SUSTAINABLE TRANSPORT

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EDITOR'S LETTER

"For 200 years we've been conquering nature.
Now we're beating it to death"
Thomas McMillan, Canadian Minister of the Environment

Booth Tarkington's 1918 novel, The Magnificent Ambersons, won the 1919 Pulitzer Prize. It follows the Amberson family – aristocrats in the US whose fortunes are on the decline as the country goes through a period of rapid industrialisation and socio-economic change. Tarkington's characters discuss the rise of the automobile over dinner. Teenage son George describes it as *"a useless nuisance"*, adding, *"They had no business to be invented."*

Eugene Morgan, an automobile manufacturer, thinks George may be right. *"With all their speed forward, they may be a step backward in civilisation"*, he says. *"It may be that they won't add to the beauty of the world or the life of men's souls. I'm not sure. But automobiles have come. And almost all outward things are going to be different because of what they bring. They're going to alter war and they're going to alter peace. And I think men's minds are going to be changed in subtle ways because of automobiles."*

Tarkington wrote The Magnificent Ambersons with the benefit of hindsight, with the story set just a decade or two before the 1918 publication. He likely wrote Eugene's dialogue already knowing the automobile's massive impact on society. Around the beginning of the 20th century, an industrialist by the name of Henry Ford and his flagship Model T were beginning to get noticed. Ford went on to introduce a new era of mass production and mass consumption – so much so that by the end of 1919, half of all cars in the US were manufactured by his company.

However, before his arrival on the scene it was electric vehicles that ruled the roost in the US, outselling gasoline-powered cars ten to one in the late 1890s. Meanwhile, Ford's wife, Clara, was an early adopter of the electric car. From 1908, she drove a Detroit Electric – a battery-powered vehicle with a top speed of 20mph that ran for 80 miles on a single charge.

Few people could have predicted just how revolutionary the humble automobile was. It initially connected people with places that were once unreachable – still true in the developing world today. But with this revolution came unforeseen negative impacts, from road deaths to urban sprawl; increased obesity to community disconnection. Then there's the small issue of air pollution.

Cars are, of course, just one part of the picture when it comes to transport. Rail's history stretches back even further, with the English industrialist Robert Stephenson's famous Rocket at the forefront of the stream train revolution. In the 1850s, just 20 years since the opening of the Liverpool and Manchester Railway in Britain, the country had over 7,000 miles of railway. Meanwhile, there are arguably even bigger environmental questions relating to air travel and shipping – both of which use massive amounts of fuel, but are in some cases going to great lengths to become more sustainable.

Ford's mass production model set the ball rolling on a manufacturing boom across all industries. And as Eugene postulated, the world is a very different place as a result. The Guide to Sustainable Transport explores how current infrastructure can and must change for the benefit of the planet and its people. We thank those responsible for developing the gasoline car, but now it's time for an upgrade.

Alex Blackburne

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CONTENTS

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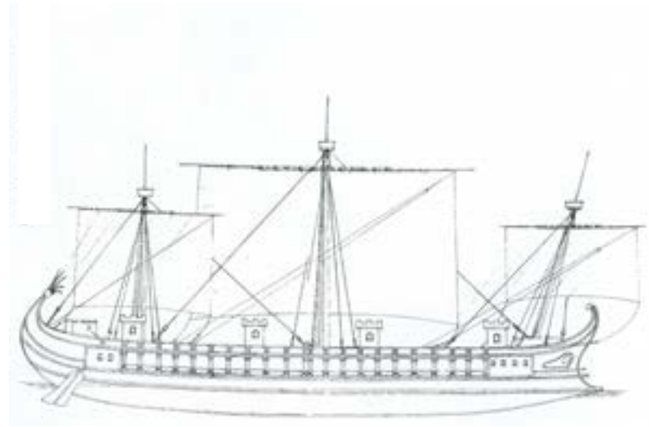
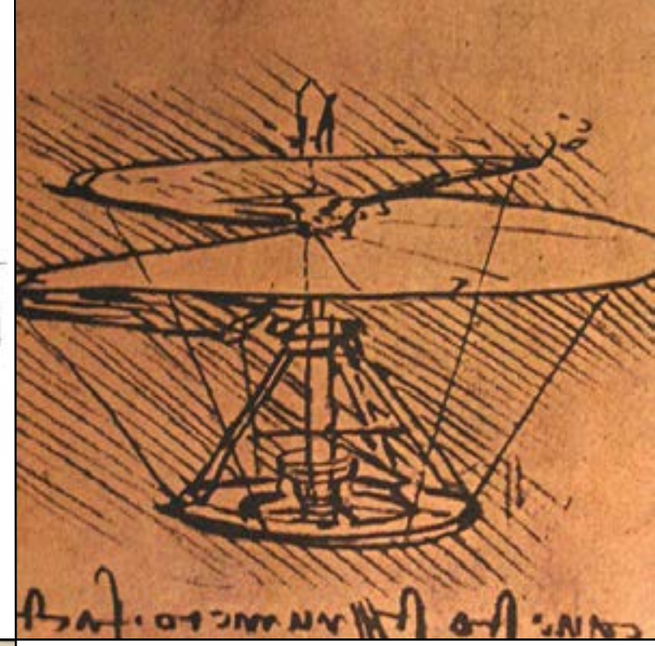
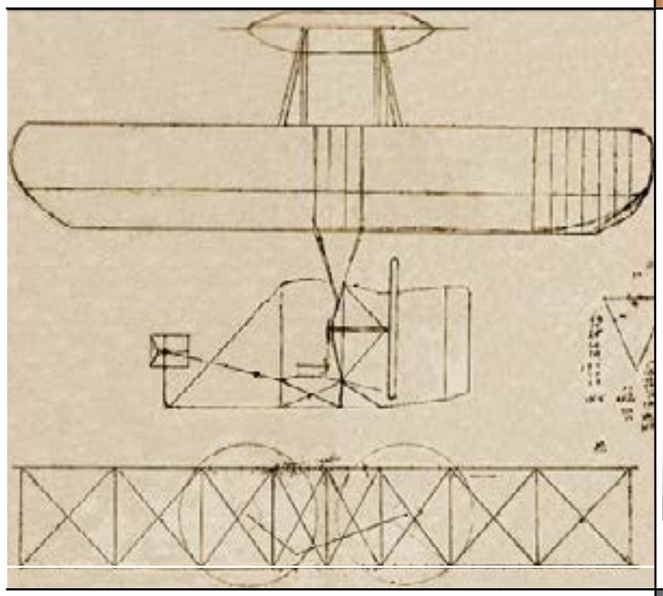
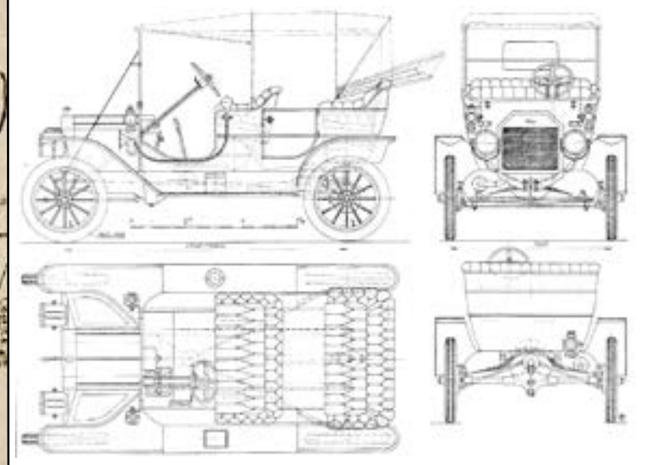
A TIMELINE OF TRANSPORT

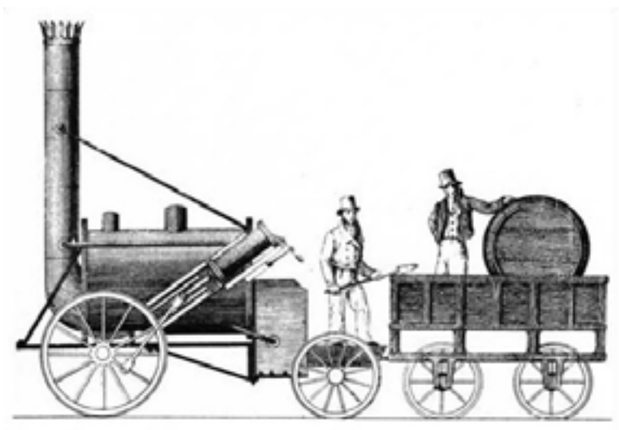
3500 BC	First wheeled vehicles
3500 BC	River boats, ships with oars, invented
2000 BC	Horses first used for transportation
1492	Leonardo da Vinci draws up first flight plans
1620	Cornelis Drebbel invents the submarine
1662	Blaise Pascal unveils first horse-drawn bus
1783	First paddle wheel steamboat demonstrated / Montgolfier brothers invent hot air balloon
1787	Steamboat invented
1769	First self-propelled road vehicle invented by Nicolas Joseph Cugnot
1790	Modern bicycles invented
1807	First hydrogen gas powered vehicle
1814	Stephenson's Rocket breaks new ground in powered rail
1862	Jean Lenoir makes first gasoline engine vehicle
1867	The motorcycle is invented
1885	First internal combustion engine powered car
1899	The Zeppelin
1903	The Wright Brothers invent and fly the first engined aeroplane
1907	First, but unsuccessful, helicopter
1908	Henry Ford introduces mass production model for car manufacturing
1926	First liquid propelled rocket launched
1938	Land speed record, steam train LNER Mallard, 126mph
1940	Modern helicopters invented
1947	First supersonic jet flight
1956	Hovercraft invented
1964	Bullet train transportation invented
1967	Air speed record, X15, 4510mph
1969	First manned mission (Apollo) to the Moon / Concorde's first flight (max speed 1354 mph)
1970	First jumbo jet
1978	Water speed record, Spirit of Australia, 318mph
1981	Space shuttle launched
1994	The Channel Tunnel opens
1997	Land speed record, ThrustSSC 763mph
2000	Toyota releases the Prius, the first petrol-electric hybrid car / Air France Concorde Crash
2002	Segway invented
2003	Concorde retired ending supersonic flight / Land speed record, Maglev Train MLX01, 581mph
2004	First high-speed Maglev train starts operation in China \ First privately-funded space flight by a human
2005	Airbus A380, carrying 800 people, takes first flight, becoming the largest passenger aircraft
2007	Boeing rollout of 787 Dreamliner / Land speed record, wheeled train TGVPOS, 357mph
2008	The Tesla Roadster becomes the world's first commercially available electric sports car
2013	Tesla and PayPal founder Elon Musk unveils human capsule transport system concept, Hyperloop

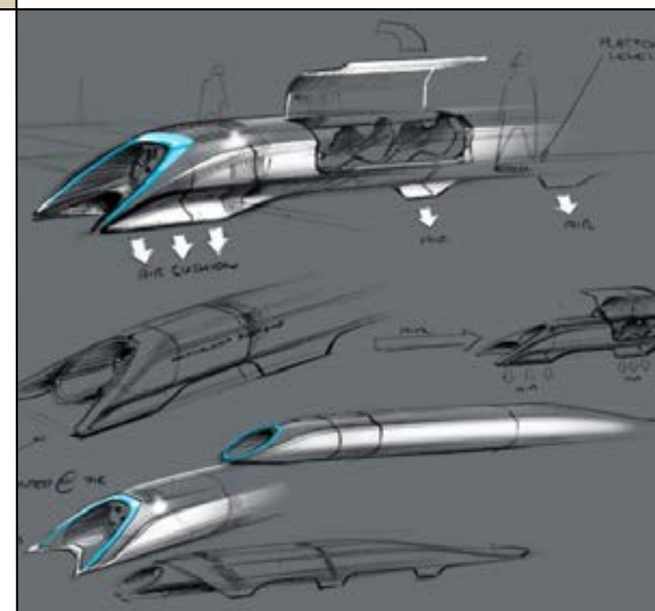












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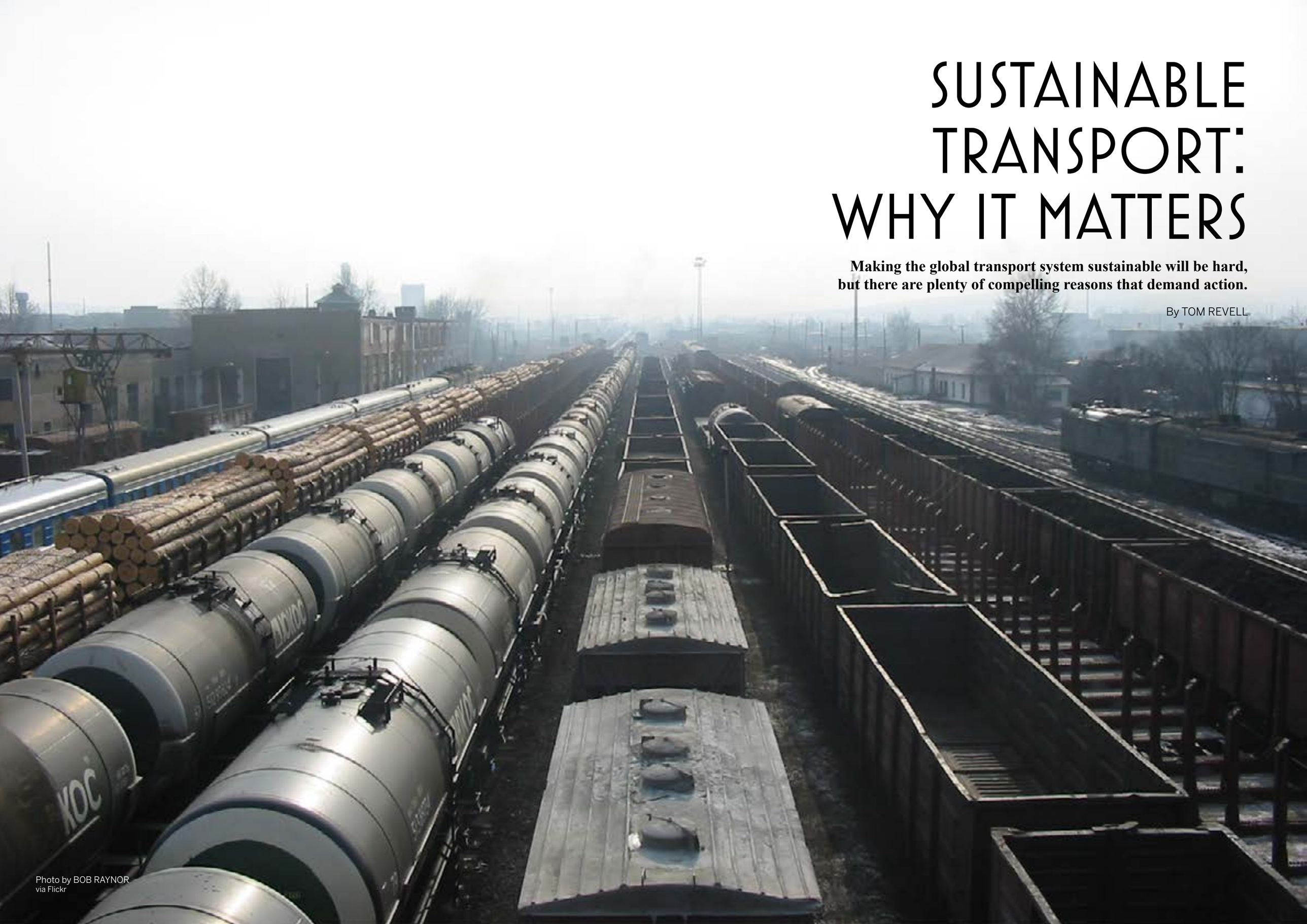
SUSTAINABLE TRANSPORT: WHY IT MATTERS

Making the global transport system sustainable will be hard, but there are plenty of compelling reasons that demand action.

By TOM REVELL



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"Overall, people do not realise how quickly the emissions actually have to decrease"
Corinne Le Quéré

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According to the latest estimates, a record high of 36 billion tonnes of carbon dioxide was emitted by the burning of fossil fuels in 2013. This represents a 2.1% increase from 2012 and a 61% increase since the 1990 benchmark. The Intergovernmental Panel on Climate Change's (IPCC) stark warning says that carbon emissions must be cut by 50% from 1990 levels in order to have just a two out of three chance of keeping average temperature increases below 2C compared to pre-industrial times, or 1.2C above today's level. If current trends continue, warming could exceed 4C by the end of the century.

Corinne Le Quéré is director of the Tyndall Centre for Climate Change Research, based at the University of East Anglia. She says staying under this 2C target is essential if we are to avoid crossing a number of *"tipping points"* that could set devastating processes in motion.

She explains, *"Because we have observed 2C of warming in the geological past, we can reconstruct what happened and we can see that the Earth has been kind of self-regulating, so there's not been anything that you could say is overly dangerous for the human species at 2C or below. This is not to say that the changes were not large, they were very large – even adapting to 2C would be a big task – but beyond 2C then it becomes an area that we don't know what is going to happen to much of an extent."*

The first tipping point likely to be crossed is the complete melting of Arctic sea ice – something that would occur shortly after, or possibly even before, the 2C threshold was passed. The second would be the melting of the Greenland ice sheet, which, if it were to disappear completely, could increase global sea levels by a staggering seven metres. Other impacts could include the increasing frequency of extreme weather, rapid changes in vegetation, resource scarcity and the devastation of agriculture. The result could be a world we barely recognise, at great cost.

"Transport is part and parcel of the urban environment."
Siim Kallas, VP, European Commission

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"With now just over 7 billion people on the planet, going up to 9 billion in a few decades, you need to have a relatively stable climate to feed these people and make sure everyone can get the level of wealth we get now", Le Quéré says.

Such catastrophes would affect all of us, but not evenly. Overwhelming, those who suffer the most from climate change will be those who contribute the least to it; people in poorer nations that are less able to defend their citizens, many of whom will have never even set foot on a plane, for instance. *"Overall, people do not realise how quickly the emissions actually have to decrease,"* Le Quéré adds. *"We are talking about decreases of 3% per year in global CO2 per year, while they are currently increasing by 2% per year. It's a U-turn we have to make."*

Transport, in all its forms, accounts for about one-quarter of global CO2 emissions. In wealthy, industrialised countries like the UK, it can account for as much as a third. The inevitable growth of transport elsewhere, driven by a rapidly emerging middle class in many developing economies, means increased global emissions are almost a certainty. If we keep driving our gas-guzzling cars to the supermarket and boarding commercial jets to far-flung places, then we can recycle all the carrier bags, build all the wind farms and buy all the Fairtrade coffee we want – it may well make no difference. If we are to effectively decarbonise our day-to-day lives, the way we travel must be one of the first things to change.

"If we take even one long-haul flight per year, this may well be the biggest single source of all our personal emissions", says Dan Calverly, a research associate at the Tyndall Centre who has specialised in transport and emissions budgets. Forgoing flying is one way we can reduce our own carbon footprints – but there are so many others. Making a personal, concerted decision to change our behaviour is crucial in sustainability. We could probably all get the bus more often than we do, and of course, there is no mode of transport more sustainable than walking.

"As voters, we can urge our elected politicians to take a more responsible path"

Away from our living habits, there are other ways we can use our influence. As investors, the possibilities are almost endless. Many sustainability-focused investment funds include sustainable transport as a key theme. They invest in areas from electric cars to companies enhancing fuel efficiency to burgeoning modes of transport that are often more suited to a science fiction film. They invest to help tackle the real problems that blight our transport infrastructure today. Meanwhile, as voters, we can urge our elected politicians to take a more responsible path.

That's not to say it's going to be easy. But to paraphrase John F Kennedy, we should become sustainable as a society and a planet because it is hard. Calverly says, *"The rates of reduction that we face in the wealthy, industrialised parts of the world are certainly very challenging, but remain feasible with the right combination of standards and regulation and investment in low-carbon energy."*

On transport specifically, Le Quéré is somewhat optimistic about the future. She says, *"There's a lot of potential for reducing emissions in transport. It's one of the sectors where there's a lot of potential because there's several ways to do it – by fuel type, by the performance of the vehicles and by reducing the number of trips for instance."*

But there is more to sustainability than carbon dioxide and climate change. Assuming almost every single credible climate scientist, scientific organisation and world government was wrong, and the globe was in fact not warming – firstly, what a relief that we aren't faced with civilisation's biggest ever threat – the benefits of re-evaluating the ways we get around the planet are still significant.

Pollution from the burning of fossil fuels is bad for our health globally. It is unsustainable to fill the air we breathe and depend on with harmful gases, regardless of their impact on the climate. But fossil fuels are not just polluting; they're finite. Oil and gas companies continue to spend large amounts of money finding harder to reach and dirtier reserves. As prices become increasingly volatile, the threat of a bursting *'carbon bubble'* could spell economic disaster.

In our cities, so many of which are designed around road infrastructure, congestion frustrates motorists and further detriments our health. Exhaust fumes are carcinogenic and can increase the chances of heart failure, asthma and other risks. Not only that, there is lots of research to suggest the presence of greener spaces in urban areas improves mental wellbeing. Instead of a new road, build a park with cycle paths and benches. Examples such as Copenhagen, Nantes and virtually anywhere in the Netherlands – where policies encourage cycling and the use of public transport – demonstrate the numerous health and aesthetic benefits of taking cars and lorries off the road. We don't have to look far for a sustainable blueprint for our future cities.

As with many environmental issues, it is not difficult to find reasons to despair at our current unsustainable travel behaviour. But this guide illustrates that there are so many opportunities in sustainable transport and so many reasons to be optimistic. We can take heart from the examples made by some of the brave, brilliant innovators, principled campaigners and keen business leaders featured in these pages. But as drivers, passengers, holidaymakers, consumers, investors and voters, we all play a crucial part.

THE CONCLUSION OF THE SEPTEMBER 2010 SPEECH BY PHILIP HAMMOND MP, THEN SECRETARY OF STATE FOR TRANSPORT.

We face huge challenges in refocusing Britain's economy to a sustainable future.

Years ago, long before Ireland's motorways were built, I was driving across that country with a colleague to a meeting on the west coast. We stopped in a small town in the Irish Midlands to ask directions of an elderly farmer. "How would you get to Sligo", I asked. "Well, you wouldn't start from here", was his instant reply.

That is sometimes how I feel about the challenges the coalition faces. But 'here' is where we have to start from. And in transport, we are clear that we have a vital part to play in addressing the challenges of the fiscal deficit, declining economic competitiveness, climate change and social exclusion. Those challenges call for a genuinely sustainable policy response: a response that recognises the need for carbon reduction, fiscal discipline, economic growth, social justice and genuine localism. Not one, or some of them, But all of them. Together. In every policy initiative.

In four months we have made a start. But we are under no illusion about the scale of the challenge ahead. But if we want Britain to have a sustainable, prosperous future, there is not a moment to lose.

The time has come to face up to our problems. To get our heads out of the sand. To recognise, and learn from, our past failures. And to get on with the job of building a sustainable future for Britain without any further delay.

And that is precisely what this government intends to do.

Full speech:
www.gov.uk/government/speeches/sustainable-transport

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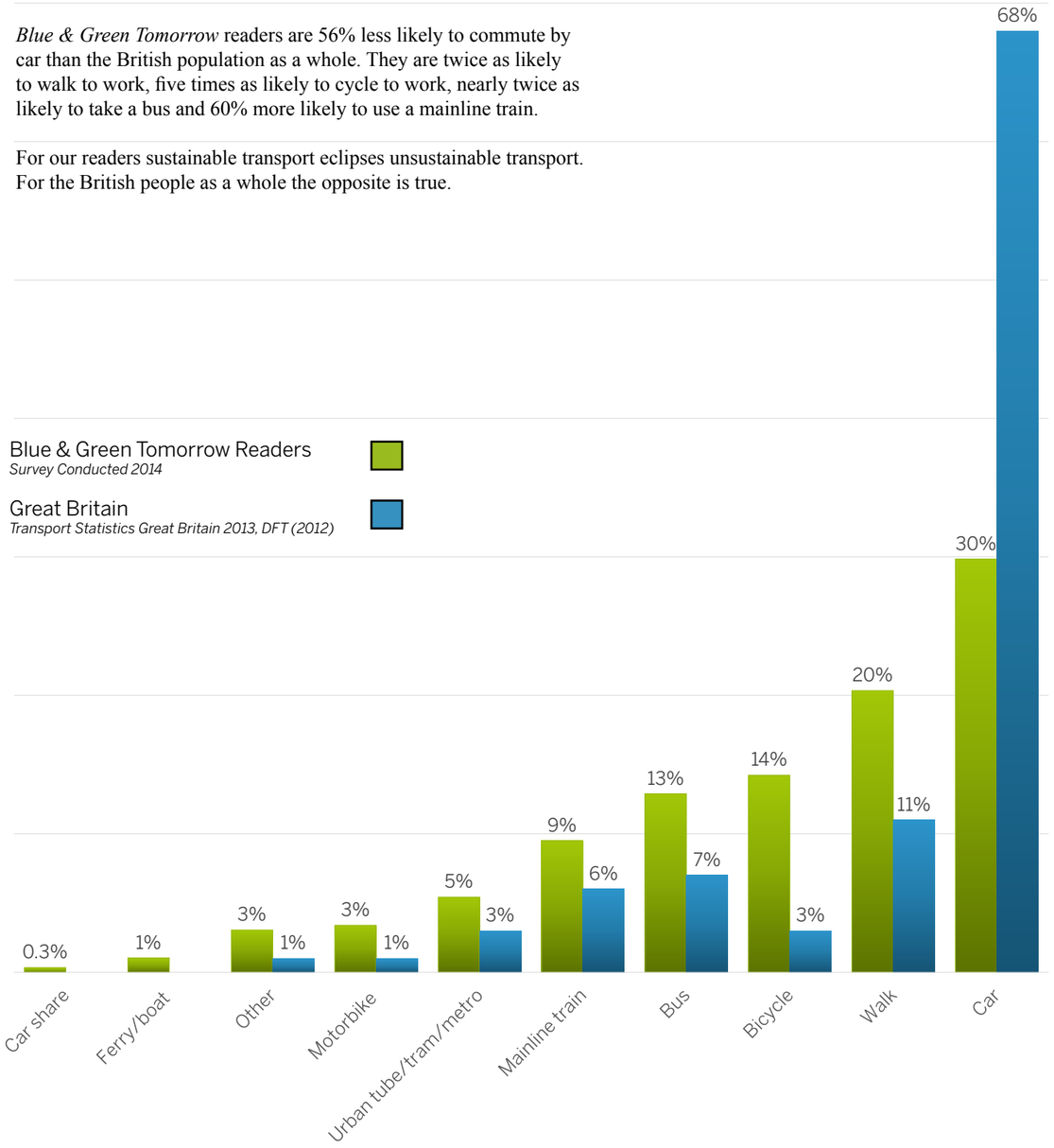
WHAT IS YOUR PRINCIPAL MODE OF TRANSPORT MONDAY TO FRIDAY?

Blue & Green Tomorrow readers are 56% less likely to commute by car than the British population as a whole. They are twice as likely to walk to work, five times as likely to cycle to work, nearly twice as likely to take a bus and 60% more likely to use a mainline train.

For our readers sustainable transport eclipses unsustainable transport. For the British people as a whole the opposite is true.



THE ROAD TO NOWHERE

"Transport continues to make the world smaller, but we have yet to pick up the bill for our increased mobility"

By JAMES MACCOLL, Campaign for Better Transport

We should be looking to increase the efficiency of our transport network, rather than building more infrastructure.

Decent transport is so central to our lives that we often only notice it when it's not there. Transport is something we complain about when traffic spoils a day out or when ticket prices stop us from doing something that we want to. Similarly, the infrastructure of transport is so embedded in the fabric of the world that we can be blind to it. Our towns and cities are built around our need to get about. Our landscapes are criss-crossed with roads and railways. Our skies are full of airliners, carrying people to and from nearly every country in the world. Our seas carry cargo to the far corners of the globe.

Modern transport has made the world smaller and moving people and things long distances has become normal. The average distance travelled by UK citizens each year has nearly doubled since the early 1970s. Airports and ports have seen corresponding growth. In 2011, UK ports handled over half a billion tonnes of goods. Passenger numbers have more than doubled since the mid-1990s and in 2013, 2m commercial flights left UK airports.

All this activity has made transport both an important service and a major industry. The position of successive governments has been that moving ever more people and goods by whatever means is both socially desirable and economically beneficial. But far less attention is paid to either the significant cost this is currently imposing on communities and the environment, or the best forms that transport can take to enable prosperous sustainable living.

In response to the recent economic downturn, business groups like the Confederation of British Industry (CBI) and the Institute of Directors (IoD) decried the country's crumbling transport infrastructure. They called for big investment, primarily in road building, in the belief that this would get the economy growing. The government's response was to announce a massive £28 billion road building programme. Next year alone, the Highways Agency plans to begin 57 major road projects and add 200 miles of trunk road and motorway to the national network.

The direct impact on the natural environment will be very considerable. Schemes like the proposed dualing of the A303 past Stonehenge, or the planned new section of the M4 across the Gwent Levels, will mean sacrificing areas with the highest protection for habitat and landscape to yet more tarmac.

Because of its impacts, road building is unpopular. The government's last attempt at a major road building programme came in the late 1980s and early 1990s. Many of the schemes that were then abandoned in the face of mass campaigns and direct action protests are now being dusted off and revisited. The most depressing aspect of this programme is that major new road building cannot actually be justified on the basis of demand. Although road travel did expand year on year between the 1950s and 1990s, it has since defied government projections of further dramatic growth. The amount of miles travelled on the UK's strategic road network is virtually unchanged since 2006 and the volume of traffic across all roads is the same now as in 2002.

A car-based society is bad for your health. Reliance on the car contributes to sedentary lifestyles that accompany poor physical fitness. For those living near busy roads, this impact is compounded by exposure to exhaust fumes which have recently been identified as a cause of cancer and implicated as a contributor to low birth weights. A more car-reliant society is often also a more unequal one. Around a third of UK households do not have access to a car. Statistics show that this is overwhelmingly made up of those on lower incomes including young people, job seekers and older people. The more we allow our lives to be organised around cars, the more these groups will be marginalised, unable to access important services such as hospitals or employment, education or training opportunities.

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Rather than blowing the budget on roads and airports, we need to invest in modern, high capacity public transport, affordable rail fares and decent bus networks

On climate change, road transport is by far the biggest source of greenhouse gas emissions from the transport sector, itself contributing a quarter of total UK emissions. Although the government has committed itself to reducing emissions from transport, progress has been very weak. Unlike other sectors of the economy, emissions from transport are on the increase. This means that if Britain is to reach its emissions reductions target, other businesses will have to take the hit while culprits like road traffic, aviation and shipping get off from playing their part.

Rather than addressing this anomaly, transport is too often treated as a special case. Recently published draft national planning guidance would actually make it illegal for a planning inspector to refuse a major road project on the grounds it would increase emissions. For aviation, commercial airlines are covered by the EU's Emissions Trading System, but a wider deal is still some way off. Foot-dragging by the International Civil Aviation Organisation means a global emissions trading system will not be in place until 2020 at the very earliest. Shipping fairs even worse, with European Union measures to even quantify emissions not due to come into force until 2018.

Rather than building ever more infrastructure, we should be looking to increase the efficiency of our transport networks. Last year, Campaign for Better Transport joined with Cubic Transportation Systems, Telefónica and Thales to form the Smarter Travel Forum. Together, we are pressing the government to increase the use of tools like real time information, smartcards (like London's Oyster card) and big data from actual journeys to make our networks more efficient. This can make cities work better, making them more attractive to investors and tourists and easier to navigate for local people.

Campaign for Better Transport is pushing the government to make it easier for individuals to make better choices, too. Rather than blowing the budget on roads and airports, we need to invest in modern, high capacity public transport, affordable rail fares and decent bus networks. Transport continues to make the world smaller, but we have yet to pick up the bill for our increase mobility. We urgently need to get off the road to nowhere.

James MacColl is head of campaigns at Campaign for Better Transport. He oversees the transport charity's main campaigns: Fair Fares Now, Save Our Buses and Roads to Nowhere, as well as heading up its policy work. He recently joined Campaign for Better Transport from RenewableUK, and has previously worked on policy and campaigning for General Motors, RSPB and CPRE.

www.bettertransport.org.uk

Campaign for Better Transport

WRITE FOR US

Whether anonymously, under a pseudonym, or with your name published loud and clear.

Journalism is changing rapidly through a digital and social media revolution. It is no longer the preserve of press barons and elite groups; journalism is now democratic and everyone has a voice.

And though that means there's a lot of noise and rubbish out there, there's a lot of great stuff too.

The role of media has changed. We still write stories every day about the amazing people and organisations that make a positive difference to the world in which we live, but we also promote and publish the most relevant blogs, tweets and articles from our readers.

We want to report on the diverse voices of our audience and beyond—regular people writing as travellers, investors and consumers.

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Join us today by emailing editor@blueandgreentomorrow.com with your thoughts and contributions.

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INVESTING IN TRANSPORT AND NOT DESTROYING THE WORLD

Leading investors reveal the drivers behind investing in sustainable transport.

By ALEX BLACKBURNE

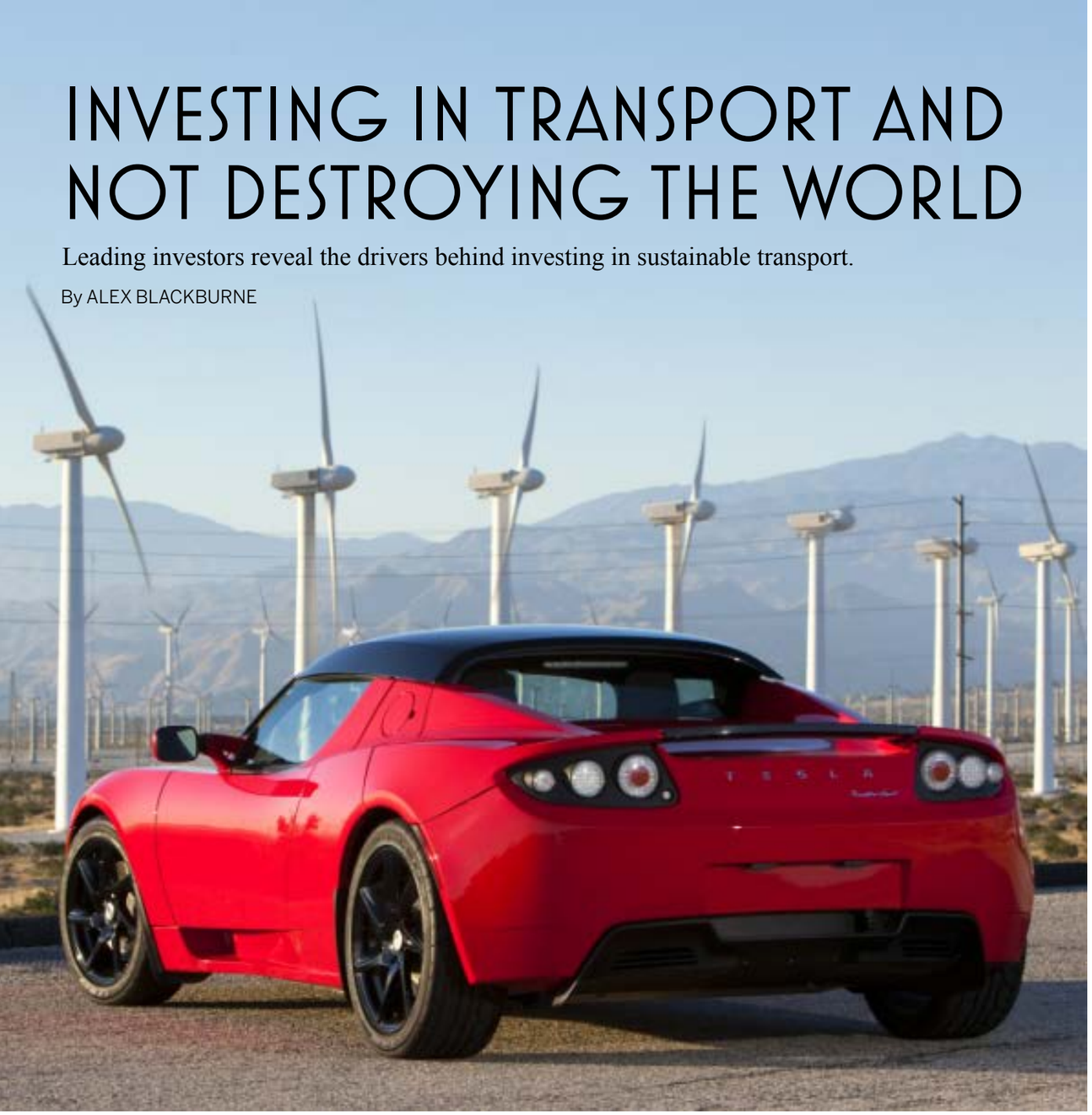


Photo by NRMA NEW CARS via Flickr

There was something different about last year's Frankfurt Auto Show. As the world's largest motoring event, it is a chance for car manufacturers to show off their new models to industry experts. While in the past gas-guzzling supercars have hogged the limelight, 2013 saw electric and hybrid vehicles take centre stage.

For the first time, every single one of the major manufacturers unveiled at least one hybrid or electric model. BMW pulled the curtain on its i3 and i8, Volkswagen showcased the E-up! and the E-Golf, Mercedes brought along the S 500 plug-in and Audi impressed with its hybrid Sport Quattro. Meanwhile, Japanese manufacturer Toyota – whose Prius model is often held up as the poster child for hybrid technology – devoted its entire stand to its hybrid range.

Manufacturers are launching electric and hybrid models at a rate of knots – and not just for the fun of it. They're reacting to consumer demand and tougher standards – particularly in the US. Most notably, in 2012 the Obama administration introduced a policy that requires the fuel economy of 90% of vehicles sold in the country by 2050 to be 54.5 miles per gallon (mpg). This one measure is said to dramatically reduce oil consumption and lower carbon dioxide emissions by around 5%.

"We need to figure out how to have the things we love, and not destroy the world"
Elon Musk, founder of Tesla

As well as the models unveiled in Frankfurt last year, Tesla has fast become one of the leading players in the market. Spearheaded by charismatic entrepreneur Elon Musk, co-founder of PayPal, its fully electric luxury saloon car the Model S has been handed numerous awards by the mainstream car world. Asked in 2012 about his motivation for developing electric cars, Musk said, *"We need to figure out how to have the things we love, and not destroy the world."*

For sustainable investors, the potential electric car revolution is just one of a number of attractive areas around sustainable transport. Tesla, initially quite a volatile stock, posted quarterly profits for the first time in Q1 2013. Hyewon Kong – a senior analyst at London-based asset management firm WHEB – says consumer demand is the major driving force behind their success. That said, there are some issues that need ironing out on electric vehicles specifically.

"Electric vehicles won't appear in the mass market yet because of constraints they have. Until we have a real breakthrough in battery technology, I don't think it's going to be a dramatic journey", she says.

WHEB is a specialist in sustainability investing. Its Listed Equity team only invest in companies that are providing solutions to key challenges like climate change, resource shortages and water scarcity. Sustainable transport forms one of the FP WHEB Sustainability fund's nine investment themes. Because of the rigour with which the WHEB team applies these, it can't invest in original equipment manufacturers – or OEMs – for whom electric or hybrid vehicles only represent a small portion of their overall turnover. But it does look at firms developing batteries (like one of its stocks, Johnson Controls) or others that are going to benefit from the shift towards electric vehicles, such as Umicore, which makes cathodes for batteries for electric cars.

Electric vehicles are not the only area within sustainable transport investment. Kong says there is a *"paradigm shift"* around improving the fuel efficiency of conventional gasoline engines that WHEB is also keeping a keen eye on. She adds, *"About two or three years ago, we did a review on fuel efficiency. What was surprising for me was how much energy is lost. Only 15% of energy from fuel is used to move the car. The rest is getting lost because of the engine. Running idle also plays a role, as does weight."*

In an effort to cut down wasted energy, a lot of work is going into making engines lighter and more efficient. There are companies working on Start-Stop technology which shuts engines off when at a standstill and restarts when the driver's foot is off the brake. One such piece of equipment, developed by Johnson Controls, is said to improve fuel efficiency by 3-8%.

Jon Forster, associate director in the listed equities team at another sustainable investor, Impax Asset Management, agrees that transport energy efficiency is a rapidly growing sector. *"Tightening global emissions standards mean that vehicle manufacturers are aiming to produce lighter and more fuel efficient vehicles"*, he says. *"Ford announced at the recent Detroit Motor Show that its new F-Series pickup truck, the best-selling vehicle in the US for the past three decades, will weigh 700 pounds less than its previous model."*

Impax specialises in resource efficiency. Its flagship investment trust, Impax Environmental Markets, returned 32.2% last year, compared to its benchmark, the MSCI All Countries World Index, which returned 20.5%. Forster says one of its holdings, Borg Warner, is focused on technologies that improve fuel economy, emissions and performance. He adds, *"Their expertise includes engine timing systems, boosting systems and ignition systems, and they are innovators in transmission and all-wheel drive technology – all of which can help improve fuel efficiency."*

"Ford announced at the recent Detroit Motor Show that its new F-Series pickup truck, the best-selling vehicle in the US for the past three decades, will weigh 700 pounds less than its previous model"
Jon Forster, Impax Asset Management

Photo by PHILLIP COLLIER via stock.xchng

Elsewhere, car sharing is a big trend. Membership schemes like Zip Car (which merged with UK rival Streetcar in 2010 and was acquired by car rental firm Avis in 2013) – that allow people in urban environments to hire cars as and when they need them – are also viewed as attractive. The recently launched easyCar Club, owned by the people behind easyJet, is another popular choice. The number of people signed up to such schemes increased by 10% in 2013 to 160,000 in the UK. Some commentators have attributed the increased interest in such schemes to the reason why car sales, post-financial crisis, have been slow to pick up.

Away from cars, bikes and public services like buses are also viewed as important in the sustainable future of transport. The Department for Transport in the UK estimates that over 540,000 journeys are now made by bicycle every day in Greater London alone. This figure doubled between 2000 and 2012. As the most environmentally-friendly mode of transport (other than walking), manufacturing companies like Shimano (held in the FP WHEB Sustainability Fund) and Giant are sure to benefit from this increased consumer demand in cycling.

But it's not just domestic transport that is being revolutionised. Intermodal transport – where goods are transported using multiple modes of transport – is another trend that sustainable investors are watching. For reasons both economic and practical, a lot of this kind of work is done by trucks. Rail, historically, wasn't very punctual – whereas trucks were. But with technology now available to improve both the safety and reliability of rail, there could be a sea change on the horizon. To benefit from such a shift, the FP WHEB Sustainability Fund holds Wabtec, which works to produce safety technology for trains. Kong says even a 1% shift from truck to rail could have a significant positive impact on society.

"Electric vehicles won't appear in the mass market yet because of constraints they have. Until we have a real breakthrough in battery technology, I don't think it's going to be a dramatic journey"
Hyewon Kong, WHEB

As for his outlook for the future, Impax's Forster sees a couple of key trends that will shape investment decisions in sustainable transport over the coming years: *"Increased focus on fuel efficiency favours existing technologies such as turbocharging, injection control and light weighting, over electric vehicles and hybrid electric vehicles. We expect emissions regulations to continue to tighten, such as the requirement for 54.5mpg by 2025 in the US and an expected limit of 95 grams of CO2 per kilometre by 2024 in the EU."*

There are a range of fund managers that see sustainable transport as a key driver in their investment decisions. Other considerations include road safety and the tightening of emissions targets, with a number of companies profiting from technologies that improve safety and make vehicles more environmentally-friendly. Given transport's contribution to global greenhouse gas emissions, and the range of innovative solutions on hand that need investment to grow to scale, it is not a sector that investors can afford to overlook.

A NEW DAWN OF THE ELECTRIC CAR

Electric cars are always seen as things of the future. But their time in the spotlight may be sooner than we think.

By ILARIA BERTINI

Photo by HENK L via stock.xchng

Photo by OSKAY via Flickr

Electric vehicles (EVs) have been around since 1884, when British inventor Thomas Parker – the same man who electrified the tube – came up with an efficient and eco-friendly (don't forget that coal pollution in London was particularly bad at the time) car, powered by an electric engine. The concept enjoyed a period of prosperity in the early 20th century, but popularity declined as innovation in the sector stalled and cheap oil entered the stage.

But electric vehicles have never quite been forgotten, and they are in fact very popular in some countries, like Japan, Norway and the US. Uncertainties over fossil fuels reserves and concerns over emissions are possibly paving the way for a new era. Has the dawn finally come for electric vehicles?

Electric cars benefit the environment in different ways. They are less carbon intensive than their gasoline-powered counterparts and contribute to much less air pollution. It is often argued that producing electricity can equally be intensive and polluting. This is certainly true for electricity produced through non-renewable sources. However, the total greenhouse gas emissions are still lower than those of oil-based vehicles. In fact, a partnership between Volkswagen and the clean energy provider Ecotricity, unveiled in 2013, demonstrated that the obstacle of dirty electricity is completely surmountable.

Despite clear environmental and maintenance benefits, massive investment and promotion by the government and the industry, electric cars have never quite reached the mainstream in the UK. Initially, the main reason was their production cost. This is coming down thanks to large-scale production, but nowadays it is mainly related to a lack of knowledge and scepticism on the part of consumers. That said, a survey by Auto Trader magazine among 3,000 motorists found that 79% think that the government should do more to make alternative fuel vehicles (AFVs) – a category that includes both EVs and hybrid cars – more affordable.

"Our report highlights a very pertinent point in that while half of motorists consider environmental factors to be important when considering purchasing a new car, the overall majority, 89%, would like their vehicle to be more green if it didn't cost any extra", Auto Trader marketing director Jonathan Williams said in the introduction of its Owners' Guide on AFVs. "This disconnect between motorists desire to embrace these vehicles and the perceived lack of information and support for them, is what stands out."

However, there are signs indicating that a new chapter is opening in the UK – particularly for hybrid vehicles. In January, the Society of Motor Manufacturers and Traders (SMMT) revealed that sales of plug-in vehicles rose by 11% in 2013 compared to 2011. The government plug-in car grant scheme has encouraged more people to buy a low-emission and alternative fuel vehicles, saving up to 25% on the cost. Meanwhile, in July last year, a study by Navigant Research predicted that sales revenue from EVs will increase by 200% by the end of the decade.

What is often ignored by motorists is that although electric cars are generally more expensive to buy than their petrol or diesel equivalents, they are much cheaper to run and are even exempt from Vehicle Excise Duty – or car tax – in some cases.

The Auto Trader survey indicates that of major concern to consumers are the relative lack of choice of electric vehicles, the limited driving range before needing to recharge and the perceived lack of charging points. The first two issues are being successfully addressed by manufacturers that have worked hard over the years to produce more models and batteries with larger capacities. Motorists want cheaper cars and more charging points. They want the government to put all its efforts into dispelling myths such as cars cutting out on the way to work. Once these are overcome, the future would look bright for EVs. The dawn of the electric car really could be quite soon.

"Motorists want cheaper cars and more charging points"

ARE ELECTRIC CARS DIRTY?

Tom Revell recently attended an event in Frankfurt, Germany, hosted by Ford, introducing journalists to its new electric and hybrid range of cars. Here is an extract from his article.

After introductory talks in an absurdly fashionable hotel, the assorted crowd, largely made of automotive journalists, was invited to test drive the Focus Electric, as well as the hybrids C-MAX Energi and Fusion Hybrid, through the picturesque streets of Frankfurt.

Speaking at the event was Robert Llewellyn – perhaps best known as Kryten in Red Dwarf, or for his boundlessly enthusiastic presenting of Scrapheap Challenge, who is now a staunch advocate of electric cars. Llewellyn made some excellent points that debunked some of the shorthand daggers that are all too often used to puncture EV tyres. One of the most common putdowns he said he has encountered in his time as an EV driver is that *"you and your green tofu-eating, sandal-wearing ecocar are dirtier than my 19-year-old diesel that's done 50,000 miles."*

Sceptics often disregard EVs on the basis that the electricity used to fuel them has itself been produced using carbon intensive methods. This is true, to an extent. However, most EV drivers charge their cars at night. At night, lower demand means that the National Grid does not have to use all available energy sources, and can be more selective. This means the electricity you use at night comes from comparatively high levels of nuclear and renewable sources. "The actual electricity that goes into the car is of the lowest CO2 possible", Llewellyn explained. With the help of a home solar panel installation, the environmental benefits, not to mention the savings, can get even better. Llewellyn claimed that last year, free solar energy added 4,500 miles to his travels. In his latest car, driving for 32,000 miles has cost him less than £600.

Read the full article here: http://bit.ly/1dXTL2T

RAIL FOR THE 21ST CENTURY

By SIMON LEADBETTER

Photo by MAX TALBOT-MINKIN via stock.xchng

Top photos on opposite page by 96TOMMY via Flickr

Bottom photo on opposite page by MATT BUCK via Flickr

The island, the record-breaking mallard, thomas the tank engine and record freight and passenger numbers needs to rediscover its love for railways. the beeching cuts, british rail's under investment and the subsequent chaotic privatisation have left us with a rail network and train operating companies that aren't fit for a 21st century purpose.

Declaring half of the British railway network as uneconomic and underused in 1963, Dr Richard Beeching's infamous report tolled the death knell for the UK's leadership in rail transport. The same lack of vision blights our transport system, economy and environment today.

The railway network in Great Britain is the oldest in the world. At its peak before the first world war, the network had around 5,000 stations and 23,000 miles of track. While considerable effort was put into trimming the system's least used lines between the 1920s and 60s and the modernising of the rolling stock from steam to diesel and electric engines in the 1950s, annual losses had mounted to £104m by 1962. The system at that time consisted of 18,000 miles of track. Today, the network consists of 2,552 stations and 9,789 miles. It is the 18th largest network in the world, one of the busiest in Europe and the fifth most used on the planet.

Beeching's report, The Development of the Major Railway Trunk Routes, proposed the closure of a further 4,500 miles of trunk lines and focus on nine main routes for future investment and development. The failures of Beeching's reports were two-fold. The rail network is just that: a network – interconnected and dependent on each of its parts. Trunk lines acted as feeders to mainline or railhead stations. Once the trunk lines had gone, commuters were just as likely to continue journeys by car to their final destination rather than park at a railhead station and switch to a mainline train to finish their journey. The savings from the cuts were tiny and losses continued to mount. Secondly, operating in the 1960s at a time when

"I suppose I'll always be looked upon as the axe man, but it was surgery, not mad chopping."
Dr Richard Beeching

Photo by INGY THE WINGY via Flickr

environmental thinking was in its infancy, he could not have foreseen the damage that the growth in personal car and heavy goods vehicle traffic would do. Nor could he see how the rising prices of fuel and insurance would eventually end our love affair with the internal combustion engine.

There was also a failure of political leadership. The transport minister at the time, Ernest Marples, was a powerful business magnate associated with the Marples Ridgway construction group, which built motorways. When opening the M1 motorway, he said, *"This motorway starts a new era in road travel. It is in keeping with the bold scientific age in which we live. It is a powerful weapon to add to our transport system."* Critically, the board that reviewed the Beeching proposals contained no one with any previous knowledge of the railway industry, but many executives who would see the private sector's benefit from the subsequent sale of unused land and valuable city centre structures. The cuts gradually came to a halt in the 1970s.

Margaret Thatcher was minded to push forward the proposals of a Beeching colleague, Sir David Serpell. His plan A would have closed 84% of what was left of the network, leaving just under 1,700 miles and reducing passenger miles by 56%. Had that plan succeeded, the only lines that remained would have been London to Cardiff via Bristol; London to Edinburgh via Birmingham, Liverpool and Manchester; and Glasgow and London to Newcastle via Leeds. Obviously, some lines in the south-east would be maintained.

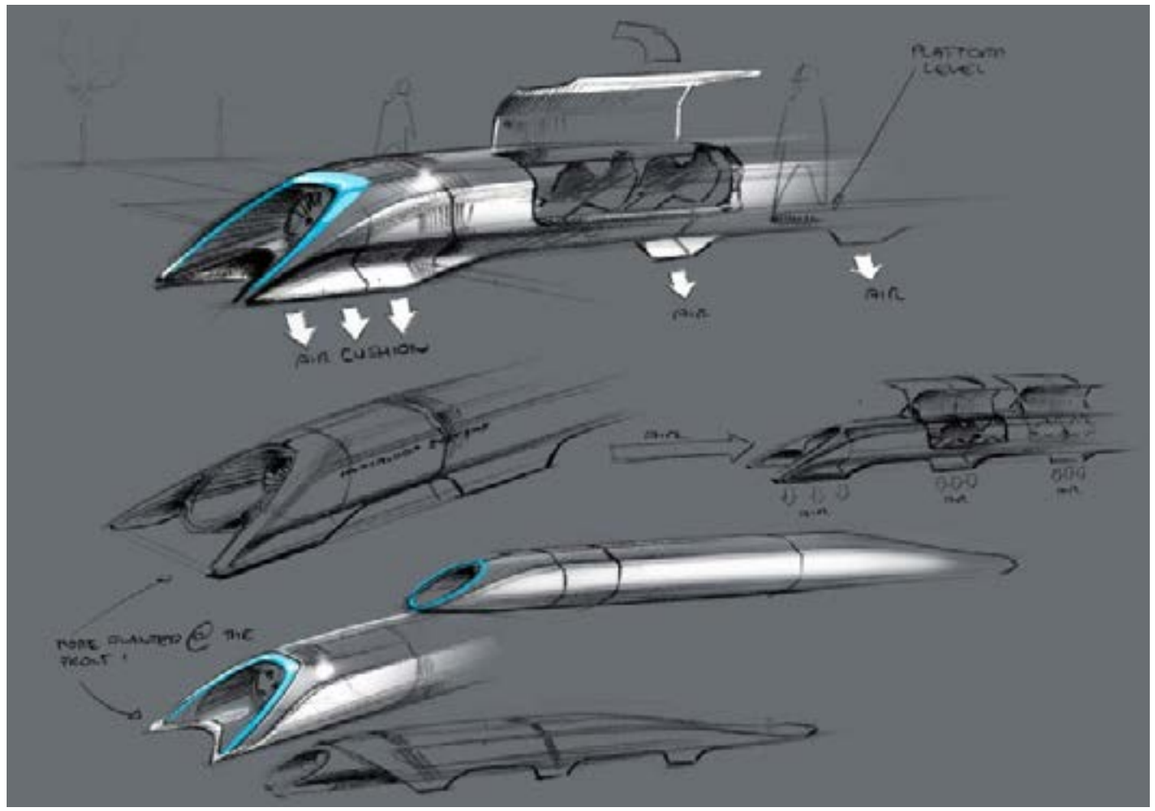
An outcry from rail users and MPs prevented the government from taking up the proposal, but several minor and duplicate lines were subsequently closed, leading to overcrowding and freight/passenger capacity issues that blight the system today.

It is often said that it is only since privatisation that numbers of passenger have grown rapidly. This is misleading. Passenger numbers picked up through the mid to late 1980s, reaching a 20-year high in 1988 and rising ever since. Privatisation has done more to hamper growth, degrade the network further, leading to the eventual collapse of Railtrack and several train operating companies, and create a dysfunctional timetable between those companies.

Demand for rail passengers is high, but aggressive ticket price rises on top of extraordinarily high base prices means people are priced off the network. Almost every station, from the most provincial to city centre mainline hubs, is seeing record traffic. Saying that there is no demand for rail in the many towns without rail connections is errant nonsense. Demand in rail needs supply. Our roads would be emptier and our air cleaner if we expanded the capacity of the network.

The impact of Beeching's cuts have been far-reaching and disastrous. We lost our leadership in rail transport just as passenger numbers were about

"Conventional high speed trains are the technology of the last century"



HYPERLOOP sketch by ELON MUSK\ SpaceX

"... all progress depends on the unreasonable man."
George Bernard Shaw

Photo by JAMES FARMER via stock.xchng

to rise nationally, but more importantly, globally. Britain invented the railways but has no domestically owned manufacturer of this form of transport. The road network had to expand to cope with the growing number of road users. Freight also moved onto the roads, meaning the existing roads degraded faster. This led to semi-permanent roadworks. Rural communities and the poorest became isolated as low cost mass transit options vanished.

At a per unit cost, rail is the safest, cleanest and most efficient way of moving large volumes of people and freight by land. Road building is significantly cheaper from an initial build perspective, especially if you discount externalities such as long-term maintenance and environmental costs, but these high variable unit costs make road transport uneconomic and unecologic.

It takes seven unproductive hours to drive from central London to Edinburgh. To get the Heathrow Express from Paddington to Heathrow, fly to Edinburgh International and then taxi to Edinburgh takes an unproductive three hours and 40 minutes, assuming no contingency. The time from King's Cross to Edinburgh by train is four hours and 20 minutes, productively connected to Wi-Fi the whole way. Carbon emissions from rail are significantly lower, too.

There are many practical, low-cost methods of rebuilding the network:

1. Take a serious and impartial look at the former Great Central Main Line (Marylebone to Manchester via Nottingham and Sheffield; closed in 1969) as an alternative to HS2, costing £6 billion rather than £50 billion
2. Reopen lines that have been closed (e.g. Okehampton to Plymouth via Tavistock would be a sensible reopening that would take traffic off the endangered coastal route at Dawlish)
3. Invest in releasing bottlenecks (e.g. the twin line 1850, Grade II-listed Digswell Viaduct at Welwyn North on the Eastcoast Main Line)
4. Use light rail to connect large, fast-growth towns without a rail connection (e.g. Haverhill in Suffolk, a fast-growth town whose former train station is now a Tesco supermarket). Similarly, use light rail to connect affordable property areas of the UK to unaffordable town centres

Going beyond the immediately practical steps above, high-speed trains are the technology of the last century. Japan had its first high speed line in 1964. We have the option to leapfrog that technology to exploit the revolution in engine technology and the use of resilient lightweight materials for track and rolling stock. Elon Musk's 598mph Hyperloop may seem far-fetched, but the idea of travelling in comfort with hundreds of passengers at speeds above 180mph at ground level was also far-fetched in the 1950s. Passengers thought they would die if they travelled in trains at more than 30mph in the 19th century.

We need a bold vision for mass transit in the UK, utilising the 2,000-year-old concept of rail transport (first evidence being the Diolkos wagon way in ancient Corinth) with the latest technology. Beeching was unsurprisingly unrepentant about his role in the closures, saying, *"I suppose I'll always be looked upon as the axe man, but it was surgery, not mad chopping."* In reality, he wasn't a bad man, just another reasonable bureaucrat, sensibly managing the steady relative decline of the UK, rather than its potential post-imperial growth.

We could reclaim our role as a world leader in rail transport if we chose to. *"The reasonable man adapts himself to the world: the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man."* So said George Bernard Shaw. It's time to get unreasonable about rail.

THE ROLE OF CYCLING IN SUSTAINABLE TRANSPORT

"Urgently increasing cycling levels is as close as we're going to get to a silver bullet for a range of economic, health and environmental issues"

By ALEC JAMES, Sustrans

Photo by JOSES TIRTABUDI via stock.xchng

Let's get straight to the point – cycling is arguably the closest to a single sustainable transport solution that the UK has. It's affordable, healthy and sustainable. More Britons on their bikes will boost the economy, save our ailing health system and give the environment a second chance.

The UK's streets are clogged with increasing numbers of motor vehicles and the air we breathe is noisy and polluted. It's affecting our health, our environment and our quality of life. Motoring is burning a hole in our pockets as the high costs of forced car ownership condemn millions of Britons into transport poverty. And the national purse is suffering too, as congestion hampers business and the NHS struggles under the increasing burden of physical inactivity. Urgently increasing cycling levels is as close as we're going to get to a silver bullet for these issues.

While we are starting to see a small shift away from the heavy car dependence that's typified the UK's transport system over the last century, it's not happening fast enough. Nearly 20% of all journeys in the UK are between one and two miles. On a bike this would take less than 10 minutes, yet incredibly 60% of these short journeys are made by car. And while some sustainable transport methods are enjoying a recent resurgence – bus usage in London has seen a year-on-year increase since 1998 and rail travel is at its highest level since 1928 – government statistics show cycling to be static at just 2% of journeys.

So why should a mode of transport, so seldom used by the majority of Britons, form the backbone of a sustainable transport system?

The personal benefits of travel by bike are enormous. While cycling is great for your health and for the environment, for most of us it's savings to our time and our money that count. Bicycles are clean, quiet and very effective for short to medium journeys. They can also provide an important link between short and long distance travel by allowing people to travel easily to and from train stations and bus stops without the need for a car. Jumping on your bike is often faster than driving – in central London the average traffic speed is just 9mph – and purchasing and maintaining a bicycle is a low-cost alternative to the costly burden of car ownership.

But what about savings to the national purse? Cycling road infrastructure provides the fastest turnaround in the provision of urban transport as well as the greatest value for money. In a recent study from the Department for Transport, the cost benefit analysis of a new cycle route in comparison to a road was 22:1 in favour of the cycle route (half of the economic benefit was in augmented health service savings).

The health benefits of walking and cycling on the National Cycle Network were worth £460m in 2012, using the World Health Organisation tool for calculating health economic impact. And with more than 35,000 people in England alone dying each year due to a lack of physical activity, something really must be done to get the UK moving. A recent report from UKactive revealed approximately a quarter of all adults in England were failing to do anywhere near enough physical activity to benefit their health. Cycling is a great way to integrate exercise into a daily routine, and can help prevent conditions such as cancers and heart disease. In fact, all four UK chief

"Bicycle transport must be an integrated part of the transportation solution for the cities of the future. "
German Dector-Vega, Director of Sustrans London

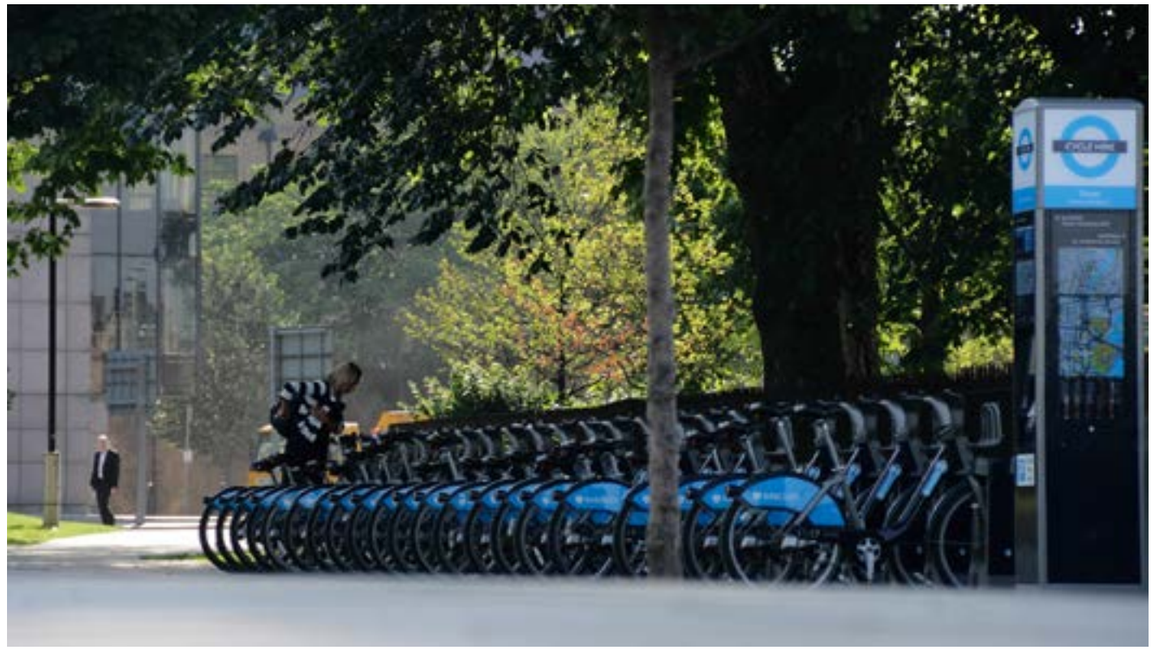


Photo by
JAMES BLUNT
PHOTOGRAPHY
via Flickr

medical officers say walking and cycling are the easiest and most effective forms of physical activity.

Despite the many obvious benefits of cycling, most people cite traffic fear as the number one reason stopping them from travelling by bike. Speeding traffic, a lack of dedicated space for cyclists and dangerous junctions all contribute to a reluctance to use two wheels to get around. Addressing that fear won't be easy. The UK government must invest in high quality infrastructure with good signage and direct routes on quiet paths and roads. We need to tackle road dangers by slowing motor vehicles right down and making sure HGVs have the correct safety equipment like mirrors and side bars, as well as expanding cycle training in schools and workplaces to equip people with the knowledge and confidence to take to two wheels.

Cycling could truly revolutionise the UK's transport system by making our cities more liveable, our travel costs more affordable and our lifestyles healthier and more active. It's a no brainer for personal finance and for the wealth and prosperity of the UK.

Alec James is press officer at Sustrans, a leading UK charity enabling people to travel by foot, bike or public transport for more of the journeys we make every day.

www.sustrans.org.uk

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NAVIGATING A SEA CHANGE IN SHIPPING

By TOM REVELL

Photo by EUNO via Flickr

"Cutting CO2 is a benefit for our business, not a threat to it"
Morten Engelstoft

Photo by JDNX via Flickr

According to the European commission, emissions from the global shipping industry amount to around 1 billion tonnes a year, accounting for 3% of the world's total greenhouse gas emissions. Though the maritime industry can make a case for being among the most energy efficient forms of freight transport, its current trajectory needs to change given the threat that is climate change.

However, a unique initiative is plotting a change of course for the maritime industry. The Sustainable Shipping Initiative (SSI) – a collaborative project originally launched by Forum for the Future but now operating independently – has an alternative vision of the industry's future. Its mission: to have established a sustainable and profitable maritime industry by the year 2040. In working towards this ambitious goal, the initiative has assembled committees of cross-industry members, including consumers, ship owners, shipbuilders, insurers, engineers and NGOs, to discuss trends, challenges and possibilities. But how does the SSI define sustainability?

"Sustainability is not just about CO2 emissions, it is the whole picture, it is human, it is financing, it is – of course – also environmental impact including greenhouse gases and things like that, but you have to look at it from a holistic view", says Helle Gleie, director of the SSI.

The SSI counts among its responsibilities tackling fraud and bribery, improving labour standards and health and safety, reducing waste and noise as well as reducing the industry's contribution to climate change.

"Of course when we look at the hard stuff – the steel and the iron of the vessels – a lot more can be done to develop new vessels, to come up with new engine designs and find new types of fuels – something which a lot of people are doing nowadays – but I think the maritime world is very aware of these possibilities and they are already moving towards that," says Gleie.

"Fossil fuels might not disappear from vessels for many years, but that does not mean that we should stop looking into alternatives. To the contrary, we have an obligation to do what we can to find new ways of moving cargoes at sea – at the same time [making sure] what we come up with can actually be picked up practically and is financially beneficial to invest in."

Though fossil fuels might not disappear, advances can still be made. Last year Maersk Line, an SSI member and the world's largest container shipping company, announced that it reached its target of reducing carbon emissions by 25% from 2007 levels eight years early. This was done simply through improving efficiency.

To keep up the momentum, the company raised its 2020 target to a 40% reduction.

"We see an increased environmental awareness among our customers, so when we improve our environmental performance, we also improve our customer relationships", explains Morten Engelstoft, chief operating officer at Mearsk Line. *"Cutting CO2 is a benefit for our business, not a threat to it."*

Such advancements have sometimes been held back by questions of finance. Though owners are under pressure to charter efficient vessels, they are often unsure that the investment needed to retrofit technologies will generate worthwhile returns – as the charterers recoup any fuel savings. The SSI has created a financial model, titled Save As You Sail (SAYS), to overcome this. The SAYS model allows an owner and a charterer to work out potential fuel cost savings and the returns on investments for different efficiency measures. These are used to negotiate the charter hire rate. The owner can also access a loan to afford the upfront costs. The model is an example of what can be achieved through industry co-operation.

Gleie says that convincing companies of the financial benefits of sustainability will be the key to her initiative's success: *"If you can't put in a benefit, then*

"I know for a fact that once the shipping industry gets the point – and they will start moving – they are fast movers"
Helle Gleie

Photo by JDNX via Flickr

it won't fly. It is a corporate and financial focused world we're living in; it's not just enough to say you have to do this because your conscience tells you, or your intelligence tells you that we need a green planet. That won't drive the maritime industry."

She predicts that those who are slow to be convinced will lose out: *"I think we will see that those in the industry that are really picking up on it, that are paying attention, and are taking the opportunities to follow and listen, they will have a great advantage. Then there will be some of the quicker followers than will manage to pick up and adapt, and then I think – sadly to say – there will be some that we will lose down the way, because they simply won't pick it up quick enough."*

Alongside Mearsk Line, SSI members include leading names such as Cargill, Wärtsilä and Lloyd's Register – companies already making strides in the sustainability space. For new enterprises to even be considered for membership, Gleie says they must be *"walking the talk already"*, or able to demonstrate that they have a plan in place for how they are going to. She admits that of the companies already involved, not everybody is doing everything. *"But we are a mirror of the real world here"*, she adds, *"We just maybe have come a step further, the groups that are sitting here, trying to lead others."*

Such a measured approach is surely the only way forward for the SSI. In terms of emission reductions, it is impossible to miss the sense of urgency transmitted by the dire warnings of science, but an industry cannot be revolutionised overnight – particularly in a challenging economic climate.

If the myriad challenges facing the industry can be overcome, Gleie argues that shipping can play a massive role in a sustainable future: *"I've been in shipping since 1977, and I know for a fact that once the shipping industry gets the point – and they will start moving – they are fast movers. They will put all their energy into it, and they are very strong communicators. If we do this right […] I think we can take the lead on innovation, and setting new ideas and new frames for how to work with sustainability."*

While there is clearly a long way to go, the SSI can already stand as an example to other industries. If the world is to keep within the near universally agreed target of 2C of global warming, unsustainable practices in all sectors must be stopped. If Gleie and her colleagues can successfully inspire such a fundamental change in thinking throughout the maritime industry, the world would do well to watch and learn.

www.ssi2040.org

THE SECRET SHIPPING INDUSTRY UNCOVERED

"Shipping is as crucial to us as it has ever been"
Rose George

By
NICKY STUBBS

The shipping industry transports 90% of the goods we use and consume – so why do we know so little about it?

The shipping industry transports around 90% of all imports to the west. It has quadrupled in size since 1970, with around 100,000 vessels now working on the seas globally. Maersk – just one shipping company, but one of the largest – has annual revenues that match technology giant Microsoft, bringing in around $60.2 billion (£36.7 billion). Despite this, the industry is often invisible.

In 2009, Sir Jonathon Band, the First Sea Lord, accused politicians of *"sea blindness"*. Although his comments were chiefly in response to the government's cuts to the defence budget, the sentiment can also be applied to the industrialised west – according to the journalist and author Rose George. In a December 2013 TED talk, George said, *"Perhaps the general public thinks of shipping as an old-fashioned industry, something brought by sailboat with Moby Dicks and Jack Sparrows. But shipping isn't that. Shipping is as crucial to us as it has ever been."*

After becoming intrigued by how the industry underpins western consumer civilisation, she decided to join a 21-strong crew on a journey from the UK to Singapore. Whilst aboard, George integrated with the ship's crew, finding out about some of the key issues they face every day. Despite the grave threats posed to the shipping industry from piracy, many workers simply get on with the job at hand, providing a vital link to the economy – and ensuring that goods get from factory to shop floor.

She was told that the black clouds of smoke bellowing from the ship's chimneys were due to bunker fuel – the dregs of the product from refined fuel. George added, *"Shipping has very tight margins. They want cheap fuel so they use something called bunker fuel... the dregs of the refinery, or just one step up from asphalt."*

Compared to the aviation industry, ships emit around a thousandth of the greenhouse gases that contribute to global warming, and around a tenth of that from trucking. However, to put that into context, there is so much shipping going on in the modern world that it contributes to 3-4% of the planet's total emissions.

The Carbon War Room, co-founded by British entrepreneur Richard Branson, says that *[http://www.carbonwarroom.com/sectors/transport/shipping/operation-shippingefficiency]* shipping is responsible for more than a billion tonnes of carbon dioxide emissions every single year. The 15 largest vessels alone account for as much nitrogen oxide and sulphur oxide as the world's 760 million cars (though the concentration of these gases in car fuel is, admittedly, much lower than in ship fuel).

Despite being one of the biggest polluters (if the shipping industry were a country, it would rank number six for pollution), the industry began to change its attitude to fuel consumption in 2007, but this was not done with climate change in mind.

Amid rocketing fuel prices, shipping firms knew that in order to keep margins at their highest, they needed to use less fuel. As a result, many adopted the practice of *'slow steaming'*, where they cruise at speeds below their maximum. This, of course, reduced emissions,

"The shipping industry transports 90% of the goods we use and consume"

but initiatives have since been launched in order to change the conversation around fuel.

Speaking to Blue & Green Tomorrow, George says, *"I think that initially the compelling factor was cost: fuel is expensive, so if you can build more efficient engines or propellers then that will be accepted by shipbuilders and owners. I think the dialogue has changed now, and there is, at least publicly, acceptance that shipping needs to address its emissions."*

Maersk has invested around $3.8 billion (£2.3 billion) in commissioning the world's most energy efficient ships, the Triple-E Class series. It completed six vessels throughout 2013, with a further five under construction and to be launched this year, and another 10 in the pipeline. But the main issue, according to George, is the remaining 100,000 ships out there still burning bunker fuel with inefficient engines.

The Carbon War Room estimates that by retrofitting old and inefficient ships with new technologies, such as harnessing wind power, energy recovery, hull optimisation, air lubrication and propeller enhancements, the industry can save around $70 billion (£42 billion) every year and slash carbon dioxide emissions by around 30%. The problem with such initiatives is that ship owners don't have to fork out a single penny extra for the emissions they pollute – because ultimately, the total bill is footed by society and the planet. Only by engaging everyone in this debate, from consumers to retailers; shipping giants to policymakers, can we align the industry's apparent operational invisibility with an invisible carbon footprint.

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CLARISM_4
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MAKING WAVES: SHIPPING IN A CHANGING WORLD

By CHARLOTTE MALONE

Photo by PATRICK KELLEY, US Coast Guard via Flickr

How will the shipping industry face up to population growth, climate change and resource scarcity?

The shipping industry is making improvements to its overall operations to improve sustainability. Measures include more fuel efficient engines, improved ship designs and better planned routes to ensure capacity is not wasted. However, growing demand, particularly in emerging markets, could offset these positive gains.

A report prepared last year by engineering firm Lloyd's Register looked at the global trends in the marine industry. It predicted what the sector will look like in 2030. The report used three scenarios using three key drivers – population growth, economic development and demand for resources – to assess future trends. What stands out in all of the scenarios is that maritime growth is strong. In fact, seaborne trade is predicted to increase from 9 billion tonnes annually to between 19-24 billion tonnes by 2030. Tom Boardley, marine director at Lloyd's Register, says, *"Seaborne trade in 2030 will be driven by population growth, increased wealth and demand for more commodities."*

As global population grows, the world's leading economies also shift away from developed countries, such as the US, Japan and western European countries, to nations that are currently emerging, such as China, India and Brazil. This will lead to the demand for trade in these areas to rise. As 90% of trade is conducted via shipping, the industry will grow rapidly.

The report also looks at the controversial issue of new shipping routes being opened up due to retreating ice. Ice melt is caused in large part by manmade emissions and rising temperatures. The shipping industry contributes around 3-4% of global emissions overall. As a result, new routes that open up will allow companies to transport goods faster and access a wider range of areas when using particular passages.

The report added, *"Should global warming continue, the possibility of trans-Arctic shipping for at least several months per year cannot be discounted. Such routes might become competitive, since they could cut distances between Asia and Europe by at least a third."* One of the industry's big obstacles is therefore the apparent contradiction between its desire to limit its impact on the environment and its plans to profit as a direct effect of climate change. Meanwhile, environmental groups have said the new routes could allow oil and gas firms to search for new fossil fuel reserves in the vulnerable region.

Another of the challenges with making the industry more sustainable is balancing the needs of various stakeholders. Whilst businesses want to grow and improve profits it is vital that the needs of the environment are also considered. Koji Sekimizu, secretary-general of the International Maritime Organisation (IMO), has previously said, *"A safe, secure, efficient and environmentally friendly shipping industry is an essential component of a green economy, both as the delivery mechanism that supports global*

One of the industry's big obstacles is the contradiction between its desire to limit its impact on the environment and its plans to profit as a direct effect of climate change

"Seaborne trade in 2030 will be driven by population growth, increased wealth and demand for more commodities"
Tom Boardley

Photo by PATRICK KELLEY, US Coast Guard via Flickr

trade and as a significant provider of jobs and economic activity in its own right."

Environmental regulations and rising fuel costs are driving the development of efficient technologies and operations. In 2012, the US North America emissions control area (ECA) came into effect with further regulation around emissions following and more on the way. A separate Lloyd's Register report looked at the industry's relationship with the environment and assessed the steps being taken to make shipping more environmentally friendly. For example, new bulk carriers can cut emissions by around 14%.

Nick Brown, Lloyd's Register's area general manager and marine manager for Greater China, says, *"Owners and operators are looking for efficiencies and now shipyards and designers are responding to this demand. Emissions regulation and higher energy prices are the two leading factors changing our industry. New technologies and innovations will play a vital role in the immediate and long-term future of shipping. New fuels, new engines and new designs are becoming available."*

Biofuel is another area that offers the sector a chance to become more environmentally friendly. Third generation biofuels give shipping firms the potential to cut emissions. According to the International Energy Agency (IEA), biofuels could provide over a quarter of all transport fuel by 2050. However, this option raises sustainability concerns around using land, lakes and seas for fuel instead of food.

The report also looks at a wide array of future ship designs including engines that harvest wind power, using hydro-dynamic improvements to enhance performance and energy saving devices that could cut fuel consumption and reduce the industry's annual fuel costs by over $2m (£1.2m). Whilst the developments are welcome, the growth the industry is expected to see over the next 20 years suggests that on the whole, the industry needs to do more in order to reduce its environmental impact.

TO FLY OR NOT TO FLY?

One side argues that the green movement can be enriched by air travel; the other says environmentalists must stay grounded. But who's right?

By TOM REVELL

Photo by AERO ICARUS via Flickr

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FCL1971
via stock.xchng

Innovations that will reduce passenger planes' considerable environmental impact may be possible, but they are not imminent. In 2001, the Intergovernmental Panel on Climate Change (IPCC) concluded that alternatives to kerosene-based fuel for commercial jets would not be viable *"for the next several decades"*. The UK Department for Transport, which would be more likely to be optimistic given the government's support for growing aviation, also admits that no quick fix is *"currently visible"*. Aviation will be the last transport sector to change.

This is unfortunate, because to fly is also to inflict the gravest damage upon the climate that a human being possibly can. In a large car carrying four passengers, for example, a return journey from London to Edinburgh of around 720 miles emits 74.4kg of carbon dioxide per passenger kilometre. A commercial plane making the same journey would emit 202.6kg per passenger kilometre, and it must be considered that an international flight can easily journey as far in a day as an average car will in a year. But this is not all. Jets release gases and particles that have an overall warming effect roughly 2.7 times as powerful as carbon dioxide alone. The altitude at which these emissions are released exacerbates the impact. Carbon offsetting – a mechanism through which emissions are compensated by small investments in things like renewable energy – has been hailed by some as a solution. However, the system has been criticised. Campaign group Friends of the Earth brands offsetting *"a dangerous distraction"*. ResponsibleTravel.com – a leading tour operator for sustainable holidays – ditched offsetting in 2009, arguing it was ineffective.

The Department of Transport estimates that demand for flights will increase by 1% annually until 2050. The European commission says that by 2020, global international aviation emissions will increase by around 70% from 2005 levels, even accounting for the anticipated improvements in energy efficiency. The International Civil Aviation Organisation predicts that by 2050 they could grow by 300-700%. This is not sustainable. But as this guide demonstrates, there are other ways to get around. That said, none make the far corners of the world so quickly and easily accessible than aviation. The environmentally conscious traveller therefore has a difficult choice. Can flying be justified?

"The airplane has unveiled for us
the true face of the Earth"
Antoine de St-Exupery, French writer, 1939

Photo by
DANIEL
DUCHON
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FLYING CAN BE JUSTIFIED

"I fly because it's the only way in which I can do the work that I do", says Brendan May, chairman of the Robertsbridge Group sustainability consultancy. *"I think that applies to people like me who advise companies and I think it applies to a huge number of NGOs. There is no way that we can transform the business practices and politics of places outside the UK without spending time with the people we're trying to help change behavior."*

May is currently working to protect the rainforests of Indonesia; something he says cannot be done without boarding a plane: *"If the work that I'm doing is successful then that would definitely compensate for the six or so flights that I have to take to Indonesia. Similarly, the social benefits of what people like the fair trade movement and the Oxfams of the world do, far outweigh the negative footprint caused by their journeys. I think you could apply that argument to much of the serious environmental work that goes on around the world."*

In fact, May argues that more environmentalists should fly. *"They should fly to influence, they should fly to engage, and they should fly to important international gatherings where decisions are made. Otherwise they are just undermining their own access and influence"*,

He qualifies this, saying that campaigners *"who just fly the conference circuit"* should stay at home, and that flying should be avoided when more sustainable options are available. *"Anyone that flies from London to Brussels or Paris is an idiot. There really is no need. But if it's going to cut out time that you could*

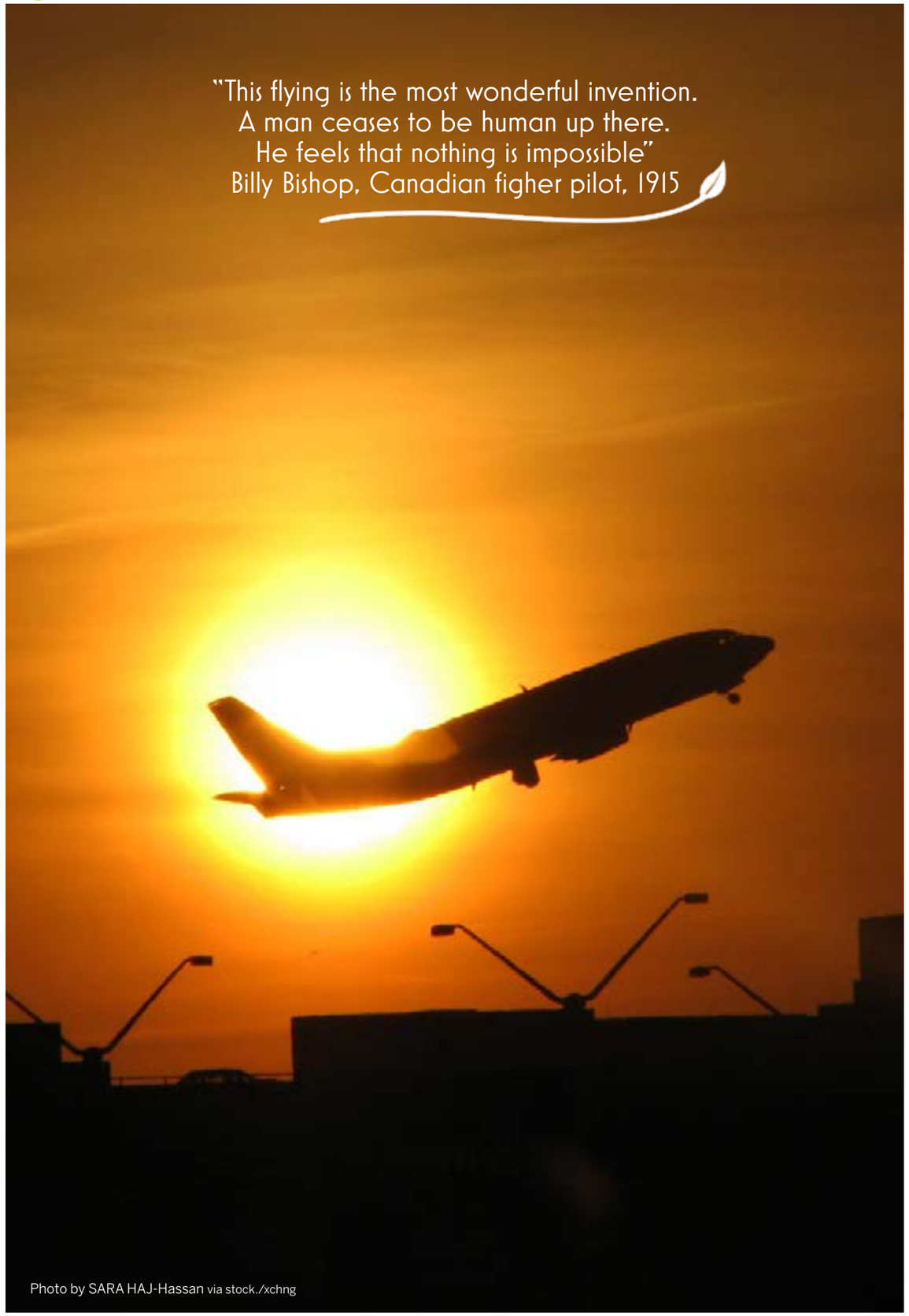


Photo by SARA HAJ-Hassan via stock./xchng

Photo by
DAVID BUTLER
via stock.xchng

then spend doing useful things then you don't want to be on a train for 10 or 12 hours. I think you have to take each journey individually."

He also makes a distinction between business and leisure travel. One of the most popular retorts of the pro-flight lobby is the economic benefits that air travel brings. Speaking to Blue & Green Tomorrow in 2012, Paul Steele, executive director of the Air Traffic Action Group, said, *"People often forget that if you're flying on vacation to Thailand or from Bangkok back to London, your plane is not just about passengers who've been on holiday. You've got business people, government people, but also, importantly, the belly of that plane is full of goods. The aviation industry transports 35% of the value of the world's goods."*

ATAG claims that if aviation were a country, it would have the 19th highest gross domestic product (GDP) in the world, generating $539 billion (£330 billion) per year. Despite this, May argues that business air travel can and should be reduced, not just for environmental reasons, but also cost efficiency ones. The increased use of ICT and introduction of software such as Skype mean that many international meetings can be made without anyone leaving an office. He is, however, wary of conveying a similar message to holidaymakers. *"I don't believe that the environmental movement is going to succeed by telling normal working family people that they cannot go on holiday with their kids by plane. I think that kind of narrative is absolutely lethal to the environmental movement,"* he says.

"The reality is that aviation is going to grow exponentially in places like the Middle East, Africa and south-east Asia, and are we really going to say to all these emerging middle class people in Indonesia, in China, in Africa, 'No, you cannot get on a plane'? What we have to do is put the aviation sector on a more sustainable footing, which means looking at aircraft design, looking at routes and fuel and the way in which people travel, but saying that we shouldn't fly anywhere is just a route to nowhere."

As previously mentioned, carbon offsetting had been put forward as one way of putting the aviation industry on such a footing, and May argues that we should not only listen to its recent bad press: *"We have to defend good offsets which bring a whole range of benefits, but not be blind to the fact that we can't just kick our dog and give the RSPCA some money and all will be well."*

He concludes, *"I think aviation has a lot to answer for and the aviation lobby has handled the climate change debate in a quite clumsy and laggard-type way, but I think it is the wrong industry to pick. There are bigger fish to fry out there where there is a more realistic chance of success."*

"Thank God, men cannot as yet fly,
and lay waste the sky as well as the earth"
Henry David Thoreau, American essayist, poet, philosopher, 1861

Photo by 101HOLIDAYS.CO.UK via Flickr

FLYING CANNOT BE JUSTIFIED

Opposing is Prof Kevin Anderson, a climate scientist and deputy director of the Tyndall Centre for Climate Change Research. He argues that environmentalists should lead by example by staying grounded.

Anderson decided that he could no longer justify flying eight years ago, and instead advocates slower, less damaging modes of transport. *"At a system level, trains have an order of magnitude lower emissions than the metal bird alternative – the saving is that significant"*, he wrote in a recent blog entitled *'Hypocrites in the Air'*.

"Attending an 'essential' conference to save the world from climate change in Venice, Cancun or some other holiday resort, is perfectly doable by plane. However, the rising emission trends don't seem to have registered the sterling work we have achieved at such events. Perhaps if we flew to more of them, emissions would really start to come down – we may even spot some flying pigs en route."

In another article, written this time with Dan Calverly and Maria Sharmina, also of the Tyndall Centre, Anderson argued that the attitudes of airborne environmentalists borders on the colonial. *"This form of patriarchal egotism perpetuates the systemic nature of many issues. Whilst alleviating narrowly bounded but high profile concerns, from the extinction of particular species through to localised deforestation, it neglects more challenging and high-level drivers such as climate change"*, they argue.

"Certainly there may be niche benefits in western experts applying 'sticking-plasters' to localised problems, but it is an inappropriate model for addressing the pervasiveness of climate change, let alone the more interconnected nature of sustainability."

Brendan May counters that most prominent environmentalists still take to the air, but Anderson is not alone in taking such an absolutist standpoint. The environmental journalist George Monbiot says that to board a plane is to be complicit in causing

"If I had to choose,
I would rather have birds than airplanes"
Charles Lindbergh, aviator and environmentalist, 1964

Photo by FRIEDWATER via Flickr

environmental destruction, succinctly saying, *"If you fly, you destroy other people's lives."*

One recent convert to this way of thinking is the meteorologist Eric Holthaus. In an article written for the Atlantic, Holthaus described how after reading the IPCC's latest review of climate change science, he emotionally realised *"any hope for a healthy planet seemed to be dwindling, a death warrant written in stark, black-and-white data"*. He and his wife decided they must reduce their own carbon footprints. Although Holthaus flew around 75,000 miles last year – mostly to Africa and the Caribbean, where he works to reduce the impact of climate change – he knew he could never fly again.

"For a lot of us frequent fliers, the environmental harm is dramatic and adds up fast", he wrote in the article. *"A one-way flight from New York to San Francisco (2.23 tonnes of CO2) has nearly the same impact as driving a Hummer the same distance (2.81 tonnes). By vowing not to fly, I went from having more than double the carbon footprint as the average American to about 30% less than average."*
Holthaus noted that he still has to travel a lot, using trains or the car he shares with his wife when videoconferencing won't do. "*But by removing my single biggest impact on the climate in one swoop, I can rest a bit easier knowing I've begun to heed the IPCC's call to action. Individual gestures, repeated by millions of people, could make a huge difference."*

THE VERDICT

To an extent, the choice seems to be between what is politically possible and realistic, and what science demands. If aviation is permitted to expand as predicted, we are relying on there being unforeseen progress in alternative fuels or emission reduction. This would be a big gamble. But then, for governments to restrict flights, it would require a significant shift in political will and an unprecedented international display of public opinion. Never before would a campaign have lobbied for a reduction of public freedoms on such a scale. Beyond that, the decision is an ethical one. When you next step on a plane, do you believe it will be worth it? As with so many of the questions that the environmentally aware must ask themselves, there is no easy answer.

BOEING: SUSTAINABLITY IS 'THE RIGHT THING TO DO...'

By CHARLOTTE MALONE

Photos with thanks from BOEING

The leading aircraft manufacturer talks energy efficiency, *'green diesel'* and reducing aviation emissions.

A report from the Intergovernmental Panel on Climate Change (IPCC) previously estimated that 2% of manmade carbon emissions came from aviation. This was expected to increase to 5% by 2050. Whilst the aerospace industry has made progress, questions remain about whether it is doing enough to cut emissions and become more sustainable.

Terry Mutter, director of enterprise strategy for Boeing Environment, Health and Safety, admits that although each time the industry improves it *"gets harder and harder"* to carry on advancing its sustainability performance, there have been recent examples of demonstrated progress such as Boeing's 787 improving fuel efficiency by 20%. He adds that emissions increasing past the IPCC's estimated 2% was *"something the industry is working hard to address"*. The sector has worked together to set up a framework for improving the impact aviation has on the environment. It has not only considered how efficient vehicles and fuels are, but the overall system the planes are used in, such as air traffic control.

Mutter explains, *"What's important for all industries is to understand where you compete and where you collaborate within the industry. So we've agreed that whilst we compete on how efficient our aeroplanes are with other manufacturers, we collaborate with the industry when it comes to the areas of traffic management and sustainable biofuels because if we can make sure those parts of the system more efficient the industry has a much better chance of being able to grow whilst reducing its overall footprint."*

Through the International Civil Aviation Organisation (ICAO), the industry has made a commitment to have carbon neutral growth by 2020 and for emissions to be reduced by 50% by 2050, from a 2005 baseline. *"To my knowledge, aerospace is the only industry that has come up with a framework and has made commitments in terms of reducing carbon emissions as an industry not just a company"*, Mutter adds.

"We have never implemented any sustainability project that did not have a positive return on investment"
Terry Mutter, Boeing

In order to achieve these targets, the industry needs to make improvements across the whole aviation system. The sector is growing, so emissions would continue to rise if the industry only focused on creating more efficient aeroplanes. The sector predicts it can cut its emissions by 12% by effectively implementing current technology that will improve the efficiency of the air traffic management system.

Boeing has proved that it is possible for the industry to grow whilst taking positive action when it comes to the environment. Following a complete restructure of the company's environment programme in 2007, it set five-year targets, including cutting emissions, water use and waste. It exceeded them all. Over this period, greenhouse gas emissions were cut by 9% whilst internal operations continued to grow with production rates increasing by 50%. The company has now committed to zero growth in absolute terms in the areas of greenhouse gases, water and solid waste to landfill by 2017.

Mutter explains that Boeing succeeded because it had linked environmental projects to the business plan and economic benefits. *"Not only is it the right thing to do but it is the right thing to do for business. We have never implemented any sustainability project that did not have a positive return on investment"*, he says. Technological advancements are key to reducing the negative effects aerospace has on the planet.

In January, Boeing identified 'green diesel' as a significant new source of sustainable aviation biofuel that emits at least 50% less carbon than fossil fuels over its lifetime. Green diesel offers the industry an alternative to traditional fuel sources. It is already in production and, unlike other biofuels, is competitively priced. Boeing also partners with airlines to test future technologies related to various environmental improvements – such as adaptive trailing edges, fuel cell technology and vibrations sensors – through its programme ecoDemonstrator. This gives it an opportunity to test different technologies and highlight what it should be aiming for in the next launch in the commercial sector.

When you compare how far the aerospace industry has come in terms of cutting emissions, it surpasses other forms of transportation. Comparing the Boeing 707, which began development in 1958, with the newer 777 model, newer planes are 70% more fuel efficient and have a 90% lower noise footprint.

Mutter concludes, *"The industry has a history of huge innovation and technological gains. We've cut emissions before, it certainly gets harder and harder, but we're optimistic we've got the right plan and we'll continue to innovate."*

www.boeing.co.uk

b>gt

ENVIRONMENTAL AIRLINES: A FLIGHT OF FANCY?

By
ILARIA BERTINI

Photo by
AERO ICARUS
via Flickr

s running an airline at odds with being an environmentalist?

If you really want to understand the role fossil fuels play in our daily lives, just look at the aviation industry. My dad once told me how different and expensive it was to fly just 20 years ago. You would only fly for important business, particularly special holidays or family visits. While telling me this, he was driving me to the airport. I was taking my latest low-cost flight from Milan to London – though not without some guilt (I usually try and avoid such environmentally unfriendly practices).

But let's face it: our ideals often clash with reality and flying has quickly become mainstream. Short-term holidays, weekend escapes and business trips have become more frequent and more accessible. Although I can't deny the pleasure I get in visiting my family in Italy, I also can't avoid questions about the costs of doing so either. I'm not referring to the £50 Ryanair ticket, but the cost on our planet.

Aircrafts produce a considerable amount of carbon dioxide (CO2), nitrogen oxides (NOX), other air particulates and noise pollution. Figures from the European Union revealed that greenhouse gas emissions from the aviation industry rose by 87% between 1990 and 2006. Meanwhile, the Intergovernmental Panel on Climate Change (IPCC) estimates that the industry might contribute to some 5% of manmade climate change by 2050, if no measures are taken to reduce emissions.

In 2006, the environmental journalist George Monbiot noted in a column that between 1990 and 2004, the number of people flying in the UK had grown by 120%. Aeroplanes' energy usage increased by 79% in that period, nearly doubling their carbon dioxide emissions. Monbiot said, *"Unless something is done to stop this growth, flying will soon overwhelm all the cuts we manage to make elsewhere."*

So what has the aviation industry done since then? According to the pressure groups, far too little. Emissions trading schemes have been said to be too weak, while the introduction of biofuels instead of traditional fuels has sparked debated among those against using crops for fuel. Global air traffic contributed to around 2% of global CO2 emissions in 2012. However, the International Air Transport Association (IATA) has pledged to reduce them significantly by 2020 through the implementation of low-carbon fuels and improved technology.

Airlines often outline specific policies in their efforts to be sustainable – which may sound contradictory. Take Virgin Atlantic Airlines, for instance, mostly owned (51%) by British entrepreneur Richard Branson. Virgin said it is working to reduce its CO2 emissions by 30% by 2020 and is working with the government on a serious framework on emissions that would include the aviation industry. The company purchases 99.5% of the electricity it uses on the ground from mixed renewable sources. The broader Virgin Group also set up an investment arm, called the Virgin Green Fund, and put efforts into creating a perfect biofuel to replace conventional fossil fuels. Virgin believes that with *"new, sustainably produced and lower carbon biofuels and step change technologies that will dramatically improve the fuel efficiency of planes"*, airlines will be able to easily met carbon reduction targets.

Branson himself – described as a climate sceptic *"converted"* by former US vice-president Al Gore's seminal documentary, An Inconvenient Truth – is not your conventional business tycoon. In a recent interview he said, *"As a big buyer of fuel for our transport businesses, I am very aware of the damage that oil and its greenhouse gas emissions is doing to the environment and the climate system in particular. At Virgin we have been investing the profits from our transport businesses into the research and development of sustainable fuels and other sources of renewable energy."*

Branson is also founder and chairman of the Carbon War Room, a pressure group that works with businesses to push for low-carbon solutions. He believes that protecting the environment could represent *"one of the biggest entrepreneurial opportunities of our lifetimes"* and that entrepreneurs should work with governments to solve the world's problems, rather than just *"trying to satisfy shareholders every quarter"*.

On the one hand, Branson's claims could be viewed as rather hypocritical. After all, he does own an airline – not a typical job for an environmentalist. On the other, he is using his significant wealth and fame to educate people about some of the most pressing environmental challenges. Meanwhile Virgin could criticised for *'greenwashing'* or it could be praised for the lengths it has gone to so far. We know admitting responsibility of a problem is the first step to solving it, so we should hope that other airlines will follow its lead.

As the administrator of the US Environmental Protection Agency (EPA) Gina McCarthy said after she was appointed in July last year, *"Can we stop talking about environmental regulations killing jobs? Please. At least for today? Let's talk about this as an opportunity of a lifetime, because there are too many lifetimes at stake."* The broader aviation industry would do well to think of sustainability in that context – like Branson and Virgin are on the way to doing.

A JOURNEY TO THE FUTURE...

By TOM REVELL

Photo by SOLAR IMPULSE

Photo by
SOLAR IMPULSE

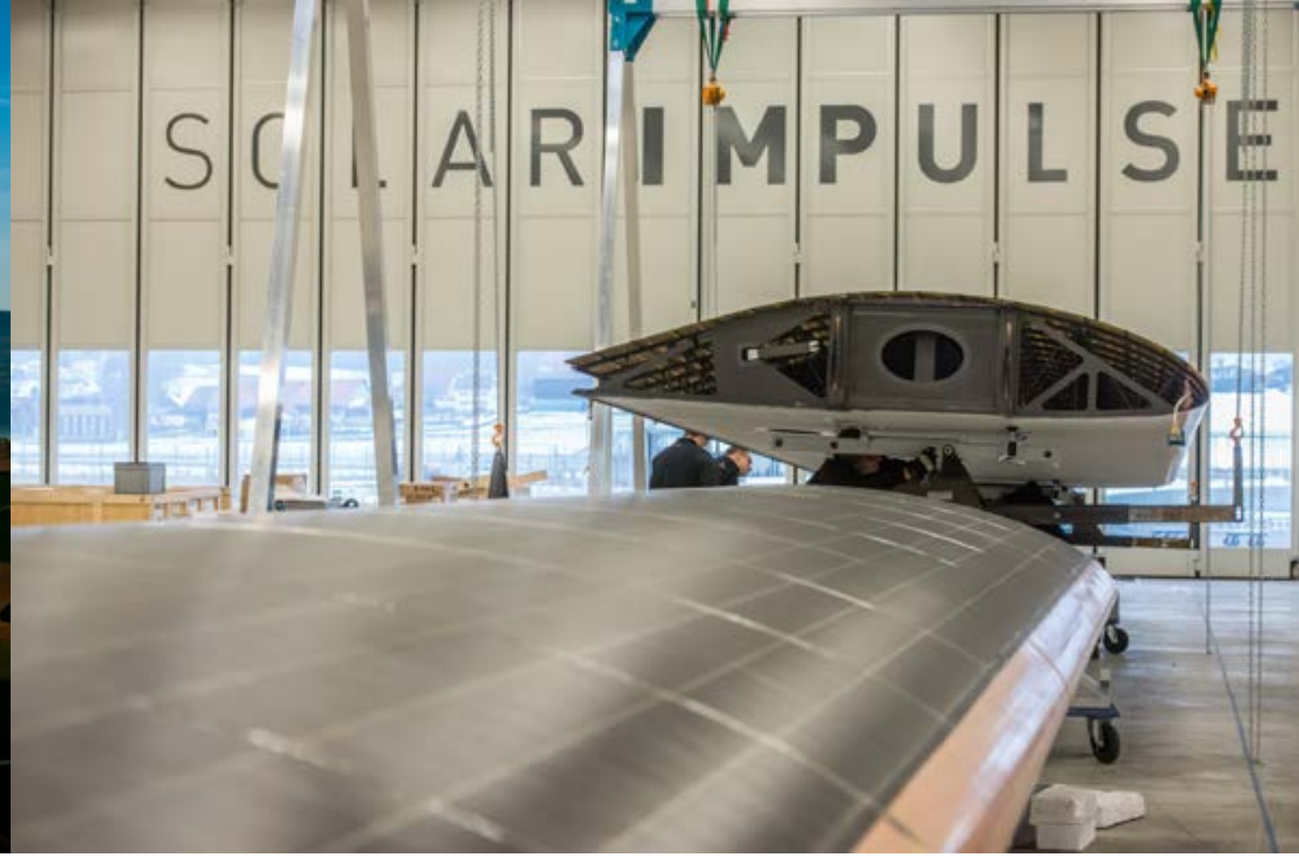


Photo by
SOLAR IMPULSE

It is safe to say that we have always been pretty bad at predicting how our great-great grandchildren will be getting around, though it never stops us trying. In Brave New World – written in 1931 and set in 2540 – Aldous Huxley imagined a London where every upper-class resident had a private helicopter. In 1915, the Washington Post asserted that the prices of electric cars would soon drop to be *"within reach of the average family"*. We can only hope that we never start commuting by jetpack, as the environmental impact doesn't bear thinking about.

The Guide to Sustainable Transport has mostly considered what can be done to improve our existing transport infrastructure. While we must not count on some new technology to save us from our carbon intensive ways, it is possible an inspired breakthrough, a brave innovator or a pioneering application of existing technologies will help us on our way.

That said, not all of these selected projects, inventions and seemingly implausible concepts are intended as blueprints for the future. Some will likely never see the light of day in commercial terms. But each deserves recognition for serving as an inspiration, as admirable demonstrations of the kinds of ingenuity that will be essential in sculpting the sustainable future of transport.

SOLAR IMPULSE

In 1999, Bertrand Piccard – a psychiatrist by trade – together with aeronaut Brian Jones, was part of the first crew to successfully complete a non-stop balloon flight around the globe. They took off with 3.7 tonnes of propane. When they landed, they had only 40kg left. When he realised that their flight could have failed for lack of fuel, Piccard pledged to fly around the world again. But this time, without depending on fossil fuels. With that, Solar Impulse was born.

The first prototype was built in 2010 – a solar powered plane with a wingspan equal to that of an Airbus A340 but the weight of an average car. It soon completed a record-breaking successful 26-hour non-stop flight. The team is now working on a second model, in which Bertrand Piccard and André Borschberg, co-founder and CEO of Solar Impulse, will attempt to circumnavigate the globe.

The plane gathers all the energy it needs from solar cells. These convert the sun's rays into electricity to simultaneously power the engines and recharge the plane's batteries, making it possible to fly throughout the night. Its designers claim that if Solar Impulse technologies were used on a massive scale, the world would be able to save up to 50% of the current consumption of polluting fossil fuel energy. However, they add that this is never going to happen, and stress that it is not the point.

"Our airplane is not designed to carry passengers, but to carry a message", Piccard explains. His project's primary purpose is not to revolutionise aviation, but to demonstrate the potential of renewable energy and change the way in which people think about clean technologies. As inspirations go, the sight of a giant, solar powered symbol soaring around the world is a good one.

www.solarimpulse.com

HYPERLOOP

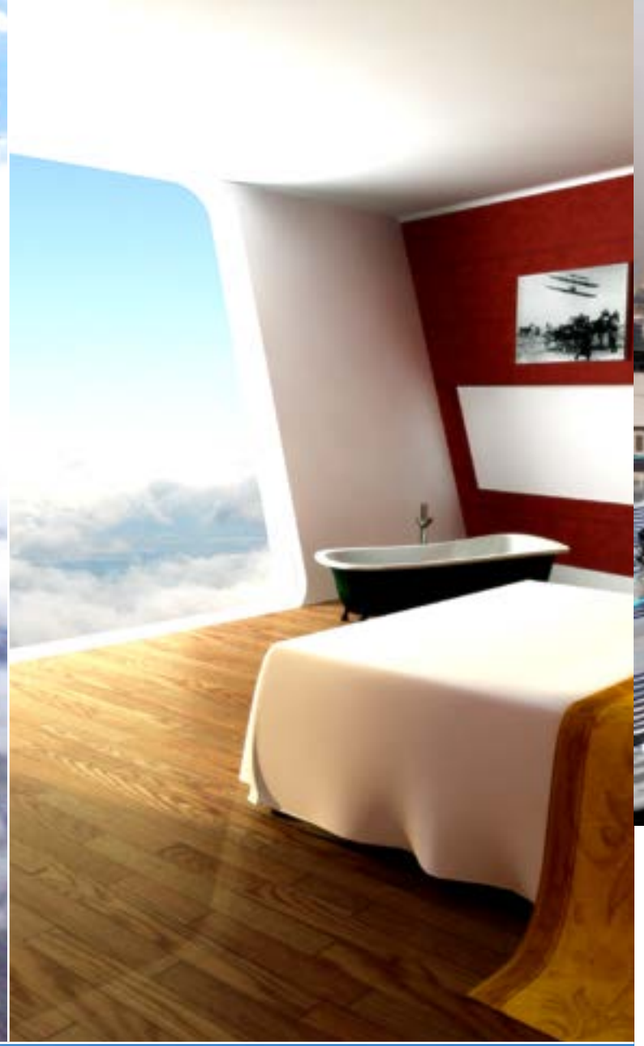
This guide has focused on trains, planes, boats and automobiles, but billionaire inventor Elon Musk thinks there could be "a fifth mode" of transport (presumably disregarding walking and cycling).

Last year, the entrepreneur behind Tesla, SpaceX and PayPal unveiled the Hyperloop, an almost sci-fi concept that proposes shooting passengers in pods through a network of reduced-pressure tubes at near-supersonic speeds. Though it may sound terrifying, Musk insists the forces on the passenger would be minimal, feeling more like a standard flight on an aeroplane than a ride on a rollercoaster.

Musk suggested the Hyperloop would even provide a safer, faster, and more efficient mode of transport between Los Angeles and San Francisco – the journey he used to illustrate the idea – than the high-speed train currently under development. According to his calculations, the concept would reduce the commute between the two cities to just half an hour, down from the one hour and 10 minutes the journey would currently take by flight.

The concept would be best used connecting cities closer than 1,000 miles apart. Beyond that, supersonic air travel would be preferable. For shorter journeys it would beat the plane, he says, because it would not spend time ascending and descending.

Perhaps most significantly, the pod could be powered entirely by solar panels installed to the top of the tube, though the environmental impact of construction would have to be considered. That said, we should not expect to see the hyperloop gracing reality any time soon. Despite fathering the idea, Musk says he is currently too busy to build it. It is suggested that the project would require $6 billion (£3.9 billion) to complete. However, customers would apparently have to pay only $20 (£13).



Photos by SEYMOUR POWELL

"Though it may seem a little farfetched, the [Skycycle] idea has the backing of Network Rail and Transport for London"

AIRCRUISE

Consultancy firm Seymourpowell's conceptual Aircruise – a giant, vertical airship lifted by hydrogen and powered by solar energy – is essentially a flying hotel. An initial design includes open internal spaces and a stylish bar and 10 apartments. Of course, journeys would be drastically slower than those made by jet – London to New York would take 37 hours – but in such luxury, that would almost certainly be a good thing.

"The Aircruise concept questions whether the future of luxury travel should be based around space-constrained, resource hungry, and all too often stressful airline travel", says Nick Talbot, design director at Seymourpowell. *"A more serene transport experience will appeal to people looking for a more reflective journey, where the experience of travel itself is more important than getting from A to B quickly."*

SKYCYCLE

Of the suggestions put forward so far, cycling high over the streets of London is beaten only by the Hyperloop in terms of its ties with science fiction. But SkyCycle, a concept put forward by London-based architects Foster + Partners, landscape practice Exterior Architecture and consultancy firm Space Syntax, proposes a network of elevated bike paths running above the capital's existing railway lines.

Its designers say that the network would run for over 136 miles, accommodating up to 12,000 cyclists per hour while improving journey times by up to 29 minutes. They claim it could even provide this capacity at a much lower cost than building new roads and tunnels. Though it may seem a little farfetched, the idea has the backing of Network Rail and Transport for London, and could offer a much safer journey to many city commuters.

Photo by FOSTER AND PARTNERS

"We chose to do this not because it is easy, but because it can have an amazing impact."
Andreas Raptopoulos

Photo by MATTERNET

MATTERNET

Drones have become synonymous with conflict and controversial foreign policy, but they do not have to mean death. Matternet is a project that wants to take the most cutting edge technology to the corners of the world where it is needed the most. It will use Unmanned Aerial Vehicles (UAVs) and the power of the internet to establish *"the next-generation transportation system"*, bringing hope rather than fear.

Using completely autonomous UAVs and intelligent software, Matternet could help deliver essential supplies to the one billion people who do not have access to all-season roads. *"Imagine one billion people being connected to physical goods in the same way that mobile telecommunications connected them to information"*, Matternet CEO Andreas Raptopoulos explains.

One model has already been successfully tested in the Dominican Republic and Haiti. Though the smaller crafts can carry a payload of 2kg, covering around 10km in 15 minutes, larger aircraft capable of carrying heavier loads are planned for the future.

The whole concept removes much of the necessity of significant investment in developing ecologically damaging, congested roads. Adapted for use in the cities of the future and for economic transactions, the Matternet team says their idea could revolutionise our transport infrastructure. Similar ideas have recently been proposed by Amazon, the world's largest online retailer, which is currently testing its own drone delivery systems.

Matternets UAVs are also remarkably energy efficient. But perhaps most impressive is the cost. To carry a 2kg payload over 10km costs just 24 cents (15p). The cost of setting up a trial network in Lesotho to transport HIV/Aids tests, complete with 50 landing stations and 150 drones, would be just $900,000. Raptopoulos adds, *"We chose to do this not because it is easy, but because it can have an amazing impact."*

WHAT DO I DO NEXT?

Having read through the Guide to Transport 2014, which we hope has inspired you to think twice about how you travel, you might be wondering how else you can make a difference in your life. We encourage you to read our other in-depth reports, from both this year and last, on topics as varied as investment, energy and the media. But above all, we encourage you to act upon what you've read.

Pg 72

FIND A SPECIALIST ETHICAL FINANCIAL ADVISER NEAR YOU

Sustainable investment is what we write about day in, day out. Contrary to the early-90s Des'ree hit 'Crazy Maze', which begins, "Money don't make my world go round", money is what governs almost every decision we as consumers and businesses make.

It's important, therefore, that we use it as a force for good. All the financial advisers listed are specialists in ethical investment and will help you choose the best possible financial solutions that match your values.

RELATED REPORT: The Guide to Ethical & Sustainable Financial Advice 2013 - http://bit.ly/GZegUA

Pg 74

SWITCH YOUR ENERGY PROVIDER TO GOOD ENERGY

Even without the climate change imperative, there is a desperate need to reduce mankind's emissions. The problem is pollution and waste. Switching to cleaner sources of energy is imperative, and Good Energy, as the UK's only 100% renewable electricity provider, is the best place to go.

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Pg 76

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While we wax lyrical about the wonders of doing good with your money, we're also of the mindset that consumers also want to have fun, kick back and relax. That's why we encourage sustainable tourism and responsible travel.

Booking a holiday – UK or abroad – with Cottages4you is the definition of luxury (and we'd be delighted to join you if invited!)

RELATED REPORT: The Guide to Sustainable Tourism 2013 - http://bit.ly/VU57xj

ETHICAL FINANCIAL ADVISER DIRECTORY

Blue & Green Tomorrow works with experienced independent financial advisers who specialise in ethical investment and understand how money can be used to create a secure future for you, for your families and for our planet. Give one of them a call and talk about your plans

You may even find you sleep easier at night if, like us, you want a better future for all. Your hard-earned money can do some of the hard work of making that happen while you sleep.

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2 Bromige Financial
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3 Equity Invest
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4 Ethical Futures
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5 The Ethical Partnership
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13 Virtuo Wealth
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