend on fossil fuel and other non-renewable resources.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Over the medium term, policies to reduce demand on oil-based products and supply constraints will force a rethink of entire value chains reliant on the petro-chemicals industry. Alternatives will become increasingly necessary and valuable as oil prices rise. Innovative insulation materials and other construction products on renewable, energy efficient resources will be needed to reduce our dependency on existing materials that have a high carbon and environmental footprint.

## CUSTOMER WATER CONSERVATION PARTNERSHIP

<b>DESCRIPTION</b>	A successful collaboration between a water and power utility to help households cut water consumption. The power utility installs free water-saving devices provided by the water utility during call-outs.
<b>WHO ARE THE INNOVATORS?</b>	Thames Water, the UK's largest water and sewage company serving 14 million customers, partners with British Gas subsidiary, Dyno Plumbing.
<b>WHO ARE THE ADOPTERS?</b>	The partnership will operate across the Thames Water Region (London and the Thames Valley).
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Reduce overall water-use by two million litres per day. Swindon already uses all available water sources and the town's population is growing. Thames Water state that water-saving devices fitted to shower heads, toilets and taps can cut customer water consumption by 25% and reduce annual water and energy bills by up to £75.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	This pilot scheme is an unusual, but potentially effective, partnership between sectors to improve water efficiency, with Thames Water providing customers with free water-saving devices worth up to £150.

## CHEMICAL LEASING

DESCRIPTION	COMPLEASE™ chemical leasing allows industrial customers to lease the chemicals, cleaning equipment and associated services they need, instead of buying them. That way, they use environmentally harmful chemicals more efficiently and safely.
WHO ARE THE INNOVATORS?	SAFECEM, a subsidiary of The Dow Chemical Company.
WHO ARE THE ADOPTERS?	Automotive companies such Volkswagen, Daimler Chrysler, Volvo, Ford, Toyota and General Motors. The semiconductor industry, including STMicroelectronics, Micron Technologies and Motorola, and the pulp and paper industry also use COMPLEASE™.  The United Industrial Development Organisation and the Austrian Ministry for Environment promote the leasing approach through a number of global projects.
WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?	Chemical leasing promotes the sustainable management of chemicals. This approach is a shift away from focusing on increasing sales of chemicals and towards using chemicals in the most efficient way possible – with the environmental and economic benefits that it brings.
WHY IS IT POTENTIALLY GAME-CHANGING?	This is a good example of a business shifting from products to services in a way that re-uses substances and moves away from using virgin materials.

## FASHION EXCHANGE

DESCRIPTION	A platform to exchange used clothing and fashion accessories for free, helping to reduce consumption and the environmental impact associated in buying new clothes.
WHO ARE THE INNOVATORS?	Swapstyle.com offers a web-platform for women to exchange clothing, cosmetics, books and accessories. There is a feedback system to show whether users are trustworthy.
WHO ARE THE ADOPTERS?	Swapstyle.com has over 40,000 members.
WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?	The environmental benefits of sharing or exchanging services depend on an overall reduction in material consumption per capita, which has yet to be demonstrated. For example, people may spend the greenhouse gas savings made by exchanging clothes on other energy intensive or polluting goods.
WHY IS IT POTENTIALLY GAME-CHANGING?	Services such as a fashion exchange have the potential to lower material consumption – without reducing standards of living.



*"The waste created from the fashion industry is huge. We live season by season, sometimes only wearing an item once. It offers people an environmentally sustainable alternative to consumption, it also helps them to save money. We receive emails from grateful members every week letting us know how much money they have been able to save by swapping, which means a lot considering the current financial climate. Since 2002, over a million items have been swapped."*

Emily Chesher, Founder, Swapstyle.com





© COURTESY OF GETTY IMAGES

*Clothes swapping is now a well-known way to exchange unwanted clothes and accessories from jumble sales, swap parties and events. Swapstyle.com provides a unique web platform where people have so far exchanged over a million items online, helping to reduce consumption, waste and money.*

# RESTORATIVE

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“We are entering an era where the multi-trillion dollar losses of natural and nature-based resources are starting to shape markets and consumer concerns. How companies respond to these risks, realities and opportunities will increasingly define their profitability; corporate profile in the market-place and the overall development paradigm of the coming decades on a planet of six billion, going to over nine billion people by 2050.”

Achim Steiner, UN Under-Secretary General and Executive Director, UNEP on the launch of The Economics of Ecosystems and Biodiversity (TEEB) report







# Restorative

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Businesses very often strive to reduce social and environmental impacts, or even make commitments to achieve zero impacts and do no harm. However, this does not deal with the significant natural capital lost over recent decades, the increasing pressures on resources from developed and emerging economies, or global carbon emissions, which have yet to come down.

In a fast-changing world that's enduring far-reaching human impacts, businesses need to go further than damage limitation and instead demonstrate added value to justify their licence to operate.

Restorative aims require new thinking about reversing previous negative impacts and restoring biodiversity, forests, fresh water systems and marine environments. Can a company facilitate the sequestration of more carbon than the amount it produces across its activities? Or recycle more waste than that produced by the business? Or generate renewable energy greater than the power it uses? Such commitments would result in net positive social and environmental impacts for the planet and a growing population.

This section explores innovations that have such restorative aims.

## ‘BENEFIT CORPORATION’ LAWS: A LEGAL FRAMEWORK FOR HYBRID BUSINESS

<b>DESCRIPTION</b>	The ‘benefit corporation’ laws enacted by states such as Maryland create a new legal status for organisations that wish to pursue environmental or social goals in tandem with the pursuit of shareholder returns. Organisations incorporating as benefit corporations must report to shareholders on progress towards their environmental or social goals with the same standards and rigour used in their financial reporting.
<b>WHO ARE THE INNOVATORS?</b>	Benefit corporation legislation has been designed and promoted by B Lab, a US not-for-profit organisation that aims to “harness the power of private enterprise to create public benefit.”
<b>WHO ARE THE ADOPTERS?</b>	On 13 April 2010 Maryland passed legislation enabling firms to become benefit corporations. Three other US states – New Jersey, Vermont and Virginia – followed suit the next year. Seven states, including California, are currently debating benefit corporation legislation.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Directors and officers of benefit corporations like Clean Currents, a renewable energy retailer, have legal protection from the state to consider the environment, the interests of employees, customers, and the communities where the firm operates, in addition to the interests of shareholders. The benefit corporation legal framework locks the environmental and social goals of a firm into its governing documents, enabling these goals to survive regardless of the intentions of new investors, management or company ownership.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	<p>Benefit corporation laws creates a new standard of clarity of purpose and accountability for firms pursuing environmental goals. Its legal status provides assurance that an organisation with an environmental mission will continue to pursue its goals regardless of changes to ownership or management. It also encourages transparency and accountability to shareholders on social and environmental goals. Companies with the status have to produce a mandatory ‘benefit report’ produced by an independent ‘benefit director.’</p> <p>Benefit corporation laws also provides distinct legal status for organisations that fall between traditional classifications of ‘for-profit’ and ‘not-for-profit.’ The aims around creating ‘public benefit’ go beyond doing less harm and are aligned with restorative ambitions and the pursuit of generating positive impact.</p>

*“We are living in a world where authenticity and transparency will become a necessity for business. B Corp certification ensures that.”*

Kyle Berner, FeelGoodz

## BIOROCK CORAL REEF RESTORATION

<b>DESCRIPTION</b>	Restoring endangered coral reef by enhancing growth with a pioneering technique involving electrodeposition of calcium carbonate, the building-block of coral skeletons.
<b>WHO ARE THE INNOVATORS?</b>	In the 1970s, Professor Wolf Hilbertz developed a technique to create building materials under the ocean using electrodeposition (passing a current between electrodes in seawater). After seeing exceptional growth of marine organisms on the structures this technique created, Prof Hilbertz partnered with Dr Thomas Goreau of the Global Coral Reef Alliance. Together, they developed 'Biorock reef structures', which support the growth of coral fragments grafted to them.
<b>WHO ARE THE ADOPTERS?</b>	Pemuteran, Bali and the Gili Eco Trust of the Gili Islands, Indonesia.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Coral reefs support rich biodiversity and are extremely important to the local economies of nearby regions. That's why making every effort to support their long-term survival is critical. But prospects for the world's coral reefs are bleak. Over-fishing, ocean acidification, rising water temperatures, sediment and nutrient run-off and the potential for sea-level rises all put coral reefs under threat. Biorock reef structures could in theory help halt their decline.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	The Biorock restoration technique is controversial. There's a lack of peer-reviewed scientific studies to show its efficacy. However, assuming it can be replicated widely, it could make a huge contribution to coral reef restoration and the ability of reefs to adapt to rapidly changing ocean conditions in the 21st century.





© CAT HOLLOWAY/WWF-CANON

*The Biorock restoration technique, if it can be proven to be replicated sustainably – has the potential to significantly restore depleting coral reefs that are rapidly disappearing due to rising sea temperatures and pollution. This solution should be used alongside wider efforts to protect and improve marine habitat conditions.*

## COSTA RICAN 'PAYMENTS FOR ECOSYSTEM SERVICES' PROGRAMME

<b>DESCRIPTION</b>	An initiative led by the Costa Rican government which involves paying land owners to maintain forest ecosystems, known as the Environmental Services Payment Program (ESPP). Land owners are asked to do this by protecting biodiversity, capturing carbon, protecting water sources and keeping the landscape beautiful. Funds for the programme come mainly from a national fuel tax, and from local schemes where water utility companies and food and beverage firms pay for the water they use. Running since 1997, the Costa Rican scheme remains the best example of a large-scale 'Payments for Ecosystem Services' programme.
<b>WHO ARE THE INNOVATORS?</b>	The Costa Rican government implemented the ESPP. Costa Rican water utility companies such as ESPH and food and beverage firms like Cervecería Costa Rica take part in Payments for Ecosystem Services (PES) schemes.
<b>WHO ARE THE ADOPTERS?</b>	Land owners with eligible forest ecosystems or agroforestry (forest used for agriculture) on their land can sign up to the ESPP scheme to receive monthly payments in exchange for good land management. Payments are usually closely tied to maintaining forest cover.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	It's likely that incentives to preserve forests have contributed to forest cover improving across Costa Rica (from 26% in 1983 to 45% in 2002). However, it's difficult to work out how much of this is down to incentives and how much it's down to other economic influences.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	PES schemes offer a practical solution to preserving forest cover, although they can be politically contentious. Schemes like Costa Rica's have inspired the approach of the United Nations Collaborative Programme on Reducing Emissions from Deforestation (REDD) to conserving and restoring tropical forest ecosystems and the carbon they store.





© COURTESY OF CHRIS MARTIN BARR/WWF-CANNON

*Engaging land owners to maintain eligible forest ecosystems or agroforestry since 1997, the Costa Rican scheme remains the best example of a large-scale 'Payments for Ecosystem Services' programme in the world.*

# WASTEWATER TREATMENT WETLANDS

<p><b>DESCRIPTION</b></p>	<p>Water management systems modelled on wetlands and used for wastewater treatment. These custom-built systems help to optimise recovery and reuse water, nutrients and energy; restore soil ecology; and create habitat for wetland wildlife.</p>
<p><b>WHO ARE THE INNOVATORS?</b></p>	<p>Natural Systems Utilities (NSU), a US wastewater treatment firm founded in 2007.</p>
<p><b>WHO ARE THE ADOPTERS?</b></p>	<p>Abita Springs Timber Company asked NSU to provide wastewater management for an 8,000 acre mixed use development in Louisiana. NSU estimate their wastewater infrastructure based on natural wetlands will save \$27 million upfront compared to conventional sewage treatment systems, with operational cost savings over 20 years totalling \$19 million.</p> <p>The Commonwealth Conservancy also contracted NSU as the water and wastewater utility for 965 homes in the Galisteo Basin Preserve, New Mexico.</p>
<p><b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b></p>	<p>NSU estimate that their water infrastructure systems use up to 50% less water and emit up to 2.5 times less carbon than conventional systems. Their 'free-surface flow treatment wetlands' mimic natural wetlands and so provide habitat for a variety of wildlife species.</p>
<p><b>WHY IS IT POTENTIALLY GAME-CHANGING?</b></p>	<p>NSU calculate that their 'biologically complex and mechanically simple' water management solutions cost up to two times less than conventional systems, and have operating costs that are three times lower. As NSU claim their wetland systems use up to 50% less water and up to 2.4 times less energy than average, their systems may be appropriate for areas which are expected to experience water stress and energy constraints in the near future.</p>

**2.5**  
**THE WETLAND WATER  
 INFRASTRUCTURE SYSTEMS  
 USE UP TO 50% LESS  
 WATER AND EMIT UP TO 2.5  
 TIMES LESS CARBON THAN  
 CONVENTIONAL SYSTEMS**

## FINANCING SYSTEM FOR SUSTAINABLE WATERSHED MANAGEMENT

<b>DESCRIPTION</b>	A system to protect the ecologically important upstream watersheds of rivers. Payments are collected from downstream water users such as water utilities, hydropower providers, farmers using irrigation and brewers. Money is then redistributed to manage upstream areas, which are critical to the regulation of water quality and flow.
<b>WHO ARE THE INNOVATORS?</b>	The Water and Sewage Metropolitan Enterprise (EMAAP-Q) of Quito, Ecuador, established the Fund for the Protection of Water (FONAG) with The Nature Conservancy to collect payments from the downstream water users and direct it to upstream watershed management.
<b>WHO ARE THE ADOPTERS?</b>	The Electric Power Company of Quito (EEQ) contributes 1% of its monthly water sales to FONAG, while the Cervecería Andina brewery and hydropower providers make fixed annual payments. Upstream farmers and land owners receive support for watershed protection programmes. These programmes have improved management across 65,000 hectares of watersheds, according to FONAG.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Managing watersheds well means they're able to continue carrying out important ecological functions, including purifying water, regulating water flow, stopping soil erosion, and providing vital habitats for species. FONAG estimates that its investments have resulted in improved management across 65,000 hectares of watershed ecosystems.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	FONAG aims to build a culture of responsible and sustainable water management through long-term ecological education and water resources management training, with projects operating for a minimum of 20 years. The combination of a system of payments and education is a promising model for encouraging watershed land owners and downstream water users to treat water as a valuable resource and manage it with long-term sustainability in mind. Upstream watersheds are in a better state as a result of this initiative.

## RWANDA: BALANCING ECOSYSTEM RESTORATION AND ECONOMIC DEVELOPMENT

<b>DESCRIPTION</b>	Using nature tourism enterprises and sustainable harvesting to restore natural ecosystems, create income and jobs in Rwanda.
<b>WHO ARE THE INNOVATORS?</b>	The Rwanda Environment Management Authority (REMA) has restored and protected mountain gorilla habitat in the Virungas National Park, leading to nature tourism revenue of US\$3 million per year since 2005. This has also created jobs managing the park and providing tourism services. REMA has restored wetlands across Rwanda too, including in Rugezi, where wetland degradation had led to water shortages and losses of US\$856,994 for the power utility Electrogaz.
<b>WHO ARE THE ADOPTERS?</b>	N/A
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	REMA's efforts have helped protect critically endangered mountain gorillas. REMA has also helped restore wetlands, which are a hotspot for biodiversity as well as a source of materials such as papyrus and pennisetum.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Much of the world's biological diversity such as species and ecosystems are found in developing countries. Innovation is required to enable the people of developing nations to meet their growing material needs and aspirations without eroding their nations' rich biological diversity. REMA is an innovative scheme that enables visitors to enjoy the natural wonders of Rwanda whilst also ensuring the local people and natural habitats benefit.



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*The Rwanda Environmental Management Authority (REMA) has helped to protect critically endangered mountain gorillas in the Virungas National Park by creating up to US\$3 million revenue a year from nature tourism since 2005.*



## GLOBAL ALLIANCE FOR BANKING ON VALUES

<b>DESCRIPTION</b>	A network of banks that aims to use finance to deliver sustainable development for people, communities and the environment.
<b>WHO ARE THE INNOVATORS?</b>	The Global Alliance for Banking on Values (GABV) is a membership organisation founded by BRAC Bank in Bangladesh, ShoreBank in the US and Triodos Bank in the Netherlands. Members must be independent and licensed banks with a focus on retail customers, hold a minimum balance sheet of \$50 million, and demonstrate commitment to social banking and the triple bottom line of people, planet and profit.
<b>WHO ARE THE ADOPTERS?</b>	The members are: Alternative Bank, Banca Etica, BancoSol, BRAC, Cultura Bank, GLS Bank, Merkur Bank, Mibanco, New Resource Bank, OnePacificCoast Bank, Triodos Bank, Vancity and XacBank.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Member banks such as Triodos have a policy of directly investing to contribute to environmental sustainability. Triodos lends money to firms and projects involving, for example in organic agriculture and renewable energy.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	GABV actively advocates for sustainable banking practice and supports regulatory change. Members hold total assets of \$26 billion and impact 10 million people in 20 countries through their lending. The organisation shows how net positive social and environmental impacts can be generated by a new kind of banking.



*"At New Resource Bank, we're out to change banking. Our mission is to advance sustainability with everything we do – the loans we make, the way we operate and our commitment to putting deposits to work for good."*

Vincent Siciliano, president and CEO, New Resource Bank

## BIOCHAR

<b>DESCRIPTION</b>	Biochar is charred organic material that is created from burning biomass (such as farm waste) at high temperatures without oxygen. It is buried into soil to enhance its fertility and acts as a carbon store.
<b>WHO ARE THE INNOVATORS?</b>	There are many entrepreneurial firms and social enterprises working in this area. These include re:char, which aims to improve soil conditions and capture carbon in sub-Saharan Africa.
<b>WHO ARE THE ADOPTERS?</b>	Small-scale farmers in sub-Saharan African countries are taking part in biochar trials. Researchers at South Dakota State University and the US Department of Agriculture are investigating an agricultural system for the US which would involve biochar <sup>1</sup> .
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Carbon capture, enhanced soil fertility and water retention – which all help to increase crop yields.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	There is good evidence that biochar improves soil fertility and crop yields in tropical soils. More scientific research is needed to accurately quantify the carbon capture benefits of biochar as well as ensuring the carbon that is used to create the material is sustainably sourced. However, archaeological evidence indicates that charred biomass has the potential to store carbon for a long time. The Terra Preta agricultural soils of the Amazonian basin contain high levels of black carbon from charred biomass, which are estimated to be over 700 years old. It is also important to consider the source of the carbon used to make the biochar. If the source and the process is sound then it is a useful innovation to improve soil nutrition.

<sup>1</sup> <http://www.sdstate.edu/news/featurestories/pyrolysis.cfm>

## EVERGREEN AGRICULTURE

<b>DESCRIPTION</b>	Evergreen agriculture involves using 'fertiliser trees' in food crop production. Trees like the acacia <i>Faidherbia albida</i> shed nitrogen-rich leaves during the early rainy season, fertilising crops without overshadowing them during the growing season.
<b>WHO ARE THE INNOVATORS?</b>	The World Agroforestry Centre has developed and promoted this farming practice.
<b>WHO ARE THE ADOPTERS?</b>	Smallholder farmers across Burkina Faso, Malawi, Niger and Zambia. In Niger there are over 4.8 million hectares of <i>Faidherbia</i> agroforests fertilising millet and sorghum.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Evergreen agriculture leads to more tree cover – meaning more carbon sequestration. The tree cover also prevents soil erosion and helps regulate water flow.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	There are increasing challenges around food security due to issues around access, distribution, affordability, population growth, changing diets, climate change, water stress and other factors. Practices such as evergreen agriculture can help with restoring soil fertility and be part of the solution.



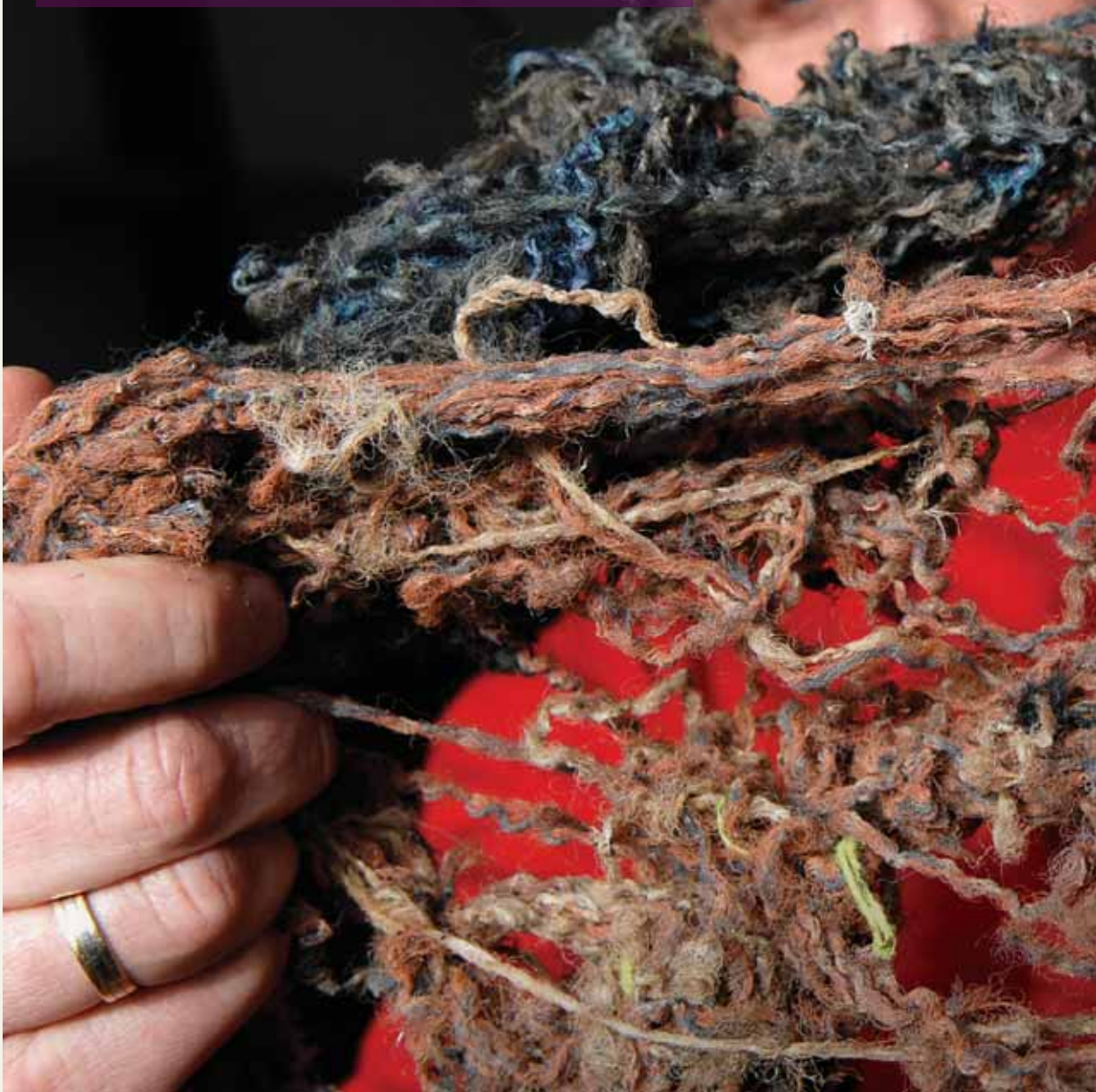
## CAPTURING WATER USING RENEWABLE ENERGY

<b>DESCRIPTION</b>	A system to collect water in arid areas, powered by renewable energy. A single wind turbine forces air through a heat exchanger, cooling it. Water then condenses and is collected.
<b>WHO ARE THE INNOVATORS?</b>	Dutch Rainmaker, a water purification technology firm founded in 2006. In April 2011, the firm was offered space by the municipality of Leeuwarden in the Netherlands to test its water capture technology.
<b>WHO ARE THE ADOPTERS?</b>	The technology is still at the development stage.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	The ability to condense water from the atmosphere with no greenhouse gas or chemical emissions.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	The UN predicts that 2.7 billion people worldwide are likely to experience severe water shortages by 2025. If this technology works at scale it could provide additional freshwater at low cost, relative to existing energy-intensive technology such as desalination plants.

# OPEN LOOP

“In nature, waste from one organism becomes food for another, and this is exactly what we’ve experienced in our business. Rather than limiting ourselves to recycling nylon from our own products to make new carpet tiles, we have looked further afield to materials such as fishing nets or limestone. We believe that the key to closing the loop is to go beyond traditional models and open up to make use of waste from other industries and businesses.”

Ramon Arratia, sustainability director, InterfaceFLOR EMEAI







Fibre from fish nets are used to make carpets at InterfaceFLOR.

# Open loop

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Our waste across the globe is becoming unmanageable. We currently need the resources of one and a half planets to absorb it. WWF's latest Living Planet Report shows that if we carry on under a 'business as usual' scenario, the outlook is serious: even with modest UN projections for population growth, consumption and climate change, by 2030 humanity will need the capacity of two Earths to absorb CO<sub>2</sub> and all kinds of other waste.

Reports on UK landfill tax show that the cost of waste disposal is increasing at a rate above inflation, and it's set to rise further in the near future. Africa, India and China are popular destinations for electronic waste and stockpiles are mounting. There were riots in Italy in 2010 about waste dumps, as residents of Naples protested over fears about toxic trash. And in Texas, geologists and engineers are fighting proposals for a super-sized nuclear waste plot.

Houston, we have a problem! But, things are changing: recycling facilities are improving, and even the UK is getting with the programme – charging for plastic bags is being introduced in certain quarters, reduced packaging is receiving more attention, and take-back schemes of used products are on the up.

However, we need to go much further. To be sustainable, there's no option but to strive for a zero-waste society – a circular economy; a place where one company's waste becomes another's resource. And that's the focus of this section – game-changers who are looking at upcycling, industrial symbiosis and other circular innovations of this nature.

## INDUSTRIAL SYMBIOSIS NETWORK FOR CHINESE INDUSTRIAL ZONE

<b>DESCRIPTION</b>	The Tianjin Economic Technological Development Area (TEDA) in China and the EU have collaborated to create an industrial symbiosis network and a training programme on environmental management systems. TEDA is one of China's largest and most dynamic economic development zones and the project aims to significantly improve resource efficiency and reduce waste through encouraging mutually profitable partnerships.
<b>WHO ARE THE INNOVATORS?</b>	The EU Switch-Asia Project provided 80% of the €1.8 million project funding, with the TEDA administrative committee providing the rest.
<b>WHO ARE THE ADOPTERS?</b>	Since March 2010, businesses based in TEDA have been able to access a free environmental management system training programme, certified to the ISO 14001 standard. The training will be available until 2014. The project also aims to engage 800 firms in an industrial symbiosis network.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	There's a very large cumulative impact when individual firms use waste more productively. For example, from 2005–2010 the UK National Industrial Symbiosis Programme diverted 35 million tonnes of waste from landfill, and reduced demand for virgin materials by 48 million tonnes.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	China's fast economic and technological development means there is potential for vast quantities of construction and manufacturing waste that can be turned into a resource. Often firms are unaware of the value that their waste materials may hold for other industries. Industrial symbiosis programmes can facilitate partnerships which generate mutual value and significantly improve resource efficiency, cost savings and bring new revenue. Due to the large scale of industries and outputs of TEDA, implementing environmental measures and industrial symbiosis can have a significant impact in reducing waste.

## UPCYCLED CLOTHES AND ACCESSORIES

<b>DESCRIPTION</b>	Clothes created from waste products such as unwanted clothing, waste plastic and rubber. This process is called 'upcycling' and it has seen many entrepreneurs getting creative with waste, such as making handbags from used fire hoses to jackets made from hot air balloons.
<b>WHO ARE THE INNOVATORS?</b>	Worn Again, a UK fashion brand which makes upcycled clothes. Another innovator is Conserve India, an organisation based in Delhi which sells bags made from waste plastic, rubber tubes denim and Sari offcuts. Thunk, based in Coimbatore, India, makes products including bags, laptop cases and wallets from recycled waste textiles and packaging.
<b>WHO ARE THE ADOPTERS?</b>	McDonald's engaged Worn Again to design a new uniform for its 85,000 UK employees, and Eurostar also engaged Worn Again to use their old staff uniforms to create new bags for their train staff. Conserve India sells bags and wallets through its website.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Clothing manufacture uses lots of resources, including raw materials and water. Buying upcycled clothes instead of clothing made from virgin resources can reduce the huge demand on agricultural land and fresh water.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Upcycling helps people get used to the idea of reused materials in new products. This can be a first step towards creating a highly resource-efficient open loop economy, where products are designed so all components can be reused.



© COURTESY OF WORN AGAIN

*Eurostar engaged Worn Again to convert old staff uniforms and seat covers to create new bags for their train staff.*



# INDUSTRIAL SYMBIOSIS WEB PLATFORM

<b>DESCRIPTION</b>	<p>Industrial symbiosis engages traditionally separate industries in a network to foster innovative ways to use waste as a resource (such as materials, energy, water, assets, expertise, logistics etc). A web platform has been launched to enable businesses to share best practice and identify how organisations can work around the world to share waste and resource streams profitably.</p>
<b>WHO ARE THE INNOVATORS?</b>	<p>International Synergies, a firm which specialises in designing industrial symbiosis systems and tools. The firm has developed 'SYNERGie', a platform for sharing industrial symbiosis examples and innovation around the world.</p>
<b>WHO ARE THE ADOPTERS?</b>	<p>International Synergies' web platform is used by project partners in seven countries: China, Turkey, Brazil, South Africa, Hungary, Romania and Slovakia.</p>
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	<p>Businesses often miss out on opportunities to collaborate on resource sharing due to a lack of communication platforms and knowledge to enable partnerships to develop. However, successful industrial symbiosis initiatives can lead to large reductions in waste and cost savings through avoiding disposal costs and purchasing raw materials. This cuts energy consumption and CO<sub>2</sub> emissions.</p>
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	<p>Individual case studies show that there are large, untapped opportunities to cut waste and save energy through industrial symbiosis.</p> <p>For example, 300 businesses in Minas Gerais, Brazil use the SYNERGie tool and to date, this collaboration has prevented 94,500 tonnes of waste from going to landfill and reduced CO<sub>2</sub> emissions by 84,000 tonnes.</p> <p>An industrial symbiosis project in Romania uses SYNERGie to support 170 members. International Synergies estimate that the project's partnerships, including one between 21 firms to turn wood 'waste' into fibreboard, have protected 2,645 hectares of forest, diverted 500,000 tonnes of waste from landfill and reduced CO<sub>2</sub> emissions by 142,900 tonnes.</p> <p>Similarly, an industrial symbiosis initiative in Tianjin, China using SYNERGie is forecast to cut landfill waste by 51,400 tonnes and CO<sub>2</sub> emissions by 300 tonnes.</p>

## POLYLOOM WOVEN PRODUCTS FROM WASTE PLASTIC

<b>DESCRIPTION</b>	Enterprises which weave waste plastic into mats and handbags to sell, using a specially designed loom.
<b>WHO ARE THE INNOVATORS?</b>	The Indian Centre for Environment Education created the 'polyloom', a handloom that can weave discarded plastic bags. Delhi-based NGOs such as the All India Women Conference, Harit Recyclers Association, Nari Utthan Samiti, Deepalaya & Aditya Group, Kirandeep and G.D.S. have used the polyloom as part of their social enterprise programmes.
<b>WHO ARE THE ADOPTERS?</b>	Local livelihoods are supported through weaving and selling the mats and handbags, while entrepreneurs from the informal waste collection sector derive an income from supplying the raw materials.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Repurposing plastic bags into useful products reduces landfill waste. It can also be seen as a stepping stone to an 'open loop' economy – where waste is treated as a resource.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	In order to tackle a growing waste management problem, an Indian High Court order banned all plastic bags from large shopping centres, hotels and hospitals. Nonetheless, large quantities of waste plastic remain. Initiatives like the polyloom demonstrate the potential for solutions to deal with Indian cities' waste management problems and create local employment.

## REGULATION FOR PRODUCERS TO RECYCLE WASTE

<b>DESCRIPTION</b>	Regulation which compels manufacturers to recycle a proportion of their products' waste or packaging materials. If they don't do this a fine is imposed which is more than the cost of implementing recycling.
<b>WHO ARE THE INNOVATORS?</b>	The Republic of Korea, the EU, Japan, Taiwan, Mexico, Brazil and Australia.
<b>WHO ARE THE ADOPTERS?</b>	Manufacturers of electronic products, tyres, lubricant, batteries and fluorescent bulbs are subject to the Korean 'Extended Producer Responsibility' (EPR) regulation.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	The Korean EPR regulation has led to continuous increases in recycling. The Korean Ministry of Environment estimates that 6,069,000 tonnes of waste were recycled under the scheme from 2003–2007, while carbon emissions declined annually by an average of 412,000 tonnes. In addition, the scheme prevented 23,500 tonnes of greenhouse gas emissions which would have been generated from landfills and incineration.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Aside from the environmental benefits, EPR regulation has created new jobs and economic benefit. The Korean Ministry of Environment calculates that from 2003–2006 the EPR system created 3,200 jobs, while the 69,213 tonnes of plastic recycled in 2008 created an economic benefit of approximately \$69 million.

**5 YEARS**  
WITHIN FIVE YEARS,  
THE SCHEME RECYCLED  
OVER 6 MILLION TONNES  
OF WASTE AS WELL AS  
CREATING NEW JOBS AND  
ECONOMIC BENEFITS

## PRODUCTS DESIGNED TO BE REMADE

<b>DESCRIPTION</b>	Consumer products designed to be remade, repurposed or 'hacked' to create another useful product after the end of their useful life.
<b>WHO ARE THE INNOVATORS?</b>	The product hacking 'Open Hardware' wiki site shares a list of open source technology and hackable products that (in theory) enable anyone to build products ranging from solar trackers and LED lighting to cooking stoves.
	McDonough Braunart Design Consultants promote the 'Cradle to Cradle' concept, which encourages designers to create products that are suitable for future life-cycles, while also being safe for people and the environment. This design concept emphasises that the chemicals used in products must be clear and traceable.
<b>WHO ARE THE ADOPTERS?</b>	Unknown.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Reusing and repurposing products will save energy as there will be less need to extract and process new raw materials. It will also cut waste.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Open source toolkits and products designed to be remade could equip people to repurpose unwanted material goods, rather than discarding them and purchasing new products.

## USING WASTE HEAT TO GROW TOMATOES

<b>DESCRIPTION</b>	The UK's largest single glasshouse uses recovered carbon dioxide and heat from the neighbouring Wissington Sugar factory.
<b>WHO ARE THE INNOVATORS?</b>	British Sugar.
<b>WHO ARE THE ADOPTERS?</b>	N/A
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	The single glasshouse uses no fuel for heating, unlike conventional glasshouses. Cornerways Nursery benefits from the Combined Heat & Power Plant (CHP) based in the adjacent Wissington Sugar Factory. The CHP is at the heart of the factory operations producing steam and electricity for the sugar processing process. This benefits Cornerways Nursery, and generates a further 50 MW that can be exported into the local electricity network which is enough for a population of 120,000 people.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	<p>More than 240 miles of piping carries hot water from the factory's CHP plant around the glasshouse to maintain the warm temperatures necessary to grow tomato plants. This hot water would otherwise be destined for cooling towers and released as steam, so this scheme ensures the heat is used twice. In order to prevent heat loss from the glasshouse at night, blinds are installed to keep in the day's heat.</p> <p>Another benefit is the productive use of carbon dioxide, produced as a by-product from the CHP boiler, which is pumped into the glasshouse at a concentration four times higher than normal air. The plants can use the carbon dioxide to grow at twice the normal rate.</p> <p>Seeking innovative ways to minimise waste and maximise the value from its raw materials, the recent expansion to Cornerways includes a new energy management system incorporating a 1 million litre water storage buffer tank, so when the nursery's heating demands are low the tank stores the hot water to be reused later. Cornerways also captures rainwater from the very large roof as the main source of irrigation. Similarly, water which has been used primarily to wash the sugar beet is recycled to irrigate the tomato plants carrying important nutrients from Norfolk soils.</p> <p>Cornerways supports British Sugar's commitment to achieving environmental and social sustainability throughout its business, producing around 140 million tomatoes each year.</p>



© COURTESY OF BRITISH SUGAR

*More than 240 miles of piping carries hot water from the British Sugar factory's CHP plant to a nearby tomato nursery to maintain the warm temperatures that is necessary to help the plants grow. This successful model enables the production of over 140 million tomatoes a year in an environmentally responsible way.*

## MINING OLD CONSUMER GOODS

<b>DESCRIPTION</b>	With the electronics and consumer goods industry expanding, businesses are increasingly seeing the opportunity to collect plastics and valuable electronic components from discarded consumer goods to resell or recycle.
<b>WHO ARE THE INNOVATORS?</b>	MBA Polymers is a plastic recycling firm based in California, with recycling operations in Austria, China and the UK. A7, a firm based in Brazil, buys electronic waste material and resells selected components to European and US firms.
<b>WHO ARE THE ADOPTERS?</b>	Customers such as Electrolux use MBA Polymers plastics in their products.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Recycling reduces the use of new resources and cuts energy consumption and CO <sub>2</sub> emissions. MBA Polymers report that for every tonne of virgin plastic they replace, energy consumption is reduced by 80% and emissions by one to three tonnes of CO <sub>2</sub> . A7 state that the firm recycles toxic and non-biodegradable products, avoiding soil and water contamination from waste disposal.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	In many countries, large quantities of plastic waste and electronics are not recycled. A7 Brazil report that around 600,000 tonnes of electronics are discarded every year in the country. According to the firm, it recycled 1.4% of this total in its first year, growing to 9.9% in its fifth year. Reusing plastic can help reduce waste problems and pollution of the natural environment. It may also prove profitable if petrochemical supply constraints drive up the price of materials to make new plastic.

**9.9%**  
**A7 BRAZIL RECYCLED  
UP TO 9.9% OF BRAZIL'S  
ELECTRONIC WASTE IN ITS  
FIFTH YEAR**



## SOLID WASTE MANAGEMENT MODELS FOR DEVELOPING CITIES

<b>DESCRIPTION</b>	A waste management model for developing world cities which composts organic waste with forced aeration to avoid methane emissions. The model can be implemented in slum areas at small, medium or large scale. The system allows composting systems to create carbon offset credits which can be sold on voluntary carbon offset markets.
<b>WHO ARE THE INNOVATORS?</b>	Waste Concern, a social enterprise based in Dhaka, Bangladesh, has developed waste management models for developing world cities in South Asia.
<b>WHO ARE THE ADOPTERS?</b>	Waste Concern works in partnership with the Bangladesh Ministry of Environment and Forests, Dhaka City Corporation and the Public Works Department.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	A cut in greenhouse gas emissions due to methane emissions being eliminated. Waste Concern also recycle composted waste, selling it to farmers as organic compost.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	This sustainable waste management model is widely replicable across developing world cities. The Bill and Melinda Gates Foundation has granted Waste Concern funding to develop its waste management models for African cities.

## GUIDED BUSWAY DRAINAGE MADE FROM 1.8 MILLION RECYCLED TYRES

<b>DESCRIPTION</b>	Using waste tyres as construction material to build a drainage system for the world's longest guided busway.
<b>WHO ARE THE INNOVATORS?</b>	BAM Nuttall, the firm building the Bus Rapid Transit system, partnered with McGrath Group, which supplied tyre shred from 1.8 million waste tyres to create The Busway's drainage system. The partnership was facilitated by the UK National Industrial Symbiosis Programme (NISP), a network of firms sharing waste that can be repurposed into useful resources.
<b>WHO ARE THE ADOPTERS?</b>	Cambridge County Council engaged BAM Nuttall to build the guided busway.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	This waste synergy avoided the use of 60,000 tonnes of virgin materials, saving around 6,120 tonnes of CO <sub>2</sub> emissions and 1,440 tonnes of water.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	The unusual pairing of using old shredded tyres as a construction material to fill the void between the concrete track shows how valuable a knowledge and waste information sharing network like NISP is. When firms communicate on how they can best use each other's waste it can lead to significant resource and cost savings across national and local economies.



© COURTESY OF CAMBRIDGESHIRE COUNTY COUNCIL

*Engineering firm, BAM Nuttall partnered with McGrath Group who supplied over one and a half million recycled tyres to create effective drainage for the busway. It provides a useful alternative to virgin materials which traditionally would have been used.*

## OPEN LOOP WATER MUNICIPAL RECYCLING

<b>DESCRIPTION</b>	Using reclaimed wastewater in drinking water supply. Open loop water recycling uses a combination of established water treatment technologies (microfiltration, reverse osmosis and ultraviolet radiation) to reclaim drinking water from wastewater.
<b>WHO ARE THE INNOVATORS?</b>	The city of Singapore supplies 30% of drinking water demand using reclaimed wastewater.
	Orange County, California has implemented the technology as part of its Groundwater Replenishment System but does not add treated water to drinking supply. Instead, it uses it in aquifers to prevent the intrusion of salt water.
<b>WHO ARE THE ADOPTERS?</b>	The citizens of Singapore.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Wastewater reclamation means greater water efficiency. It also saves energy as water is only purified once, rather than twice (before it's released into freshwater, and then when it's extracted again later).
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	UN forecasts point to increasing water stress in many regions of the world as the 21st century progresses. Many areas are now using 100% of available water resources, with such areas of water scarcity being home to over two thirds of the world's population. Moving towards using water efficiently by recycling is a priority in many regions. Innovative reclamation processes and building consumer acceptance of drinking reclaimed water will be key steps in the journey towards this goal.

**30%**  
SINGAPORE MEETS  
30% OF ITS DRINKING  
WATER DEMAND USING  
RECLAIMED WASTEWATER

## HELPING WASTE PICKERS BECOME ENTREPRENEURS

<b>DESCRIPTION</b>	Social enterprises that help informal waste pickers start up waste management micro-enterprises, known as 'waste picker corporations.' Waste pickers charge a small fee for collecting waste. They then sort the waste into recyclable materials and organic waste for composting and bio-fertilizer, which they can sell. They can generate additional income by selling greenhouse gas emission reductions on the CER (certified emission reduction under the EU Emissions Trading Scheme) or voluntary carbon offset market.
<b>WHO ARE THE INNOVATORS?</b>	Waste Ventures provides technical assistance to waste pickers so they can form their own micro-enterprises. This ranges from techniques for composting on a large scale to helping them access equity capital to fund the construction of composting and recycling plants. The social enterprise works with the Indian NGO Nidan.
<b>WHO ARE THE ADOPTERS?</b>	Around 57 waste pickers in Bokaro Steel City, Jharkhand, India. In January 2011, Waste Ventures started collaborating with local NGO partners in Osmanabad, Maharashtra, India to form waste picker corporations with 250 local waste pickers.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Waste picker corporations promote sustainable waste management through the recycling of waste plastics and organic waste as well as creating income. By composting organic waste, waste picker corporations avoid methane emissions from landfill.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Waste Ventures estimate that Indian cities generate as much as 40 million tonnes of waste annually. This increases by around 10% year on year. As little as a quarter of this waste is collected by local government, and there is little recycling. Waste picker corporations can provide a solution to this problem.

## UNCONVENTIONAL PAPER

<b>DESCRIPTION</b>	Paper created from unconventional, non-forest products, such as calcium carbonate or elephant dung.
<b>WHO ARE THE INNOVATORS?</b>	Haathi Chaap, based in New Delhi, create paper from elephant dung. TerraSkin, based in New York, create paper from calcium carbonate harvested from marble and limestone scraps combined with non-toxic resin.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Using unconventional feedstocks for paper production reduces pressure on forest resources, and typically uses less energy during manufacturing. Conventional paper production requires large quantities of water and chlorine to bleach wood pulp. The production of TerraSkin paper requires none – saving water and removing a source of pollution.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Global land-use change, predominantly from deforestation, is responsible for around 20% of global greenhouse gas emissions. Forest ecosystems are a critical carbon store helping keep Earth's climate stable. Though many paper manufacturers purchase wood only from responsibly managed forests under the Forest Stewardship Council certification scheme, some wood pulp is still sourced from unsustainable sources. Alternative materials and use of waste that can displace the need to source virgin wood fibres can significantly reduce impacts on forests.



© COURTESY OF HAATHI CHAAP

*Haathi Chaap, based in New Delhi, India have boosted their income and generated local employment through their creative and unusual business venture to produce paper made from elephant dung.*



# RENEWABLE ENERGY AND LOW CARBON

“By 2050, we could get all the energy we need from renewable sources. The Energy Report by WWF and Ecofys, shows that such a transition is not only possible but also cost effective, providing energy that is affordable for all and producing it in ways that can be sustained by the global economy and the planet. The transition will present significant challenges, but we hope to inspire governments and businesses to move boldly to bring the renewable economy into a reality.”

Jim Leape, director general, WWF International





# Renewable energy and low carbon

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The major energy companies envisage scenarios where fossil fuels make up a significant part of the energy mix in the middle of this century. The International Energy Agency describes a ‘golden age of natural gas’ where global use of gas (including shale gas) will rise by more than 50% from 2010 levels to account for a quarter of global energy demand by 2035. Its report also advises that this could result in warming of over 3.5°C – not exactly a ‘golden age’ for the planet.

In 2010, PwC explored the feasibility of 100% renewable electricity across Europe and North Africa by the middle of this century. And more recently, WWF and Ecofys published *The Energy Report* ([www.panda.org/energyreport](http://www.panda.org/energyreport)), which advises that globally a 100% renewable energy future in the next 40 years is very much affordable and achievable with today’s technology.

This is a transformative solution to energy and climate security. Many elements make up such a future, with innovations of many kinds being a vital part of the mix. A few examples of these are described in this section.

## AD-FUNDED SOLAR STREET LIGHTS

<b>DESCRIPTION</b>	Solar-powered streetlights in India, entirely funded by revenues from attached advertising.
<b>WHO ARE THE INNOVATORS?</b>	Shuchi Energy Ad Promotions is a joint venture formed by Sunwatt and Shuchi, based in Hyderabad, India. The firm offers lighting and advertising space for schools, universities and colleges across India.
<b>WHO ARE THE ADOPTERS?</b>	Advertising agencies such as Ogilvy and Mather Advertising, Portland and Madison.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Free solar-powered lighting for cities in the developing world.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	This is an innovative business model which may support countries like India to expand solar-powered lighting across cities. There are benefits for the advertisers too: installations like solar panels are highly visible and offer immediate positive brand associations for many consumers.

## COMMUNITY-OWNED RENEWABLE ENERGY PROVIDER

<b>DESCRIPTION</b>	UK's first community owned renewable energy plant, which generates electricity for local businesses and residents. Backed by 250 community shareholders, it also provides a return in investment to investors from income generated from a government feed-in tariff (FiT).
<b>WHO ARE THE INNOVATORS?</b>	The Ouse Valley Energy Services Company (OVESCO), set up by Transition Town Lewes, partnered with solar installation firm Southern Solar and local brewery Harveys, to create a 98kW solar PV panel array. Harveys will use some of the electricity generated in exchange for the lease of its roof space for the solar panels. The remainder will feed back into the national grid. Income from the UK government FiT will be used to repay investors and generate interest of around 4% over the 25 year lifespan of the installation.
<b>WHO ARE THE ADOPTERS?</b>	Individuals from the local area invested around 85% of the total £307,000 project costs.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	The scheme generates decentralised renewable energy to residents and local businesses.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Though this model is reliant on government FiTs to generate revenue, it shows public appetite for investment in community renewable energy generation and the potential for this to be replicated with more mutually profitable partnerships between communities and local businesses.



© CHRIS ROWLAND, OVESCO

*“We’ve been blown away by the positive response to our first project. This is just the start, we want to work with the Lewes District community to install a further 200KW of PV over the next year on schools, community buildings and local businesses. We aim to develop the OVESCO business model to supply alternative ways to generate low carbon heat and power and see Lewes become a solar powered town.”*

Chris Rowland, company director, OVESCO

## REDUCING THE CARBON IMPACTS OF WHAT WE EAT

<b>DESCRIPTION</b>	Restaurants and catering outlets that inform customers about the carbon emissions of their menu choices and offer low carbon alternatives.
<b>WHO ARE THE INNOVATORS?</b>	<p>The Otarian restaurant, based in New York and London, lists the carbon footprint of everything it serves on its menu. Customers have a loyalty card, which they can use to store the carbon they save and once they reach a target, they get a free meal.</p> <p>Bon Appétit Management Company is a US firm that provides café and catering services to corporations, colleges and universities in over 400 locations in 29 states. Their service model involves informing chefs and customers on food choices that help reduce carbon impacts.</p> <p>Max Burger, a Swedish fast-food chain that publishes the carbon footprint of each item on its menu, while encouraging customers to eat less meat.</p>
<b>WHO ARE THE ADOPTERS?</b>	Restaurant diners and caterers.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	The majority of sustainability efforts in the food industry focuses on direct operations, which only account for a small fraction of their total environmental footprint. Businesses should take a life cycle approach from farm to fork, where wider impacts within suppliers and consumer behaviour are addressed. These examples of catering and retail firms engaging consumers on healthier and more sustainable food choices, demonstrate the practicality of increasing customer awareness of the energy and resources it takes to produce meat and encourage more considered consumption.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	<p>There has been much discussion about the role of retailers in guiding consumers towards more sustainable consumption. However, there is little evidence of retailers actively directing customers towards more sustainable consumption choices at a significant scale.</p> <p>Guiding consumers towards more sustainable choices, for example through a carbon-cost menu and offering low-carbon alternatives, is one of the most powerful means by which the food industry can positively influence consumers' health and the ecological sustainability of our food systems.</p>



## LOW-CARBON REAL ESTATE USER ALLIANCE

<b>DESCRIPTION</b>	Created in mid-2009, the Greenprint Foundation is an alliance of real estate investors and occupiers, including some of the biggest companies in the world. All members are committed to making their properties more energy efficient to reduce carbon emissions – while increasing property values across the global real estate industry at the same time.
<b>WHO ARE THE INNOVATORS?</b>	Allianz and Prudential Real Estate Investors, Aetos Capital, AvalonBay, Beacon Capital Partners, Douglas Emmett, GLL Real Estate Partners, Henderson Global Investors, Hines, Jones Lang LaSalle, McArthurGlen Group, Paramount Group, PATRIZA Immobilien, ProLogis, RREEF and Sonae Sierra.
<b>WHO ARE THE ADOPTERS?</b>	The alliance’s members, who can compare their energy saving performance against each other using the Foundation’s Carbon Index. They can do this anonymously to control the flow of commercially sensitive data. The Foundation has publicly published its carbon index and is committed to publishing white papers and case studies in the future to pass on knowledge to others.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	The Greenprint Foundation provides valuable information. Looking at the activity of over 35,000 tenants, the Carbon Index gives an insight into their energy use patterns, so building owners and occupiers can benchmark their energy procurement strategies and consumption patterns. The data also lets us see the growth in the use of renewable technologies and renewable electricity among members.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	In developed economies, a significant portion of greenhouse gas (GHG) emissions come from the built environment. Around 36% of total UK GHG emissions come from building’s energy consumption, according to Department of Energy and Climate Change estimates <sup>2</sup> . The Greenprint Foundation members share operational data on energy, water, waste and emissions from 16.3 million m <sup>2</sup> of buildings across the globe. Using this data, members can analyse and benchmark their efforts to reduce emissions.

<sup>2</sup> [http://downloads.theccc.org.uk.s3.amazonaws.com/4th%20Budget/4th-Budget\\_Chapter5.pdf](http://downloads.theccc.org.uk.s3.amazonaws.com/4th%20Budget/4th-Budget_Chapter5.pdf)

## CHINA'S ELECTRIC BICYCLE REVOLUTION

<b>DESCRIPTION</b>	Electric bicycles powered by rechargeable lithium-ion batteries.
<b>WHO ARE THE INNOVATORS?</b>	Luyuan (Green Power) is the largest electric bicycle manufacturer in China.
<b>WHO ARE THE ADOPTERS?</b>	Luyuan reports that 36 million electric bicycles were sold in China during 2010.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Electric vehicles of all sizes reduce air pollution and have the potential to be powered by low-carbon or renewable energy.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	<p>China's aim to build a world-beating electric vehicle industry is clear and well-reported. In March 2011, the State Grid Corporation of China announced a target of manufacturing 500,000 electric vehicles by 2015, along with a supporting infrastructure of 220,000 charging points and 2,351 battery swap stations.</p> <p>However, the rapid uptake of electric bicycles is less reported. If electric bicycle use replaces car journeys, the uptake of electric bicycles could have a significant impact on air quality and greenhouse gas emissions from China's rapidly urbanising population of 1.3 billion people.</p>

**36M**  
OVER 36 MILLION  
ELECTRIC BICYCLES  
WERE SOLD IN  
CHINA DURING 2010



*An electric bicycle (as pictured) has an electric motor that is used to power the vehicle. It has rechargeable batteries and can travel up to 20mph. China has experienced rapid growth of sales with an estimated 120 million electric bicycles on their roads as of early 2010. This boom was triggered by Chinese local government's efforts to reduce traffic congestion and pollution in city centres.*

## RENEWABLE ENERGY FINANCE SCHEMES FOR THE POOR

<b>DESCRIPTION</b>	Partnerships between energy service firms and banks to create financing schemes so rural, 'bottom of the pyramid' households can buy solar lighting technology.
<b>WHO ARE THE INNOVATORS?</b>	SELCO, a social enterprise which employs 170 people across 25 energy service centres in Karnataka and Gujarat, India. Since 1995 it has sold, serviced and financed 115,000 solar systems. Rural bank Karnataka Vikas Grameen Bank is a long-term partner of SELCO.
<b>WHO ARE THE ADOPTERS?</b>	Customers range from rural households to schools and Madrasas (Islamic schools) including Neelbagh School and Madrasa Baitul Uloom. SELCO has also provided renewable energy to villages such as Bommalapura and small businesses.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Solar PV panels provide a renewable energy alternative to polluting and health-damaging energy sources like kerosene. Where solar lighting is cost effective, it can save households money.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Thirty percent of India's rural population suffer from chronic poverty. Innovative financing models like this allow the poorest to save money, improve their health, and reduce carbon emissions. SELCO's work with rural Indian banks and NGOs indicates that renewable energy service financing to the poor is a viable proposition.

# 115,000

SINCE 1995, SELCO HAS  
SOLD, SERVICED AND  
FINANCED 115,000 SOLAR  
SYSTEMS TO THE POOREST  
HOUSEHOLDS IN INDIA

## SOLAR PANEL GROUP DEALS FOR RESIDENTS

<b>DESCRIPTION</b>	An enterprise which negotiates group ‘bulk buy’ deals for householders looking to buy roof-top solar PV panels. The firm manages the solar installer selection process and negotiates a group discount in exchange for a customer referral fee from the supplier.
<b>WHO ARE THE INNOVATORS?</b>	One Block Off The Grid, a US firm, offers group deals on solar PV installations in Los Angeles, Maryland, Massachusetts, New Jersey and the San Francisco Bay area.
<b>WHO ARE THE ADOPTERS?</b>	Home owners in Los Angeles, Maryland, Massachusetts, New Jersey and San Francisco. One Block Off The Grid are developing a service which will help tenants collaborate with their landlords to install solar PV panels.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Rooftop solar PV panels provide renewable electricity for households which they can use themselves or sell back on to the grid.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Countries including Canada, Germany, Italy, the UK and several US states have created feed-in-tariff incentives for home owners to install solar energy generation, enabling them to make some money from their panels. Domestic solar energy generation is a key part of California’s energy strategy; the state is aiming for one million rooftop solar installations by 2017. Group purchasing can help lower solar PV panel installation costs for customers, encouraging uptake, and potentially stimulating demand through the ‘neighbourhood effect’, where people follow a general trend in their neighbourhood.

## SOLAR ENERGY KIOSKS

<b>DESCRIPTION</b>	<p>Developing a blueprint solution for an off-grid photovoltaic energy supply for rural villages in the developing world. The energy kiosk is set up to charge an array of battery boxes, that customers can take away to charge their mobile phones, or for lighting, for a small fee. The battery box has the potential to support any low power devices, including low power medical equipment.</p>
<b>WHO ARE THE INNOVATORS?</b>	<p>e.quinox, an initiative founded by a team of electrical engineering students at Imperial College London in 2008. They are supported by academics from Imperial College and the Kigali Institute of Science and Technology, Rwanda.</p>
<b>WHO ARE THE ADOPTERS?</b>	<p>Energy kiosks have been installed in three villages in different regions in Rwanda. Local people use the kiosks to charge mobile phones and other appliances. Local authorities and students from KIST collaborate with e.quinox, giving advice on marketing, pricing and shopkeepers to manage the kiosks.</p> <p>There is now another kiosk in UN Habitat serving another 100 households and one in Tanzania supporting a school – 50 households. The original kiosks were designed to serve up to 400 households in total (but of course practical numbers are lower) – these are in Batima, Rweru; Minazi, Gakenke; and Kamonyi, Gihara. The last one was an experimental non-solar setup, connected to the grid.</p>
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	<p>Renewable energy for off-grid villages. The energy kiosks are developed to be financially sustainable as well – if successful, these kiosks should ‘finance themselves’.</p>
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	<p>Around 85% of Rwanda’s population live in rural areas, yet these areas account for just one third of energy consumption in the country. The system is designed to be flexible, and not adhere to solar power only – the students plan on deploying small hydro-powered kiosks the following year. The e.quinox’s energy supply model has the potential to be replicated across rural areas, providing renewable energy for unserved communities, if it proves that it can finance itself.</p>



*“e.quinox’s mission is to find the perfect blueprint solution for rural electrification that can be replicated throughout rural communities everywhere. It is a tough process, as there are many considerations – technical, business, socioeconomic, logistics – particularly so as there is little ‘market data’ about these areas. It is our belief that the financially sustainable approach is the only way forward to tackle this difficult modern world issue.”*

Daniel Choudhury, vice chairman, e.quinox



## RENEWABLE ENERGY-GENERATING SHIPS

<b>DESCRIPTION</b>	Innovators like B9 Shipping are developing cargo ships powered by 100% renewable energy. These ships typically combine modern sail technology to generate thrust from wind with biofuel-powered engines. Some ships will go even further and actually generate energy themselves, store it and transfer it back to the grid.
<b>WHO ARE THE INNOVATORS?</b>	<p>The Fraunhofer Centre For Manufacturing Innovation has designed a vessel which can harvest wave-energy offshore, store it, and transfer it to the grid during peak demand.</p> <p>J Kim and C Park, from the Korea Aerospace Research Institute and the Korea Advanced Institute of Science and Technology, have also demonstrated the potential for a ship to store energy generated from wind. In their design, a ship towed by a giant parafoil (parachute) generates electrical power with under water hydraulic turbines. The electrical power is then used to produce a liquid energy store, such as hydrogen created from the electrolysis of water.</p>
<b>WHO ARE THE ADOPTERS?</b>	No plans to test renewable energy-generating ships have been disclosed. However, current model the Auriga Leader is partly powered by solar panels <sup>3</sup> . Planet Solar, a Swiss design team, have also built a solar-powered catamaran covered with 600m <sup>2</sup> of solar PV panels <sup>4</sup> .
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Renewable energy-powered cargo ships could significantly reduce greenhouse gas emissions, while renewable energy-generating ships could feed power into national grids, or provide liquid fuel.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Over 80% of goods used worldwide are moved by sea. According to The Carbon War Room shipping initiative, global shipping industry produces one billion tonnes of CO <sub>2</sub> each year. The industry is currently focusing its reduction efforts on improving fuel efficiency. But shipping powered by renewable energy could make cargo shipping greenhouse gas neutral. Furthermore, energy generating ships could provide a platform for harvesting offshore energy, without power transmission lines.

<sup>3</sup> <http://www.cbc.ca/news/technology/story/2008/12/19/solar-freighter.html>

<sup>4</sup> <http://www.guardian.co.uk/environment/2010/apr/01/turanor-solar-power-yacht-launch>



*With over 80% of the world's goods transported by sea, ships powered by renewable energy will significantly help to reduce carbon emissions from this form of transport.*

## PHONE-CONTROLLED SOLAR WATER PUMP

<b>DESCRIPTION</b>	A solar-powered water pump accessed via a mobile phone payment system, known as LIFELINK. People can take water from a small concrete storage structure using a credited FOB key. Data on water consumption, local water tables and other operations can be accessed remotely to manage water supplies.
<b>WHO ARE THE INNOVATORS?</b>	Grundfos group, a manufacturer of pumps and water technologies, developed the LIFELINK solar water pump system.
<b>WHO ARE THE ADOPTERS?</b>	Grundfos have partnered with the Red Cross to deploy the solar water pump at 14 sites across arid and semi-arid Kenya, including the drought-prone Isiolo district. The scheme has two telecoms partners, M-PESA and Safaricom <sup>5</sup> .
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Access to clean water using renewable energy infrastructure.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	As well as providing much needed safe drinking water, the Nordic Development Fund estimate that one site with solar-powered pumps averages savings of around 700 tonnes of CO <sub>2</sub> emissions per year <sup>6</sup> . Solar power eliminates local dependence on imported fossil fuels and physical labour to pump freshwater.

<sup>5</sup> [http://www.vodafone.com/content/index/about/about\\_us/money\\_transfer/news/grundfos.html](http://www.vodafone.com/content/index/about/about_us/money_transfer/news/grundfos.html)

<sup>6</sup> <http://www.ndf.fi/index.php?id=82>

## SOLAR THERMAL AND WASTE HEAT AIR-CONDITIONING

<b>DEFINITION</b>	Renewable energy powered air-conditioning which uses thermal energy from solar power or waste heat rather than electricity.
<b>WHO ARE THE INNOVATORS?</b>	The Hangzhou Integration of Solar, Air and Water (ISAW) Technology Corporation, based in Hangzhou, China, develops heating, ventilation, air-conditioning, energy recovery and desalination products based on psychrometrics – engineering based on the physical and thermodynamic properties of gas-vapour mixtures.
<b>WHO ARE THE ADOPTERS?</b>	Masdar City, Abu Dhabi, engaged Hangzhou ISAW Technology Corporation to develop a large-scale solar-powered liquid air-cooling system.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Using solar thermal energy and waste heat saves energy and reduces CO <sub>2</sub> emissions.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Most commercial and public sector buildings around the world have heating, ventilation and air-conditioning systems which require electricity. This system eliminates the need for fossil-fuel generated electricity, creating a significant opportunity for energy and carbon savings. The Hangzhou ISAW Technology Corporation estimate that if their products made up 5% of the heating, ventilation and air-conditioning market in China, the country would save 30 million tonnes of CO <sub>2</sub> equivalent.

## 100% RENEWABLE ENERGY CHARGING FOR ELECTRIC VEHICLES

<b>DESCRIPTION</b>	An innovative partnership between an electric vehicle (EV) infrastructure firm and a renewable energy provider to deliver charging systems for EVs using only renewable energy.
<b>WHO ARE THE INNOVATORS?</b>	<p>The world's first known national network for EV charging was launched on 27 July 2011. Ecotricity, a renewable energy retailer, and Welcome Break, which runs service stations, launched a network of free electric car charging points, powered by renewable energy, which will eventually span 27 motorway service stations.</p> <p>In 2011, Betterplace, an EV infrastructure firm operating in Australia, the EU, Israel and the US, signed a \$60m deal with Australian utility ActewAGL to supply renewable energy to its EV charging network in Canberra for the next 10 years. Another partnership is Green Mountain, a renewable energy retailer, with eVgo, an EV infrastructure firm owned by US utility NRG Energy.</p>
<b>WHO ARE THE ADOPTERS?</b>	In policy makers' and many customers' minds the end-goal of increasing EV uptake is to power them with low-carbon energy.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	By installing EV charging networks in popular destinations and roads will help to increase consumer confidence in buying and using the vehicles. It also encourages the uptake of renewable energy.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Partnerships between renewable energy providers and EV infrastructure firms are a great way to encourage the uptake of EV transport options. Creating local and national charging infrastructure frameworks for EVs will also significantly help to improve accessibility.



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*Innovative partnerships between renewable energy providers and EV infrastructure organisations will hopefully see the increase of local and national EV charging networks to upscale accessibility to 100% renewable transport options.*

## ISLAND-WIDE SMART GRID

<b>DESCRIPTION</b>	A new 'smart' electricity grid which will be installed on Maui in Hawaii and will manage a relatively high percentage of renewable energy. It is made up of a network of intelligent electronic devices and bi-directional flows of electricity and communications.
<b>WHO ARE THE INNOVATORS?</b>	Six companies will collaborate to implement the smart grid, which will handle 15% renewable energy. It will also demonstrate load control and support infrastructure to charge electric vehicles. Cyber Defense Institute, HP Japan, Hitachi, JFE Engineering, Mizuho Corporate Bank and Sharp will work together with Japan's New Energy and Industrial Technology Development Organization (NEDO), the Hawaiian Electric Company, the University of Hawaii and the Pacific Northwest National Laboratory.
<b>WHO ARE THE ADOPTERS?</b>	The US state of Hawaii.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	This project will demonstrate the effectiveness of an electricity grid supplied by a large proportion of renewable energy.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	The collaboration will build and test a system to manage the fluctuations in power that happen when large volumes of weather-dependent renewable energy, such as wind and solar, are added to a power grid.



## RENEWABLE ENERGY MICRO-GRIDS FOR RURAL AREAS

<b>DESCRIPTION</b>	Renewable energy micro-grids for remote communities, which also enables residents to share costs of installation and maintenance between multiple households. These can include solar PV panels, efficient LED lighting and mobile phone charging points.
<b>WHO ARE THE INNOVATORS?</b>	Mera Gao Micro-Grid Power (MGP).
<b>WHO ARE THE ADOPTERS?</b>	Rural villages in Uttar Pradesh, India. MGP partners with the Sarathi Development Foundation, an Indian NGO, to work with villagers to decide whether solar-powered lighting is an appropriate replacement for traditional kerosene lighting. MGP has already built six solar micro-grids in Uttar Pradesh and Bihar.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Solar PV provides clean, renewable energy to replace greenhouse gas-emitting energy sources like kerosene and diesel – which also pose a risk to people’s health.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Micro-grid systems can share the costs of rooftop solar PV installation and maintenance between multiple households. The cost of the solar PV micro-grid can be kept low as the energy demand from households using LED lighting is typically low. Low cost micro-grids can play an important enabling role in meeting India’s goals to extend solar-powered lighting to rural areas. By 2022 the Indian government’s National Solar Mission aims to install 20 gigawatts of solar power, and provide 20 million solar lighting systems to replace kerosene lamps in rural communities. Significant commercial opportunities will emerge through this expansion of solar power: India’s Centre for Development Finance and Research and the World Resources Institute estimate that the potential market for clean energy products and services for India’s rural poor totals \$2.11 billion per year.

## TRANS-EUROPEAN LOW-CARBON TRANSPORT NETWORK

<b>DESCRIPTION</b>	A transport network made up of existing road infrastructure and railways coupled with an electric vehicle charging network of battery swap stations and charging points, powered by renewable energy.
<b>WHO ARE THE INNOVATORS?</b>	The European Commission has awarded a coalition of organisations, businesses and cities €4.95 million to analyse, test and pilot an electric vehicle charging infrastructure of battery switch stations and existing rail infrastructure. Better Place will coordinate the project, with the following organisations working together: the City of Amsterdam; the City of Copenhagen; DSB Kommerciel, a Danish rail travel provider; Elia System Operator, the Belgian electricity transmission operator; FCC Construcción, a construction firm based in Spain; the Public Research Center Henri Tudor of Luxembourg; the Technical University of Denmark; and Verbund, an Austrian power utility.
<b>WHO ARE THE ADOPTERS?</b>	Ministries of Transport from Austria, Belgium, Denmark, Luxembourg, the Netherlands and Spain have endorsed the project.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	The development of a renewable energy-powered transport network across Europe, cutting carbon emissions significantly.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	The EU's 'roadmap for moving to a low-carbon economy in 2050' report identifies the electrification of transport as a target for 'major and sustained investment'. Pilot projects such as this will help strengthen the case for a renewable energy-powered transport network.



*"This project is the first ever and only one awarded under the TEN-T programme for being a de-carbonisation infrastructure project. We believe that when scaled, a multi-nodal transport network with our network for electric car charging as the backbone represents one of the greatest opportunities to help Europe achieve its 2020 goals. We're helping to displace oil use and harmful CO<sub>2</sub> emissions for a better trade balance and more green jobs."*

Joe Paluska, vice president, communications, Better Place

<sup>7</sup> <http://www.euractiv.com/en/climate-environment/eu-low-carbon-roadmap-aims-25-cuts-2020-news-502197>



© COURTESY OF BETTER PLACE

*Better Place will co-ordinate a project to analyse and pilot a trans-european transport network which involves embedding EV charging and swap stations within existing road and rail infrastructure.*

## TOP RUNNER PRODUCT STANDARDS RACE

<b>DESCRIPTION</b>	A set of minimum standards for energy efficiency in products. Positive and negative labelling shows whether products are up to standard. Manufacturers race to achieve the ‘Top Runner’ status in their product category, while products failing to meet the standard are labelled negatively.
<b>WHO ARE THE INNOVATORS?</b>	Japan’s Top Runner programme sets minimum efficiency standards for 23 categories of machinery, equipment and vehicles under the Energy Conservation Law. The programme applies a minimum standard for each category, which is periodically raised according to the speed of innovation. The most efficient product in the category is labelled the ‘Top Runner’. Manufacturers then agree a timeframe within which they must meet the minimum standard, or their product will be labelled negatively.
<b>WHO ARE THE ADOPTERS?</b>	Manufacturers of automobiles, consumer appliances, copiers, vending machines, heaters and transformers for the Japanese market have to comply with the Top Runner programme.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	This model makes products more energy efficient, saving energy and lowering greenhouse gas emissions. Similar systems could be set up to set standards for other products, like those that use water, for example.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	A mix of regulation, which fosters industry collaboration, competitive dynamics and reputational risk have been effective in making Japanese manufacturers raise their standards. Though Japanese firms may be particularly sensitive to reputational risks, this model could be replicated anywhere.

## DECOUPLING REVENUES FROM ENERGY SUPPLY

<b>DESCRIPTION</b>	Regulatory model that means power utilities profit when people use less energy.
<b>WHO ARE THE INNOVATORS?</b>	The Californian Power Utilities Commission. California applies a complex body of legislation comprising regulation of utilities and financial incentives. The key innovation has been to decouple energy sales from profit by fixing the revenues that utilities can collect from customers in advance. Utilities under this system are not incentivised to sell more energy to customers, and instead pursue rewards offered by regulators for creating customer energy efficiency savings, and the reduction of their own fixed or variable costs.
<b>WHO ARE THE ADOPTERS?</b>	The state of California implements one of the most effective examples of decoupling regulation. However, some form of decoupling has been implemented in 30 US states for at least one power utility.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Improvements in customer energy efficiency are achieved through the efforts of utility companies.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	State-level regulation decoupling energy sales from revenues has enormous potential to increase energy efficiency, as demonstrated by California. The applicability of this type of regime extends to all privatised utility markets, where energy demand reduction plans are required to meet energy security and climate change mitigation goals. The model could also be applied to the water utility sector.

## PLANT-INSPIRED SOLAR ENERGY

<b>DESCRIPTION</b>	Dye-sensitised solar cells which can be used to replace existing glass windows, or be integrated into a variety of areas from building facades, roofing, backpacks to tents.
<b>WHO ARE THE INNOVATORS?</b>	Dyesol, a supplier of solar technology based in Australia, describes their technology as ‘artificial photosynthesis’ using an electrolyte, a layer of titania (a pigment used in white paints and tooth paste) and ruthenium dye sandwiched between glass. Light striking the dye excites electrons which are absorbed by the titania to become an electric current many times stronger than that found in natural photosynthesis in plants. Dyesol’s technology is listed as an example of biomimicry on Ask Nature, a web platform developed by the US Biomimicry Institute, which links design problems to solutions that have evolved in nature.
<b>WHO ARE THE ADOPTERS?</b>	Dyeseol works with others to develop, manufacture and market metal roof and wall cladding products with dye-sensitised solar cells integrated into the steel surface.
<b>WHAT ARE THE ENVIRONMENTAL SUSTAINABILITY BENEFITS?</b>	Dye-sensitised solar cell technology could enable a densely populated country such as the Netherlands or UK to significantly increase solar energy generation.
<b>WHY IS IT POTENTIALLY GAME-CHANGING?</b>	Innovation in dye-sensitised solar cells has the potential to provide affordable solar power generation while dramatically increasing the surface area we can use for solar technology. The Dyesol and Tata collaboration aims to supply one third of the UK’s renewable energy needs by 2020, capitalising on the 4 billion m <sup>2</sup> of building facades and roofing in the UK.



*“The core idea is that there is no need to reinvent the wheel. After 3.8 billion years of evolution, nature has already found the solutions to the sustainability challenges humans face.”*

Janine Benyus, founder of the non-profit Biomimicry Institute and author of Biomimicry: Innovation Inspired by Nature



© PHOTO COURTESY OF DYESOL

*Dye-sensitised solar cells have the capacity to be applied to replace existing glass windows to generate power. Dyesol's most recent achievements include integrating the solar cells into fabrics such as backpacks and tents which give access to light-weight and portable sustainable energy solutions.*



## LOOKING AHEAD

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In this report, we've explored 50 new innovations from around the globe and some of the lessons that can be taken from them. We've grouped the innovations according to key elements of sustainable businesses – dematerialisation, restorative, open loop and renewable energy and low carbon.

These case studies have provided exciting examples of business activities that could be game-changing if conditions emerge where the innovations can be deployed at scale. Multinational corporations which recognise the need for transformation that couples business success with natural capital stewardship will benefit if they develop conditions whereby innovations such as the ones in this report can flourish.

One of the fascinating examples of **dematerialisation** centres on peer-to-peer lending or leasing of household goods – from the likes of Ecomodo and Zilok. These illustrate collaborative consumption in action. This approach can replace all kinds of conventional resource-inefficient buy and sell models with more dematerialised business services. Such an approach is often explored by high street retailers but overcoming the barriers to jumping into this space remains a challenge. Is partnership between peer-to-peer enterprises and retailers an option? Or could there be a knowledge transfer to stimulate the escalation of such business services?

The report looked at **restorative** – the idea of moving beyond damage limitation, to the creation of net positive social and environmental impacts. One excellent case study is from Ecuador, where the Fund for the Protection of Water collects payments from downstream water users and uses the income to fund upstream watershed management. Many companies are taking steps to manage their impacts. But are they also challenging themselves to go further and generate enhancements to the world's natural capital during the course of doing business?

International **open loop** practices are on the increase. This report highlights companies like International Synergies, which offers industrial symbiosis web platforms to help find new uses for waste. British Sugar's waste heat and CO<sub>2</sub> used for growing tomatoes in

the UK's largest glasshouse was another extraordinary open loop innovation. It seems we are just scratching the surface when it comes to turning waste into a resource. The scaling up within this area requires a great deal more collaborative thinking between companies and sectors. How might companies collaborate more and bring more ideas from their side to the likes of International Synergies?

Finally, there are many innovations in the **renewable energy and low carbon** space. It's becoming increasingly evident that today's technology could deliver a future where we come close to 100% renewable energy by the middle of this century. This would achieve the necessary cuts in carbon from the energy sector. The largest electric bicycle manufacturer in China – Luyuan (Green Power) – has reported that 36 million electric bicycles were sold in China in 2010. If electric vehicles as a whole are to form an effective part of a low-carbon energy system, they'll require new international incentive structures and greater support from the automotive sector, on a global scale.

There are exciting opportunities ahead. Unleashing the power of business innovation will be critical if we're to arrive at sustainable solutions. We look forward to receiving more case studies, sharing experiences, and seeing small and large businesses innovating to their full potential in order to tackle today's global challenges.

Please continue to add your findings to ours at [wwf.org.uk/innovation](http://wwf.org.uk/innovation) and help to build a future in which people and nature thrive.

### Acknowledgements

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# Innovation in numbers

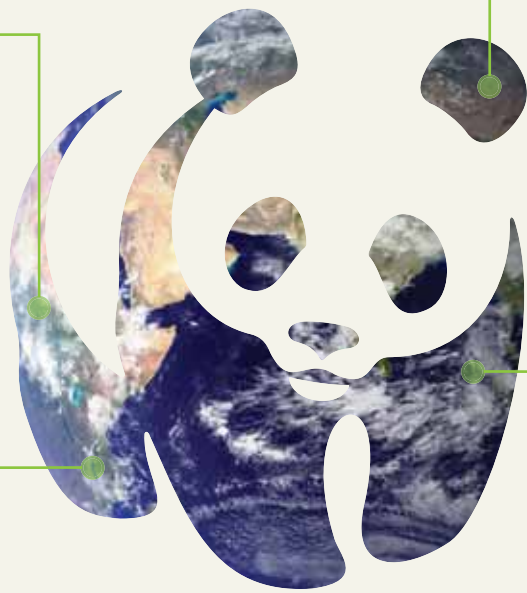


4.3%

The UK's total green goods and services market grew 4.3% year-on-year, expanding by £4.8 billion during 2009/10.\*

## SIXTH

The UK's Low Carbon and Environmental Goods and Services (LCEGS) sector is the sixth largest in the world behind the US, China, India, Japan and Germany.\*



US\$2-6TN

Sustainability-related business opportunities in natural resources (including energy, forestry, food and agriculture, water and metals) may be in the range of US\$2-6 trillion by 2050.\*\*

100%

In *The Energy Report*, we show that all the world's energy needs could be met by renewable energy by 2050.\*\*\*

	<p><b>Why we are here</b> To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.</p> <p>wwf.org.uk</p>
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\* Department of Business, Innovation and Skills – Low carbon and environmental goods and services, July 2011.  
\*\* The Economics of Ecosystems and Biodiversity Report (TEEB 2010).  
\*\*\* The Energy Report – WWF and Ecofys 2011.