Economist Conferences | The Economist

CLEANING UP CARS

Do biofuels, electricity or hydrogen represent the best bet for society?

An Economist Debate • Executive Summary

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About this report

Economist Conferences' debate "Cleaning up cars: do biofuels, electricity or hydrogen represent the best bet for society?", was held over 90 minutes on the evening of September 22nd, 2009 at London's Royal College of Physicians in Regent's Park.

This report summarises the main arguments put forward on the debate topic by a panel of six speakers, representing a cross-section of opinion, as moderated by the debate chairman -- see details below. The format began with introductions and two minutes of opening argument by each of the speakers, with some initial Q&A by the moderator after each speaker's initial remarks. A debate ensued between the speakers, with interrogation by the moderator, and then the debate was opened up to an invited audience of experts, also representing various opinions on the topic, including some from industry, academia, government and environmental activism.

—MODERATOR—

GREG ARCHER
Managing Director
Low Carbon Vehicle Partnership

Greg Archer is Managing Director of the Low Carbon Vehicle Partnership (LowCVP), a multi-stakeholder not for profit company with over 350 members. LowCVP works to accelerate the shift to low carbon vehicles and fuels and Greg has been leading the organisation since 2004. Mr Archer is also a Director of Cenex (Centre of Excellence for Low Carbon and Fuel Cell Technology) and of the Board of the Renewable Fuels Agency, in which capacity he co-authored the influential Gallagher Review examining the indirect effects of biofuels.

Mr Archer is a Chartered Chemist with wide ranging experience in managing environmental businesses, programmes and research.

—SPEAKERS—

JULIA KING
Vice-chancellor
Aston University

Ms King was appointed by the Chancellor of the Exchequer in March 2007 to lead the 'King Review' to examine the vehicle and fuel technologies that, over the next 25 years, could help to reduce carbon emissions from road transport.

Having held several senior academic positions, Julia King became Vice-chancellor of Aston University in December 2006. She was previously Chief Executive of the Institute of Physics, prior to which she held a number of senior executive appointments at Rolls-Royce, having joined the company in 1994.

Among her numerous board memberships, Ms King is a member of the Governing Board of the European Institute of Innovation and Technology and of the World Economic Forum Global Agenda Council on the Future of Transportation.

KEN KEIR, OBE
Managing Director UK and Senior Vice-president
Honda Motor Europe

As a member of the Honda Europe board, Mr Keir is responsible for all corporate matters for cars, motorcycles and power equipment in the UK and Europe.

Born in Dundee, Scotland, Mr Keir moved to Birmingham in 1967 to study engineering. A life-long car man, he began his career with British Leyland in 1972. Prior to joining Honda UK in 1991, Mr Keir worked for Renault UK as Director of Sales and as Regional Director for the South of England for Peugeot UK.

MICHAEL HURWITZ
Head of Environment, Policy and Delivery
Department for Transport

Michael Hurwitz is Director of the Office for Low Emission Vehicles, a new cross-Whitehall team responsible for placing the UK at the global forefront of ultra-low carbon vehicle development, demonstration, manufacture and use.

Prior to the civil service, Mr Hurwitz was a consultant with Andersen and Deloitte, specialising in programme management and organisational change. In 2002 he was seconded to the Cabinet Office, joining the Department for Transport in 2004. Previously Head of Environment Policy and Delivery at the Department for Transport, Mr Hurwitz led the development of Low Carbon Transport: A Greener Future, the Government's carbon reduction strategy for transport.

Current policy responsibilities include the £260 million package of consumer incentives and infrastructure support to stimulate the market for electric vehicles, as well as oversight and direction of the government's R&D spending in this area.

DOUG PARR
Chief Scientist and Policy Director
Greenpeace

Dr Doug Parr is Chief Scientist and Policy Director at Greenpeace UK, looking after the science and political lobbying functions. Currently working on climate change policy in the power, heat and transport sectors, he has previously worked on a number of issues including GM crops, chemicals policy, green refrigeration, marine conservation, biofuels and nuclear power. He obtained a D.Phil in Atmospheric Chemistry from Oxford University in 1991.

TOM STANDAGE
Business Affairs Editor
The Economist

Tom Standage oversees the newspaper's business, finance, economics, science and technology coverage. He is also the author of five history books, including *An Edible History of Humanity* (2009), *A History of the World in Six Glasses* (2005), a *New York Times* bestseller, and *The Victorian Internet* (1998), described by the *Wall Street Journal* as a "dot-com cult classic". He holds a degree in engineering and computer science from Oxford University, and is the least musical member of a musical family.

GRAEME SWEENEY
Executive Vice-president, Future Fuels and CO_2
Shell International Petroleum Company

Dr Graeme Sweeney has worked for Shell for 33 years and is currently Executive Vice-president of Future Fuels and CO_2. In his previous role, Dr Sweeney was Executive Vice-president of Renewables, Hydrogen, CO_2 and Power.

Dr Sweeney is also elected Chairman of the Advisory Council of the European Technology Platform of Zero Emission Fossil Fuels Power Plants (ETP-ZEP) and a member of the Gleneagles Dialogue Project Steering Board and the UK Energy Research Partnership (UKERP). He also chairs the Advisory Board of the UK Energy Research Centre (UKERC) and works in the context of Chairman with DBERR/DEFRA on the Near-Zero Emission Coal (NZEC) and the EU Coach Programmes.

The Debate

INTRODUCTION

In the run-up to the United Nations Climate Change Summit in Copenhagen in December, there is enormous media attention focused on opportunities to cut greenhouse gas emissions and the risks posed by climate change.

Globally, transport contributes a quarter of all greenhouse gas emissions, with 80% of that coming from road transport and half of that coming from cars. That is projected to double by 2050 unless alternatives to fossil fuels are developed.

At the outset, the invited audience of experts were polled to determine their view ahead of the debate on the question at hand: which represents the best bet for society – biofuels, electricity, hydrogen, or something else? There was a clear majority for electric vehicles, which chimed with an online survey by *The Economist* which found that 43% favoured electric cars, while just 15% leaned toward biofuels as the solution.

OPENING SHOTS

JULIA KING, Aston University, is a strong advocate of electric car development.

Tough targets for CO_2 emissions cuts by 2050, and the fact that sectors such as aerospace and shipping are unlikely to meet their share, means that car transport will have to bear more than its share of the burden – and it is urgent.

> "We're only three car lifetimes to 2050, so we must have radical change for the manufacturers, but also for us as consumers and drivers. If we are going to have ultra-low emissions vehicles as the entire car parc by 2050, which is what we'll need, whether they are electric vehicles, hydrogen or something else, we need to start the change now, we cannot wait."

Professor King argued that we need to start with the technologies that we know will work – we know that electric vehicles work. We know the infrastructure already runs under our streets and into many of our garages.

The Committee on Climate Change (CCC) modelling suggests that the UK should aim to have 1.6m electric vehicles on the road by 2020. The German government has announced a target of 1m electric vehicles by 2020 [and France is aiming for 2m by the same date].

There are a number of perceived problems: cost, emissions and range. There are new partnerships and innovative business models starting to address the cost issues. On emissions, some argue that there is no point in electric vehicles if you charge them from coal-fired power stations. But it is an absolute priority in any developed country to "de-carbonise" electricity generation in any case, so it's not an excuse against electric vehicles. On range, that can partly be addressed by persuading consumers to start thinking differently and be more realistic about the mileage they actually drive. Most drive less than 50 miles a day.

Electric vehicles are the technology to start with now, even if it isn't the ultimate solution. It must also be realised that technology cannot give us all the answers. Everyone will need to make compromises about their expectations for personal mobility options; it is a tough one for governments, but they must start thinking about that too.

KEN KEIR, Honda, expects incremental evolution of technologies, with the regulations and incentives put in place by government to drive consumer preferences.

The century of dominance of the petrol-powered unit is clearly shifting and there is a need for low-carbon technology. Since 2003 the car industry has already delivered a reduction of 20% in the average amount of energy used per car.

> "Our belief is that a range of technologies will have a role in powering personal mobility. The industry we're in is extremely competitive, but significant progress has to be made before they can reach a mass market."

Honda believes that petrol-electric hybrid cars – which offer a 30% reduction in CO_2 – will play a significant role in the short term. In the medium term, say next 10 years, there is no doubt that electrification is going to play a part in our transport and the plug-in motor is without doubt going to play a role.

We believe, however, that hydrogen fuel cell electric motor power is the ultimate expression of what consumers want in personal mobility. The reason for that, Mr Keir said, is what is referred to in the industry as RPR (range, performance, refuelling). These are the things that consumers require now and will want in the future.

MICHAEL HURWITZ, from the UK's Department for Transport, underlined Julia King's point: that while the debate is about technology, it is important that it is put in the broader context of how people access goods and services, use transport generally and interact with urban spaces.

> "It is quite hard to predict now whether there will be a dominant technology. The role for government is to provide a stable framework – for industry and consumers – to ensure that various opportunities can be pursued in a sustainable way."

It is important to remember, when you look at the analysis in the government's carbon reduction strategy, that efficiencies in conventional engine technologies offer the greatest CO_2 cuts out to 2020.

Biofuels also offer an opportunity if we can assure their sustainability. Electric drivetrain technologies – such as plug-in hybrids, or electric vehicles – offer substantial benefits; and while the mass market for these is still some years away, given the requisite development cycles and length of time our vehicles spend on the road, we need to start preparing now if these are to make a substantial contribution. Hydrogen may indeed offer a solution in the long-term but there are questions about energy-source cost, storage of the fuel and infrastructure.

The good news is that the combined potential of all these to reduce transport emissions is absolutely enormous. But all alternatives to fossil fuels require answers on sustainability, infrastructure and life-cycle energy use.

DOUG PARR, Greenpeace, argues that biofuel is the least attractive option because there isn't – and won't be anytime soon – the right regulatory framework in place to ensure its production is sustainable on a large scale.

> "We need to dramatically reduce our CO_2 emissions right across the power, heat and transport sectors. Delivering CO_2 reductions from the transport sector now has to be an overwhelming public policy priority...We should be making far more efforts than we actually are, certainly than the present government is, to shift demand away from ever-increasing vehicle use."

The development of electricity-based cars relies on the decarbonisation of electricity, a battle that is still being fought. Decarbonising electricity is not automatically going to appear. Hydrogen and electricity are going to need significant deployment of new infrastructure.

Mr Parr argues that we must get back to the standards that we're trying to achieve -- European legislation is needed to clearly set out what motor manufacturers have to do. But the UK government is going to have to make a choice about which technologies it is going to back. The government must set very stringent standards and it must drive the huge amount of replacement infrastructure that is needed.

TOM STANDAGE, *The Economist*, says electric cars are the way to go.

> "It is risky to pick winners but as a journalist it is my job is to simplify and exaggerate. I am going to pick a winner: I agree with Professor King that electricity is the way to go. I'm a fan of SciFi but the other two (hydrogen and biofuels) are Sci-Fi. Electric cars are here now, they do work and they're getting better."

There is enough power to charge vast growth in electric cars. A study in the US that found that if you could wave a magic wand and turn the entire fleet into plug-in hybrids, the US grid infrastructure could support 84% of the fleet as it stands.

On emissions, even with coal-heavy capacity in the US (and slightly less coal-heavy capacity here in the UK), charging a car from the grid produces about 50% fewer emissions than burning the fuel in the engine, essentially because engines are less efficient than power stations.

Biofuels: there are some lovely ideas out there about cellulosic ethanol on marginal land that doesn't compete for land and water with agriculture, but it is still very expensive. Craig Venter and his hydrogen spewing bugs, that would be great too but that's also Sci-Fi.

Hydrogen is very interesting but while a lot of technologies have one Achilles heel, hydrogen has four: there is no cheap or easy way to produce the fuel; it is very hard to store it in the vehicle; fuel cells are also incredibly expensive – the price has come down only 65% since 2002; and they have a propensity to blow up. It is the car of the perpetual future.

GRAEME SWEENEY, Shell, argues that there is no silver bullet among the available technologies and that biofuels in particular have much greater potential than other debaters have argued. It would be a mistake to pick a winner just as the game is starting, he says.

There is clearly a massive challenge, especially as the number of vehicles on the road is expected to double by 2050, to about 2bn globally. Fossil fuels would struggle to keep pace with that growth in any case, on top of which there are climate change-related CO_2 restraints.

"These pressures will simply create the opportunities for biofuels, electricity, hydrogen and probably natural gas. Sometimes the process will produce change at a less radical pace than we would like but the incremental process will produce a lot more change than we might think."

The UK low carbon transport strategy is commendable. That is about focusing on three things: it's about vehicles – about standards, CO_2 per kilometre; it's about fuel and saying what you want for those; also, it's about drivers, about better driving, better information and changing access.

It's important for the government not to pick winners but instead to set a policy framework that encourages the outcome that we are looking for. Those that attain significant CO_2 reductions in a sustainable way must be properly rewarded. It is important for the government to clearly articulate its social and environmental standards.

By 2030 the global biofuels market could reach 15m barrels a day (b/d). [The IEA estimates that global biofuel demand was just over 0.8m b/d in 2007 and that it will rise to 3.2m b/d by 2030 in its "reference scenario", meeting about 5% of road transport fuel demand.]

To achieve the alternative transport fuel goals will require an unprecedented partnership between society, industry and government.

DISCUSSION HIGHLIGHTS

Electric vehicles have clear support from a number of panellists, but Greg Archer asks about the possibilities for technological advancement bringing down the still-enormous cost of the batteries. Isn't the consensus that the battery cost has to come down by a factor of five kilowatt per hour to reach commercial viability?

Julia King points to the example of the laptop computer industry and lithium ion batteries, which saw dramatic improvements and cost reductions. The car industry likewise is talking about making rapid improvements.

At the same time, the cost of carbon is way too low – that is a market failure because if it goes on like that then market forces and competition won't deliver in time. "Maybe cars will just have to be more expensive."

Doug Parr makes the point that carbon prices have remained way too low to achieve the desired effect through market forces alone – US$10 on a barrel of oil equates to US$24 a tonne for carbon. The price of carbon through the European Union's emissions trading scheme (ETS) has remained below that price on average, and even at much higher prices it still would amount to just pennies per litre and have little effect. Different drivers are needed, specifically much tougher standards from governments together with better incentives for consumers.

What about the problem of range for electric vehicles? Tom Standage says that consumers may really require reassurance about the problem of range, citing the tiny India car, the Reva, that comes with breakdown coverage in case you run out of charge.

Isn't the fact that the government is spending hundreds of millions of pounds on electricity transport development and not nearly as much on second-generation biofuels or hydrogen mean that it isn't really a "technology neutral" position? Isn't government making a choice?

Different types of government intervention are needed depending on the outcomes sought, Michael Hurwitz explains. There is a need for an overall regulatory framework to drive down CO_2, with the European Union's standards on cars (the target has been set at 95 grams per kilometre by 2020) having the potential to be the biggest single carbon saving measure in transport. But other targeted interventions are also needed, for example the governments £230m incentives package for electric vehicles, which is aimed at fostering an early market for the ultra-low emission technologies now emerging.

Biofuels have had an inauspicious start but they could also offer an opportunity if we can assure their sustainability. As Doug Parr indicates, we need the right regulatory framework in place to ensure their production is sustainable on a large scale. Graeme Sweeney says that good biofuels represent a material, near-term option to take carbon out of transport fuels but corn-based ethanol is not part of the solution to reduce CO_2 and it was never meant to be. He challenges Tom Standage to visit Shell's plant in Ottawa to see its progress in developing, with partner Iogen, commercially-viable cellulosic ethanol. It costs more than first-generation biofuels and its future development will also depend on putting a price on carbon that reflects the desire to make it sustainable.

On hydrogen, the cost of fuel cells is still enormously high, the cost of storing the hydrogen also still very expensive, and there are issues of producing renewable hydrogen in the volumes needed. When will it mature to a commercially sensible product on the market?

That may be at least a decade away, Ken Keir agrees. Infrastructure is being developed in Japan, California and Germany for hydrogen and quite substantial investment is being made by Shell, amongst others. The fuel manufacturers recognise there is infrastructure needed.

SOME POINTS MADE FROM THE FLOOR

Dan Lewis, Research Director, Economic Policy Centre: Why aren't car manufacturers, government policy-makers and consumers that excited by the huge efficiencies that could be exploited by the reduction of vehicle weight? Only 6% of a typical vehicle's power is used to transport the passenger, the rest to transport the vehicle.

Simon Wood, Technical Director, Lotus Cars: Carbon-based fuels are far too cheap. They need to double in price before the public will take notice.

James Scruby, CEO, Matrix Biofuels: Both biofuels and electric cars have a part to play. Both have difficult technical barriers. Regulation should play its part – legislation at the moment has no penalty for unsustainable biofuels or incentive for good carbon. But it is profoundly dangerous to try to pick winners. Financial investors hate that because it is completely non-transparent. Better to set clear targets on carbon reduction and sustainability and let people work out the best way to get there.

CONCLUSION

Greg Archer finally polled the audience again on the debate question and the three options, but added a fourth: how many feel that the best bet is to pursue all of these plus a lot of demand management?

> "The reality is you have to do all of this – do biofuels right, electric vehicles, plug-in hybrids, which may be important sources of transport in the future. Fuel cells later, but they'll be exceptional. All have great potential."

Concluding, he emphasised the urgency of the issue, quoting US Secretary General Ban Ki-moon's point that those least responsible for global warming are bearing the brunt of its consequences, adding that it will be the following generations that will have to deal with the consequences of decisions made by this one on future transport.

Economist Conferences are running a series of energy debates in 2009, supported by Shell. The topics and themes for these are selected by the editorial team at Economist Conferences, based upon key issues covered by *The Economist* over recent months.

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Economist Conferences
26 Red Lion Square
London
WC1R 4HQ
Telephone +44 (0) 207 576 8000
Fax +44 (0) 207 576 8472
www.economistconferences.co.uk