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european energyinnovation

Electric Vehicle Supplement

Fuel Cells and Hydrogen Joint Undertaking
The European Green Cars Initiative
Electric Charging infrastructure

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"Hydrogen and fuel cell applications are strategic European energy technologies contributing to a low carbon (urban) energy and transport system. They are among the technologies needed to put Europe on the path towards sustainable growth, as stated in the Europe 2020 strategy."

[The European Strategic Energy Technology (SET) Plan]

According to the first forecasts, fuel cells will emerge as a true cornerstone sector for the low-carbon economy. The market is going to grow to about $1.22 billion in the next years, with an annual growth rate of about 20%. This dynamic, accelerating growth will be accompanied by creation of high-value jobs.

think ahead, exhibit at efcll !

europeanfuelcell.it

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Contents


8


11


16

ElectroGraph

Graphene-based Electrodes for Application in Supercapacitors

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- Danubia NanoTech s.r.o. (Ltd.)
- Institute of Occupational Medicine
- Trinity College Dublin
- Centro Ricerche Fiat S.C.p.A.
- Instituto Nacional del Carbon - Consejo Superior de Investigaciones Científicas
- The University of Nottingham
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Flexible, reliable and comfortable individual mobility while dramatically reducing emissions can be regarded as one of the greatest technological challenges of the future. Only by switching to sustainable energy concepts and radical energy savings can realize the climate-friendly means of transportation. To achieve these goals new, versatile and sustainable approaches to storage and conversion of electrical energy are needed.

The ElectroGraph project follows an integrated, technology driven approach in development of novel materials and components for realization of optimized supercapacitors.

Supercapacitors are considered one of the newest innovations in the field of electrical energy storage. In electric vehicles, supercapacitors can be coupled with fuel cells or batteries to deliver high power needed during acceleration as well as to recover the available energy during regenerative braking.

To design a supercapacitor with high energy and power density, it is crucial to select the correct electrode materials and the most suitable electrolytes. In ElectroGraph project the progress beyond state of the art will be achieved by development and use of graphene and graphene-based material as electrode components and use of room temperature ionic liquids (RTILs) as electrolyte.

The development of production processes for the materials, components and devices will be an integral part of the project. As printing technologies are an essential aspect, if a low-cost mass production is envisaged, the determination of the optimal method of application is therefore also an important project goal. At the end of the project the performance of materials and components is to be demonstrated on the functional model of supercapacitor.

Together with the technological development, the experience-based understanding of appropriate practices for the safe production, processing and recycling of graphene nanomaterials will be generated, and will facilitate the development of guidance on risk management and best available techniques to minimize and control any health risks to manufacturers, downstream users and the environment. Furthermore, methods by which the graphene containing materials can be recycled to recover value at the end of their life will be identified with the primary objective of reducing environmental impact.

And now, from European Energy Innovation… something new!

Although perhaps not exactly an innovation, this is nevertheless the first ever supplement to the magazine. It is devoted to electric vehicle technology, and we have produced it to coincide with the European Electric Vehicle Congress here in Brussels. We propose to repeat this exercise regularly, when suitable opportunities arise; for it seems very much part of our mission to focus attention on major events such as these, when policymakers, academics and industry come together to exchange views and information.

Or, if you prefer, when those who shape what we do meet those who shape how we do it.

Tackling greenhouse emissions due to transport currently forms a major part of EU carbon policy, and one consequence of this is the seemingly irresistible momentum that is now building up behind electric vehicles (EVs), seen by many as offering an answer to many of the problems associated with internal combustion engines. What better time to bring to your attention these articles, written by distinguished contributors who represent different aspects of EV technology? In the area of policy, the Commission's Directorate General for Research, with a special interest in advanced road vehicles, discusses the role of the European Green Cars Initiative (EGCI), which commands a total budget of □1 billion. Of course, one of the major obstacles to the greater uptake of EVs is the relatively limited range between charges. So from Eurelectric, the body representing national electricity suppliers, we have an article examining some of the key requirements for a user-friendly charging infrastructure. Meanwhile, an article from AVERE shows how EU FP7 funding is being used to support projects as diverse as the impact of EVs on European power systems; and pioneering low-voltage technology.

Although it is clear that there remain many obstacles to more widespread adoption of EVs, including the range between charges, the time to recharge and the much higher initial price of electric vehicles, it is also clear from the quality of the articles we publish here, and from the presentations being made at the Congress, that human ingenuity and human effort will find the solutions that human consumers will accept. In this regard, perhaps one aspect that remains relatively unexplored is the image of EVs in the mind of the consumer. The earliest examples may be charitably described as unsophisticated; perhaps little better than shopping trolleys that lacked much of the carrying capacity, performance and safety features of modern cars. But prestige and sports car manufacturers may have transformed the image of EVs, as Porsche, Tesla and Rolls Royce, among others, enter the debate. Certainly, most, if not all, mass-market manufacturers now appear to have an electric (either fully electric or electric-hybrid) model on offer, and this factor suggests that EVs will fulfill the potential suggested by their environmental credentials.

Mike Edmund
Commissioning Editor

The European Green Cars Initiative

A European research scheme designed to support electric cars.

Frédéric Sgarbi

The European Green Cars Initiative (EGCI) is a research and innovation measure which was included in the European Economy Recovery Plan adopted in November 2008.

Along with two additional research and innovation measures, the EGCI is a so-called Public Private Partnership (PPP) with a total budget amounting to €1 billion to develop new technologies for the greening of road transportation. It includes all kinds of vehicles: two wheelers, passenger cars, bearers, vans and trucks for long distance haulage.

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The main target retained for the EGCI has been to contribute to improving the energy efficiency of road transport operation with a double effect on decreasing CO2 emissions and therefore mitigating global warming on the one hand and securing energy availability through rationalisation and diversification of energy sources.

Three major research pillars were identified: long distance road haulage representing 50% CO2 emissions in road transport, electrification of road and surface transport, logistics and co-modality.

In terms of allocated budget and number of ongoing projects, electrification represents 50% of research efforts within the EGCI. This percentage of the budget dedicated to electro-mobility is an ambitious attempt within European research to concentrate resources in a new and emerging technology where Europe must mobilise its researchers and industries to remain the world leader in the production of road transport vehicles.

Existing vehicles based on Internal Combustion Engines have reached a very high level of maturity; however more incremental research and integration of available technology will be needed to meet the CO2 2020 targets.

Regardless the pace of electric vehicle introduction, Europe must be ready to deliver attractive and affordable products that can withstand international competition when massive introduction starts. A realistic forecast for the time of such an introduction could be year 2020. In the meantime, community research supports and will continue to support European manufacturers to develop electric cars.

Since the EGCI was launched in year 2008, already more than 50 research projects amounting €200 million are under way in areas such as electric batteries, electric and electronic components, electric engines, safety aspects, new vehicle architecture for electric cars, charging points and vehicle to grid interfaces.

The EGCI has set up a steering committee called the "EGCI ad-hoc Industrial Advisory Group" to define and prioritise technological research topics that are included in the 7th Framework Programme annual calls. This group is composed of representatives of major European industries (Volkswagen, Renault, Volvo, Siemens, Bosch, Valeo, etc.). Several Commission services representing different areas of community research also actively participate in this group: transport, material, nanotechnologies and manufacturing, energy, environment and ICT. This type of governance has led to a closer integration in the decision making process and has resulted in increased multidisciplinary research actions, for example research on electric storage and lightening of electric vehicles.

At the moment Commission services are reflecting about the future of the EGCI as one of the major pillars of transport research within Horizon 2020.

Charging infrastructure

Ensuring consumer convenience and system stability

As part of its wider low-carbon commitment, the European Union has set the ambitious goal of reducing greenhouse gas emissions by 80-95% by 2050. To meet this target, Europe's electricity generation mix will change significantly and transport will have to shift away from oil to sustainable alternative fuels. This approach, if properly integrated, will fundamentally change the way mobility is organised across Europe.

Electricity is key in making transport more sustainable and reaching the carbon reduction targets. Using low-carbon electricity in the transport sector can decrease greenhouse gas emissions, encourage energy efficiency gains and decrease the EU's dependency on fossil fuels. In addition, when electric vehicles reach a significant market share, their batteries will offer balancing opportunities to the distribution grid. This will help to smoothly integrate the increasing share of variable renewable energy sources, thereby contributing to system stability.

Contrary to internal combustion vehicles, electric vehicles do not require dedicated refuelling stops, but will be charged while the vehicle is parked. Cars will be charged in different types of locations, with varying charging modes: at home, at work, at a shopping mall, in dedicated charging stations. Although the core infrastructure for charging electric vehicles, i.e. the electricity distribution grid, is already in place, more needs to be done to support the roll-out of charging posts in public areas and to smoothly integrate electric vehicles into the electricity networks.

Common standards for electric vehicles and the associated charging infrastructure are needed to ensure a large-scale take-up of the technology. Standardisation for both hardware (connector and cables) and communication software will generate cost benefits and help to create economies of scale. Hardware standards will help avoid the risks of stranded assets and ensure interoperability, thus enabling consumers to charge their vehicles anywhere across Europe.

In addition to hardware standards, unlocking the full benefits of electricity as a low-carbon fuel will require an intelligent connection between the distribution grid, charging infrastructure and vehicle. This so-called "smart charging" will enable a better coordinated and managed charging of electric vehicles. In addition, it will facilitate the integration of renewable energy sources, enable grid management, and optimise the efficient use of power generation capacity.

At the early stage of market development however, it is important to leave room for further market improvements and refrain from overcomplicating market and regulatory models. Given the current infancy of the market, few initiatives are being taken to build up the public charging infrastructure. Distribution system operators (DSOs) could accelerate this process by taking on a pioneering role for installing public charging infrastructure. In addition, existing regulatory models across Europe need to be assessed to ensure an effective and efficient roll-out of public charging infrastructure.

Hans ten Berge

Clearly, electric mobility will have a significant contribution towards the goal of a low-carbon Europe by 2050. The synergies offered by electric mobility need to be fully exploited. Proper integration into the distribution networks and an end-user friendly charging infrastructure are vital to facilitate early deployment and market penetration. To this end, the electricity industry calls for industry-wide understanding and cooperation, complemented by well-implemented and enforced legislative support at the EU level.

Hans ten Berge, Secretary General EURELECTRIC
Born in Eindhoven in 1951, Dutch citizen Hans ten Berge holds a degree in Chemistry from the Rijksuniversiteit in Utrecht and also graduated from the University of Delft in business administration. Following posts in a number of international enterprises, including Exxon Chemie and Kemira Agro, he joined ENECO Energie in November 1998 as Managing Director of Energiehandelsbedrijf, subsequently serving as a member of the ENECO Energie Board of Management from November 1999 until January 2006. He served for several years as Chairman of the EURELECTRIC Markets Committee, before taking on the full-time post of Secretary-General in 2007.

How will EVs look in the future?

Jacques de Selliers, Going-Electric aisbl

Daimler Victoria taxi, 1897
Driver seated high up to see over what, horses?

Many of the first cars of the late 1800s were designed just like horse carriages. Often, the driver was seated high up on the front of the car – just like a coachman. Some were even steered by reins – that's what coachmen were used to!

Similarly, many of the electric vehicles (EVs) appearing in the market look just like normal petrol car. However, there is a major functional difference between an EV and a petrol car: driving range.

Indeed, petrol cars have a virtually infinite driving range: they drive thousands of miles only by refuelling for a few minutes every several hundred kilometres. But EVs have a limited range – typically 100 to 150 km for most current models, maybe more in the future. And even with the fastest charging stations available, it takes about 30 minutes to charge a medium-size EV for 100 km.

This is bad news for EVs: because of their limited range, their usage is limited to short daily trips, such as commuting and city trips. But there is good news too: such trips are the main usage for cars - 90% of daily car trips are less than 80 km, well within the range of most EVs available today.

About 90% of commuting and city trips are driven with only one occupant at slow speed, often in congested traffic. For such usage, the comfort and speed a big powerful car is not only unnecessary, it is unpractical: an extremely small microcar, being easier to handle through traffic and to park, is much more convenient. Therefore the future of EVs is microcars. This includes the SMART EV, the MIA Electric, and two-seaters hardly bigger than large motorcycles that several manufacturers (including Renault, Opel, Audi and Volkswagen) are launching.

Such micro-EVs are not only more practical, they are better for the environment: their construction requires less material and their usage requires less energy. Moreover, they are significantly better for cities: not only they are clean, but also they occupy far less space and thereby can significantly reduce traffic and parking congestion. Micro-EVs are really a magic solution for a more sustainable future!

Governments are in charge of promoting what's good for society. But they should only promote technologies that have the potential of becoming financially competitive. This is the case for EVs: in about a decade, large production series, collapsing battery prices, integration of EV electronics and rising oil price will make the total cost of EVs ownership very advantageous. Just think of the first mobile phones: only 25 years ago, they weighted nearly a kilo and cost thousands of dollars, and consumer surveys forecasted a market penetration below 5%!

Some of the electric cars of the future
Hardly bigger than large motorcycles

Smera by Lumeneo
98 cm wide, 250 cm long
500 kg
110 km/h, 0-100 km/h in 8 s
Driving range 100 km
www.lumeneo.fr

Twizy by Renault
119 cm wide, 233 cm long
450 kg
75 km/h
Driving range 100 km
www.renault.com

Tilter by SynergEthic
90 cm wide, 253 cm long
340 kg
110 km/h, 0-100km/h in 13 s
Driving range 120 km
www.tilter.fr

So governments should promote the spread of micro-EVs until they are sufficiently inexpensive to become consumers' obvious choice. Financial incentives help, but they are costly. And experience shows that non-financial incentives, such as access to bus lanes, congestion charge exemption, and free unlimited parking on public space, are much more effective incentives – while costing little to governments!

Also, governments should ensure that EV owners can charge at or near home during the night, for two reasons: it is very convenient (charge while sleeping); and it uses off-peak electricity, which is good for renewables and the grid. Also, residential charging can be done with inexpensive low power installations using domestic sockets: 220 Volts at 10 Amps for 8 hours replenishes a micro-EV for over 150 km!

EV owners who don't have a garage must have the possibility of charging on public space – for instance by leasing a space on the kerbside in front of their home. Some countries are installing charging stations in city centres, but many forget that they will mostly be needed in residential districts. And a few countries, such as Belgium, have hardly started considering the question yet!

So we can hope than in a decade, a truly sustainable individual mobility will spread, based on micro-EVs. This is a unique opportunity to develop a fast and convenient sustainable mobility while reducing traffic and parking congestion. This bright future is only possible with the help of governments. But they need to promote the right vehicles – micro-EVs – with the right measures: non-financial incentives, and low-power residential charging poles.

© Wikimedia
Mobile phone from the mid-eighties: 35 cm high and 800g for a cost of 4000$.

EASYBAT
EASY AND SAFE BATTERY SWITCH IN AN EV

EASYBAT – Easy and Safe Battery Switch in an EV

EASYBAT is part of the first EU Commission supported project for electric cars with switchable batteries. Standardized automobile components and interfaces are developed within the framework of this project. This enables European automobile and battery manufacturers to easily integrate battery switching technology into their electric car platform.

Part of the Seventh EU Framework Program (FP7), EASYBAT is a 2.5 year project, which is expected to run until June 2013. The European Commission will contribute 2.2 million to fund the project.

The consortium led by Better Place and including Renault SA, Continental, Ernst & Young, TÜV Rheinland, KEMA and five leading European institutions collaborates on making it easier for European automobile and battery manufacturers to build electric cars with switchable batteries.

THE PROJECT

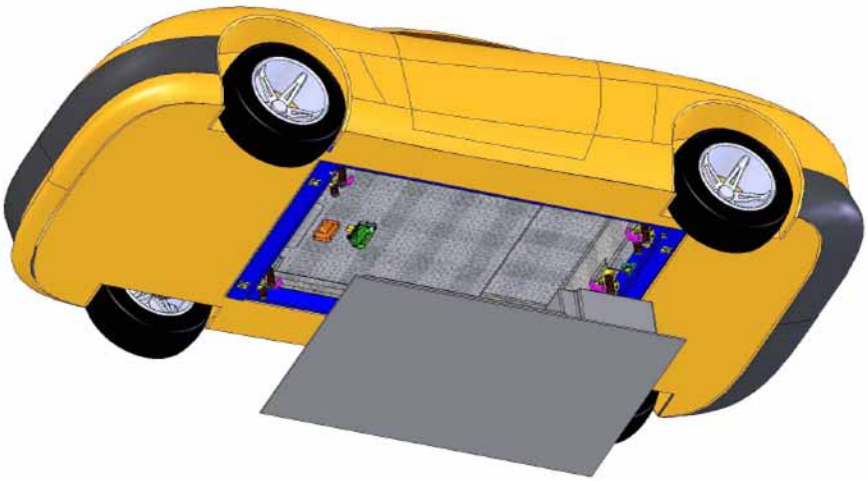
The EASYBAT solution will consist of interfaces for switching a battery in and out of an electric car quickly and safely; the connector interfaces between the car, the battery, the communications network, and the battery cooling system; and design specifications that meet European industry and safety standards. The solution will be integrated and tested on fully electric vehicles to ensure it meets production-grade manufacturing criteria and European safety standards.

The EASYBAT Consortium brings together for the first time in one project, leaders in the fast-growing EV industry. Better Place, Renault and Continental will contribute their expertise in producing production-grade switchable battery electric cars. European standardization organizations, CENELEC, will facilitate the creation of agreements between the parties for the creation of consensus documents to facilitate standards development for battery switching.

TÜV Rheinland and KEMA will ensure that the EASYBAT solution complies with European safety directives and standards. Leading research institutes in Germany (RWTH Aachen University, Fraunhofer Institute für Produktionstechnik und Automatisierung, and Technische Universität München), Denmark (Danish Technological Institute) and Israel (Haifa University) will team together to provide research support.

THE AIM

Upon conclusion, EASYBAT will have a next generation, commercially available solution for battery switch integration components and design plans that allow for different types of batteries, not just a single standardized battery. Car manufacturers that want to focus on proprietary battery technology can do so and still be able to integrate their technology into a switchable battery electric car platform as envisioned by EASYBAT.



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Fuel cells and hydrogen joint undertaking: the challenge of deployment

Fuel cells and hydrogen technologies are recognised as key enabling technologies for the decarbonisation of future European energy and transportation systems. Hydrogen has unique properties: like electricity, it is an energy carrier, but unlike electricity it can be transported and stored in gaseous or liquid form, depending on the needs. Hydrogen can be generated from all primary energy sources, notably renewables such as solar, wind or biomass ensuring its almost infinite availability in Europe. Offering storage options to intermittent renewable sources, hydrogen can be converted with fuel cells, directly and very efficiently, into electricity without emitting greenhouse gases or air pollutants.

Europe has emerged as a credible player in developing and demonstrating fuel cells and hydrogen technologies. Over the last few years, technology development has brought fuel cells and its applications from research on 'how to make it work', development 'on how to make it cheaper and better' to demonstrations on how innovation can lead to market.

Providing the potential for a reliable, carbon–free energy pathway and a flexible decentralised power generation in various applications, these technologies are approaching market reality and have made particular progress in the automotive sector. Hydrogen can be used with advantages as an alternative fuel for a clean mobility using fuel cell electric vehicles such as passenger cars, buses, light duty and material handling vehicles. Typically, a fuel cells car is actually three times more energy efficient than a conventional car, has no tail-pipe emissions and is silent. Furthermore, it implies no major performance compromises for the user in terms of size, range, speed, refuelling time or comfort compared to conventional cars. FCEVs, particularly suited for larger passenger cars that account for more than 70% of C02 emissions, provide a credible alternative for inter-city and regional mobility in addition to urban transport.

Vehicles are market-ready from a technical point of view. A scale up of the car-fleet through mass production and the build-up of a dedicated hydrogen refuelling infrastructure are needed in order to make FCEVs a practical and affordable option for the consumers.

Bert De Colvenaer

Actually, a recent fact-based study backed by major automotive OEMs and infrastructure providers concluded that fuel cell vehicles will be competitive as of 2020, provided public incentives –fiscal and purchase incentives - are installed and an

Hydrogen bus in operation in London, CHIC Project

appropriate hydrogen refuelling infrastructure is built.

Innovative transport projects, such as the H2 Moves Scandinavia project supported by the Fuel cells and hydrogen joint undertaking are a step in the right direction. It demonstrates the technology readiness and paves the way to customer acceptance for hydrogen-powered electric vehicles in Scandinavia. The project, including seven partners from the North of Europe, is supported with a FCH JU contribution of €7.8 million, and Danish and Norwegian national funds (€2 million). It aims to roll-out latest state-of-the-art hydrogen fuel cell vehicles operated by customers, consolidate existing hydrogen-fuelling hub in southern Norway while building a new station in Oslo, as well as carry out five European vehicle road tours supported by a mobile refuelling station.

In the same spirit, the leasing by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) of a hydrogen- powered fuel cell car in Brussels, serves to demonstrate the readiness of this technology to EU policy makers and will provide for the opportunity to experience for themselves such an innovative car.

In addition to that of passenger cars, the bus market is also promising.

In that respect, Europe's leading role in fuel cell bus manufacturing and demonstration is worth mentioning. With the support of the fuel cells and hydrogen Joint Undertaking, the EU has been successfully conducting the largest fuel cells bus demonstration in the world with active support of local

and regional governments. Following previous demonstration projects of fuel cells buses (CUTE 2001-2005 and HyFLEET:CUTE 2006-2009), the Clean Hydrogen in European Cities Project CHIC (2010-2016) , is the essential step leading to the full market commercialisation of Fuel Cell Hydrogen powered (FCH) buses. With a total budget of over €80 million, €26 million of which coming from a FCH JU contribution, and 25 partners from 9 countries across Europe, along with industrial partners for vehicle supply and refueling infrastructure, the project aims to integrate 26 FCH buses in daily public transport operations and bus routes in five cities across Europe - Aarau (Switzerland), Bolzano/Bozen (Italy), London (GB), Milan (Italy), and Oslo (Norway).

The CHIC project forges partnerships between cities which have previously gained experience with hydrogen powered buses and 14 new cities and regions in Europe which are considering moving into the field, with the objective to move these demonstration vehicles towards full commercialisation by 2015.

Large capital investment in the creation of new fuel cell and hydrogen equipment industries and supply chains, fuel cell vehicles, and infrastructure are required to sustain the competition of new technologies with entrenched traditional ones. Returns on investments are only expected in the medium term and market forces alone are not sufficient to drive the process. Pooling public resources is therefore crucial, generating leverage for private finance, the main drive of innovation. Addressing this is the general objective of the Fuel cells and Hydrogen Joint Undertaking, a unique European public-private partnership between the European Commission, the industry and the Research community, which also promotes close operational cooperation between the EU, national and regional authorities.

With the objective to reduce time to market, the Joint Undertaking is fostering close coordination with market-players and relevant policy-makers to work-out and commit to a fuel cells and hydrogen vehicles roll out plan at EU level and will launch early 2012 a study on the commercialisation of fuel cell buses in comparison to other clean drive train options for buses.

Fuel cells and hydrogen joint undertaking car on lease, model Hyundai ix35

Addressing other obstacles facing the commercialisation of FCH technologies, such as a favorable regulatory framework, the Joint Undertaking also works with international partners from US, Japan, Korea, China, and Canada on standardisation and pre-normative research, which are essential for every new technology to assure safety, reliability and interoperability.

Bert De Colvenaer is the Executive Director of the Fuel Cells and Hydrogen Joint Undertaking.

Can Transport ever truly be called "Green"?

Michael Edmund

It is relatively easy to recognise the scale of the challenges faced by making the transport of goods and people "Green". Properly defining the solution may not be; and achieving it, very difficult indeed.

It wasn't the Exxon Valdez captain's driving that caused the Alaskan oil spill. It was yours.
- Greenpeace advertisement

Bitter-sweet. Open Secret. Virtual reality. To many people, the words 'Green Transport' might seem like a contradiction in terms; another modern oxymoron. And they might have a point: economic activity surely relies upon the transport of goods and people, and any physicist will tell you that moving an object over a distance involves energy somewhere in the process; it was in 1826 that French mathematician Gaspard-Gustave Coriolis first called that process "work".

Modern evidence confirms a surge in world energy consumption during 2010. According to Enerdata's 2011 Global Energy Statistical Yearbook, energy consumption rose 5.5% globally, and by 4% in Europe during that year. These figures correlate well with those for CO_2 emissions, which rose 6% globally and by 3% in Europe. The data should of course be interpreted in the context of a world rebounding from the financial crisis of 2008/9, but they clearly demonstrate the relationship between economic activity and CO_2 emissions.

But how does the electricity reach the car?

Siemens press picture

OR DO THEY?

In a thoughtful article in the Social Europe Journal last year, Jo Leinen, Chairman of the European Parliament's Committee on the Environment, Health and Food Safety, states that emissions in the European Union have "dropped slightly" during the last twenty years.

REALLY? A SLIGHT DROP OVER THE LAST TWENTY YEARS?

Indeed, according to the European Environment Agency (EEA), the EU-15's emissions are 6.5% lower than they were in 1990. So growth in emissions might not be inevitable, although it must be said that these figures may be interpreted in different ways. The point is that Leinen was arguing for a greater focus on Transport. He suggested that it will be the next step in Europe's Climate Strategy, citing Commissioner for Climate Action, Connie

Hedegaard, who will make Transport the focus of the legislative package to be drafted by the Commission by the end of this year.

WHY IS THAT?

Finding the answer is simple; even if finding the eventual solution is not. Against the background of the overall decline in emissions since 1990, those due to Transport have risen 26% over the same period. They now comprise 19% of Europe's overall emissions. Transport seems therefore to have become increasingly relevant to EU climate policies, and the EEA indicated so in 2008, when it called for the Transport sector to apply "rigorous measures to help Europe meet its greenhouse gas emission targets".

AND THAT IS WHERE THE PROBLEMS BEGIN.

Increases in national economic activity and the globalisation of business inevitably lead to increases in disposable personal wealth and higher personal expectations. Together, these increase the demand for personal mobility, including air travel for both business and leisure purposes. They also foster broader shopping habits for food, such as fresh fruit out of season; and for other goods, including, of course, cars. Moving more goods and more people requires the provision of more transport, either directly of the people themselves, or indirectly by bringing the goods to the people.

And so we return to basic physics to provide part of the answer to the question posed in this article. Economic activity requires the movement of goods and people. Transporting them requires energy, and so can never by itself be truly "Green".

Transport: at the focus of every aspect of power production and consumption?

The rest of the answer depends how you examine the problem. Great strides have been made in reducing the fuel consumption of the car, so making it "greener", and the goal of 120g CO_2 per kilometre is an important step. But there are more cars on the road than ever before (16% more within E-15 between 1990-1999, according to Eurostat), while the benefit of increased efficiency of aero engines has been offset by the growth in air transport. Electric cars are "green" because they produce no emissions. Until you consider that the electricity must be generated somehow. Mass transport (such as a single train replacing many cars) is "green" (if the train is full) because it consumes less fuel and emits less CO_2 per passenger mile travelled. Unless you also consider the fuel consumed by the cars as they converge upon the mass transport systems.

Leinen summarizes these issues very well: "Despite its environmental impact and the recognition of the need to cut down on transport emissions, reducing them is not an easy task for policymakers".

While under Professor McGlade, the EEA document TERM 2009 calls for "a package of policy measures that does not rely solely upon technology", including measures whose impacts may be "so distant in time, we need a common vision for sustainable transport and mobility". Nevertheless, it has been observed that "The Stone Age did not end because we ran out of stones". It ended because a better technology emerged; and a new technology to replace our dependency on fossil fuels represents perhaps the most important single contribution to the resolution of the problems we face.

Climate change is obviously important to the future of mankind: and although M. Coriolis might not recognise the use of his term, there nevertheless remains much work to be done. And the clock is ticking.

Electric Cars: Current predictions

Prediction is hard, especially of the future – Neils Bohr

By Mike Edmund

Global temperatures and atmospheric CO2 levels have marched inexorably upwards in recent years. The discussion of any man-made link between the two factors is far beyond the scope of this publication, but it nevertheless seems reasonable to predict that these two trends will continue, at least for the foreseeable future.

In a recent issue, we reviewed the effect of transport emissions on EU carbon targets, and there is no doubting the momentum gathering behind the development of fully-electric vehicles (FEVs), plug-in hybrid electric vehicles (PHEVs), and variations of these technologies as possible solutions. A recent road test of the Rolls Royce 102EX suggests just how powerful this momentum has become: the test revealed that the leviathan is responsible for 193g/km CO2. This is a very significant figure, even if it is some 60% higher than the EU target of 120g/km, because a manufacturer traditionally associated with supreme automotive luxury has now revealed its attention to an environmental indicator. The 102EX is however quite remarkable for one other reason: this particular Rolls Royce is powered only by batteries.

The concept of electric vehicles (EVs) has been around since the earliest days of the automotive industry, but today's high oil prices and growing concern for the environment have combined to focus interest far beyond the traditional stakeholders – the policymakers from

government and industry. This is, after all, the basis upon which you are reading this special supplement. Indeed, apart from Rolls Royce, Lexus and Porsche, whose brands traditionally occupy the higher reaches of the car market, it seems that nearly every mass-market car manufacturer, from Ford, through Nissan, Peugeot, Toyota and Honda, to General Motors and many others, has added, or is about to add, an FEV or PHEV to its model range. Moreover, it seems that BMW has developed the concept even further with BMW-i. A recent study, performed by CE Delft and reprinted elsewhere in this supplement, confirms the impression that the trend towards electric vehicles is almost as inexorable as the trends in those temperature and CO2 graphs.

ALMOST.

Recent work by Deloitte Touche Tohmatsu Limited (DTTL) seems initially to confirm these impressions. Between November 2010 and May 2011, DTTL conducted a global study among 13,000 consumers in order to investigate their attitudes to major selling points, including price, range and charge time. It revealed that the majority of consumers are either willing to consider the purchase of an electric vehicle or see themselves as potential first movers, which the study defined as those likely to purchase or lease a new vehicle of some kind within the next 12 months. But this is not the whole story, for the study also highlighted a significant gap between consumer perceptions and expectations of EV technology, and the current realities of what can be achieved. These concern primarily the range of an EV and its purchase price; and we have already featured two new approaches to the problem.

A battery-powered Rolls Royce has undeniably altered the image of the electric car, perhaps forever. But will customers' expectations eventually be met? The stakes are clearly very high and we cannot yet be certain; but according to computer scientist Alan Kay, the best way to predict the future is to invent it.

Porsche 918 Spyder Hybrid (Courtesy of Porsche)

Electric vehicles: Large climate potential in the long term

by Bettina Kampman, senior researcher/consultant CE Delft and Huib van Essen, manager transport CE Delft

Electric Vehicles (EVs) are a promising technology for drastically reducing the environmental burden of road transport. From the perspective of a low carbon future, their most important benefit is that they can drive on a whole range of low carbon energy sources. This brings large scale low carbon or even zero-emission mobility within reach, in the long term. In the short to medium term, however, the technology is not yet mature and will remain dependent on government support and ongoing R&D efforts.

ELECTRIC VEHICLES IN THE EU

In recent years, a number of electric passenger cars have come on the EU market and most car manufacturers have announced one or more EV models for the coming years. It is clear that the industry is taking this technology seriously and that the vehicle market might be on the verge of quite a significant technological transformation.

However, EVs are not yet competitive. Costs are still high and battery technology is still being developed. R&D investments worldwide are impressive, and various governments, including many EU member states, support both the development and the sales of EVs. These efforts are expected to lead to cost reduction and performance improvements in the coming years and decades. However, it is also expected that it takes at least one to two decades before electric driving becomes competitive on a large scale, and independent from government incentives.

In this context, CE Delft, together with ICF and Ecologic, carried out an extensive study on the potential impacts of market penetration of electric vehicles in the EU, commissioned by the European Commission (DG CLIMA). The study covered full EVs (FEV), plug-in hybrid EVs (PHEV) and EVs with range extender (EREV). Impacts on both the transport and electricity sector were analysed as well as a policy implications.

EV MARKET DEVELOPMENTS STILL VERY UNCERTAIN

Successful battery development seems to be the most crucial condition for market uptake of this technology. Batteries have a strong impact on EV costs and electric driving range, two key parameters that consumers will look at when considering to buy an EV. In addition, a number of other issues will play a role, such as availability of charging infrastructure and/or battery swap stations.

In the study for the EC, future market developments and impacts were predicted for three scenarios:

- Scenario 1 was based on current best estimates of cost and performance development of EVs and conventional cars, and current government incentives.
- Scenario 2 assumed that ICE vehicles remain the prominent technology also in the longer term, with strongly improved fuel efficiency.
- Scenario 3 assumed fast battery cost reductions and thus market uptake after 2020.

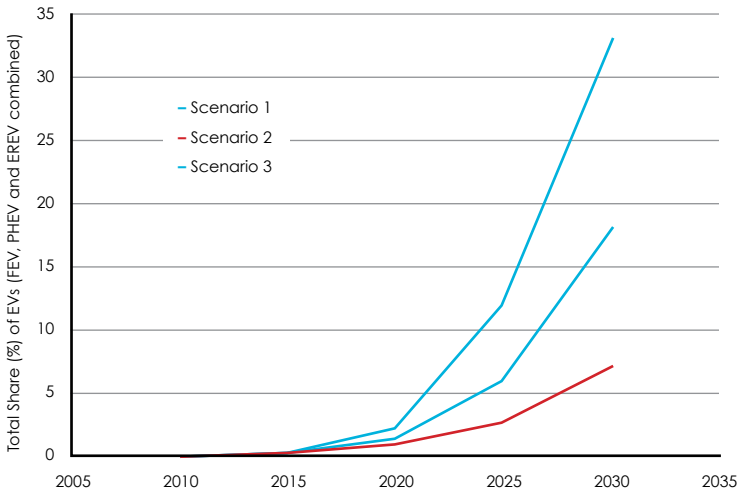

Figure 1 Total share of EVs in the EU car fleet, FEVs, PHEVs and EREVs

The total share of EVs in the EU car fleet in these scenarios were modelled, see Figure 1. Until 2020, the share of EVs will remain relatively low, but after that it could take up quickly, depending on the scenario. In all three scenarios, most of the EVs (about 60%) are expected to be Plug-in Hybrids.

The future EV market uptake will have a number of environmental and economical impacts. Petrol and diesel use will reduce, leading to lower greenhouse gas and air pollutant emissions of the vehicles themselves. On the other hand, electricity production will have to increase, leading to additional emissions in that sector (of which the CO2 emissions are covered by the EU Emission Trading System). In the study, various impacts are quantified, for the three scenarios given above.

POLICY RECOMMENDATIONS

Policies on many different levels (EU, national, cities) can play a role in EV developments and market uptake. In the short term, at least over the next five years, EV technology will not yet reached maturity and government support is needed to speed up innovation.
In this phase, however, it is important to avoid unfair competition with other types of energy-efficient vehicle and sustainable biofuels. To prepare for the longer term, a consistent overall fiscal and regulatory framework should be developed, providing consistent treatment and coverage of EVs and all competing technologies.

All reports of the study 'Impacts of Electric Vehicles' (five background reports and one summary report) can be found at http://www.cedelft.eu/publicatie/impact_of_electric_vehicles/1153

The study was carried out by CE Delft, ICF and Ecologic.

CleanTech Leasing

Enabling Green Technologies Through Joint Venture Partnerships

Financing Sales Success

What will ultimately determine the success of the Electric Vehicle (EV) industry? Sales.

A great product and interested customers are not enough, the interested have to be converted into buyers in order for EV companies to grow and be successful. But herein lies the problem, despite demand being high, customers wishing to buy Cleantech products struggle to obtain finance to allow them to do so.

Any market offering high-value capital items depends on good financing deals to make its products affordable. Customers have always needed assistance from leasing to spread the cost of major purchases. But EV and other Cleantech industries, being young and unproven, are not seen as attractive prospects for most of the traditional UK asset finance companies.

These asset finance companies are by nature cautious. They are reluctant to get involved in markets where current sales are still low and demand may not meet forecasts. They also look for proven re-sale markets and re-sale values to cover themselves in the event of non-payment of leasing. Clearly for new products the second-hand market has yet to be established.

The answer, says Peter McDonald of SME Eurofinance, is for the EV manufacturers to partner with a finance company to create their own bespoke leasing product. One that they and their customers can have confidence in because they control the terms, and where they have a vested interest in the market success.

Tim Rogers was formerly the UK CEO of Nasdaq-listed Clean Diesel Technologies Inc. "Our product was in great demand from companies affected by the London Emission Zone Initiatives but we needed to be able to provide financing in order to secure sales. Many customers can't pay cash up front and need to be able to spread the cost of their purchases over time. It was while searching for a leasing product for Clean Diesel that I came across SME Eurofinance, and I knew at once that their joint venture product was just the kind of innovative solution that our market needs."

Since leaving Clean Diesel Tim has been working with SME Eurofinance to establish CleanTech Leasing, aiming to provide funding and leasing solutions through joint venture (JV) partnerships with CleanTech companies.

CleanTech Leasing
Enabling Green Technologies Through Joint Venture Partnerships

"We've looked at the CleanTech Market and can see that EV companies are well-advanced in terms of developing great products. There is a ready market of customers who understand the benefits and want to buy cleaner vehicles. The stumbling block that we see, and believe we can remove, is financing," explains Tim.

"The JV model overcomes the two big issues that traditional asset finance companies will cite as reasons not to get involved in Cleantech. Firstly there is a level of investment by the company themselves that spreads the risk. Secondly the manufacturer is taking responsibility for re-use and re-sale of any recovered assets."

"For EV companies wishing to offer their customer a leasing product a JV is a win-win solution," says Peter McDonald. "For a small up-front investment not only do they get to secure sales and a satisfied customer that they might not win otherwise, but they get to share in the profits of the JV and, ultimately, see their investment returned. Although third-party investment is required to set up each partnership company, the aim is that the JV should become self-sufficient, using the proceeds of the leasing agreements to fund future growth.

"This is a model that SME Eurofinance have developed and are using successfully in other industries, but which we see can have particular appeal for the newly emerging Cleantech markets who cannot readily find asset finance elsewhere. "

SME Eurofinance is an independent UK asset finance brokerage and lessor with 25 years experience and well-established relationships with investors. As the power behind CleanTech Leasing, they are able to provide full lease management that enables the new companies to get up and running very quickly. All the back office functions of underwriting, documentation, administration, billing and collecting are taken care of through the white label product, allowing each JV to have its own identity, bank account and contract terms.

"We believe we are offering a unique financing product that could really open up growth opportunities for the EV market," says Tim. "Having worked in the Cleantech industry I know how much untapped potential there is and how frustrating it can be to be sitting on products that have customer demand but no easy way of securing sales when cash is hard to come by. We're excited to be able to offer a solution to EV companies that we believe will get the market moving by enabling more sales to be made, provide a boost to the economy, and maybe even do some good for the future of the planet. It's a great feeling!"

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AVERE

Founded in 1978, AVERE is a body that aims to promote the widespread use of electric vehicles throughout Europe and Africa.

Its European network is structured on a non-profit basis and is composed mainly of national associations. Members include vehicle and equipment manufacturers and electricity utilities, as well as EV user groups, non-profit groups, public bodies and research & development entities.

Outside Europe, AVERE also collaborates with other international bodies such as the EDTA (Americas) and EVAAP (Asia Pacific), with which it forms the World Electric Vehicle Association.

Today, AVERE remains committed to promoting the use of electric vehicles, whether individually, in fleets or for urban freight. Earlier this year, a new bureau was elected to serve for the next three years, which will set our agenda with respect to the transition towards a different world of transportation, where electric vehicles will play a fundamental role. Our ultimate aim is to achieve a green and sustainable mobility.

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Today, all the focus seems to be on transportation and research and development into sustainable alternatives. Reducing carbon emissions has become a primary concern for the European Union and electric drive is right at the top of the list of solutions.

So, it is now more than ever the time for electric vehicles, but the success of Electric mobility will depend on effective collaboration between all the different actors and the integration of multimodal transports. By ensuring cross-collaboration between our members, by increasing our interactions with other European organizations and by developing the work we are currently doing with our International partners, we believe that AVERE can lead the way to a great future for electric transportation.

AVERE is currently involved in 2 projects funded through the FP7:

MERGE, which aims to evaluate the impacts that electric vehicles will have on the European electric power systems – whether that be in terms of planning, operation or market functioning; and SAFEDRIVE, which is about developing a new type of electric drive train for electric vehicles. The project is pioneering research into low voltage technology.

AVERE is also part of the Implementing Agreement on Hybrid & Electric Vehicles (IA – HEV), which is one of the transport related programmes working under the umbrella of the International Energy Agency; and of the Expert Group on Future Transport Fuels (EG FTF), which advises the European Commission on the development of political strategies and concrete measures aiming at substituting oil as transport fuel.

european energyinnovation

Coming in the Autumn 2011 issue:

- Wind Energy
- Smart Cities
- Fuel Cells
- Danish Presidency
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