

Corus automotive contact details

Body & closures

Steel body sheet

Corus Strip Products IJmuiden
Netherlands
t: +31 (0)251 496126
cspy.salessupport@corusgroup.com

Corus Strip Products UK

United Kingdom
t: +44 (0)1633 755201
cspuk.marketing@corusgroup.com

Tailor welded blanks

CDBS Automotive Service Centre,
United Kingdom
t: +44 (0) 1902 638900
Richard.Down@corusgroup.com

Interior & trim

Plated steel strip

Corus Special Strip Head Office
c/o Hille & Müller GmbH
Germany
t: +49 (0)211 79 50 471
css.marketing@corusgroup.com

Hot rolled components

Corus Narrow Strip
United Kingdom
t: +44 (0) 1709 842527
bsmsales@corusgroup.com

Envirobond® - Adhesive coated steel

Corus Firsteel Coated Strip
United Kingdom
t: +44 (0) 1922 629593
firsteel.sales@corusgroup.com

Chassis & suspension

Tubes for Automotive Structures and Interior Systems

Corus Tubes - Automotive & Engineering
Netherlands
t: +31 (0) 26 3689111
corustubes.a&e@corusgroup.com

Innovative semi-finished products for Tubular and tailor rolled blank applications in body structure and chassis

Corus Strip Products IJmuiden
Netherlands
t: +31 (0)251 496126
cspy.salessupport@corusgroup.com

Electrical steels

Cogent Power Ltd
United Kingdom
t: +44 (0) 1633 290033
orb@kogent-power.com

Powertrain

Precision Engineering Steels

Corus Engineering Steels
United Kingdom
t: +44 (0) 01709 826814
enquiries.ces@corusgroup.com

Wire rod

Corus Construction & Industrial
United Kingdom
t: +44 (0) 1724 404040
rods@corusgroup.com

Technology Services

Corus Automotive Engineering
United Kingdom
t: +44 (0) 2476 241 200
automotive@corusgroup.com

Corus RD&T

Netherlands
Product Application Centre
t: +33 (0) 251 498276

European automotive service centres

Corus Namascor BV
Netherlands
t: +31 (0)168 393 400
For heavy gauge wide HSLA sheets from coils.

Corus Degels

Germany
t: +49 (0) 2131 74950-0
steven.dijkstra@corusgroup.com

Corus Gelsenkirchen

Germany
t: +49 (0) 209 98460

Corus Feijen

Netherlands
t: +31 (0) 43 3688444

Corus MultiSteel Service Centre

Netherlands
t: +31 (0) 43 3688444

Corus Unitol

France
t: +33 1693 92 300

Corus Service Centre Milano SpA

Italy
t: +39 024 457651

Corus Steel Service Hungary

Hungary
t: +36 96 518 168
stephan.flapper@Corussteelservice.hu

www.corusautomotive.com

Inside this issue...

Metals - meeting the recycling targets

European vehicle emissions targets discussion 'hots up'

Automotive R & D in China



emotions

Issue 15: 2008

A passion for design and technical excellence

Contents

page 3	News in brief
page 4	Metals - meeting the recycling targets
page 5	Collaborative working style benefits XF
page 6	The current R&D situation in the Chinese automotive industry
page 7	Volvo Car Corporation benefits from direct strain analysis
page 8	Climate change, renewed energy - Automotive Engineer Magazine
page 10	European CO ₂ legislation

Cover image: Corus helps Volvo Car Corporation optimise its press shop process in support of the new XC60 crossover vehicle launch - see page 7



Editor Clive Sutton
Email emotion@corusgroup.com
Enquires tel +44 (0) 2476 241253
Enquires fax +44 (0) 2476 241205

Design Zoe Kirby

Corus has taken care to ensure that this information is accurate, but Corus including its subsidiaries does not accept responsibility or liability for errors or information which is found to be misleading.

Corus cares about the environment - this magazine is printed with biodegradable vegetable inks and using material with at least 80% recycled content.

Foreword

Given the tumultuous events in the world's financial markets since the last issue of emotion magazine, it would be easy to be pessimistic over the prospects for carmakers and their suppliers. But despite the gloom, let's remind ourselves that the world has not stopped turning; trees still grow, homes, bridges and energy generation infrastructure still need building and CO₂ reduction will remain a challenge for all of us. In our view, technical excellence and a collaborative approach are what's needed to help the whole car industry through the challenging times it finds itself in.

The key issues remain of 'energy, emissions and economic growth' (Tristan Honeywill; pages 8 and 9). Within Corus, we certainly see no reduction in the debate about the true impact of CO₂ reduction. In automotive, through efficiency improvements and light-weighting, carmakers and legislators are working to find the most efficient means to address and motivate action in the best way.

On the same theme, our own Andy Clough has written a second article, to follow on from that of the last issue, on the topic of which of the CO₂ reduction technologies are likely to yield the greatest benefits in the short term - take a look at page 10.

Finally, Corus continues to make a difference in both technology and business approach for those customers who seek the multiplying value of collaborative relationships. The article on page 7 talks about how our on-site press-shop services have helped Volvo Car Corporation in Torlanda.

Perhaps there is something we might be able to help you with? If so please contact us at emotion@corusgroup.com. We will do our best to help.

News in brief

Victory at Hockenheim

For the tenth year in succession, Corus has once again supported some of Europe's leading student race teams. The Corus Research Development and Technology (RD&T)-sponsored Delft University Racing Team, based in the Netherlands, beat off stiff competition from around the world to mount the top step of the podium in the 2008 Formula Student Germany competition. This challenges teams of university students to design, manufacture and compete with a single-seater racing car.



The DUT08 team claimed overall victory at the Hockenheim circuit in Germany, which was host to 1,800 students in 77 teams. The team also picked up the Business Plan Presentation Award, The Most Fuel Efficient Car Award and won the Overall Dynamic Events, presented by VDI, the Association of German Engineers. RD&T in IJmuiden, Netherlands, provided steel and aluminium for the roll hoops, integral safety components of the DUT08 race car, as well as offering their knowledge and expertise in metals technologies.

Hot off the press

Production ready coils of Dual-Phase 600 hot-rolled steel (DP600HR) in gauges above 2mm are now available from Corus. This latest product has been designed to help carmakers continue to reduce weight and meet ever more stringent environmental targets. Amongst a range of applications, the use of DP steels typically offers potential weight savings

Articles: Corus

It's 130g/km (probably)

In September, the European Parliament resisted motor industry pressure and voted to keep the current proposal for reduced vehicle emissions of 130g/km by 2012-2015. Though the European Parliament is not the legislative body of the EU, its recommendations will set the scene as the EU enters into negotiations with member states to set the binding targets and its proposed penalty framework (as outlined in the last issue of emotion). Commenting, Ivan Hodac, Secretary General of the



European Automobile Manufacturers' Association (ACEA) said: "MEPs missed the opportunity to help shape a realistic framework for the car industry and enable manufacturers to continue contributing to the CO₂ reduction objectives of the EU".

Low CO₂ website

Further to our article about Corus involvement in the ULCOS research project in the winter 2006 edition of emotion, the World Steel Organisation have launched the www.ulcos.org website. This site is packed with excellent animated illustrations of the four leading CO₂ reducing technologies currently under study; Advanced Direct Reduction - eliminating the need for coke ovens; Top Gas Recycling Blast Furnace - reducing coke consumption; a combination of three other technologies into 'ISARNA' - a process using sustainable biomass in the iron reduction process; and electrolysis-based methods such as pyroelectrolysis and aqueous alkaline electrolysis. ULCOS is a consortium of 48 companies and organisations from 15 countries, seeking to reduce the CO₂ produced in iron and steelmaking by 50%.

£60m to reduce CO₂

Corus has invested £60 million into energy management technology at its Strip Products UK businesses in South Wales. The investment will substantially reduce carbon dioxide emissions at its Port Talbot site through the reuse of gas generated inside the Basic Oxygen Steelmaking (BOS) plant. The investment is Port Talbot's largest since Corus and Tata Steel joined forces in April last year. Managing Director of Corus Strip Products UK, Uday Chaturvedi, says: "As well as continuously developing steel products that will help our automotive customers achieve their environmental goals, Corus is committed to reducing its energy requirement and improve its environmental care and protection. This investment will play a significant part in creating a sustainable steel industry here in the UK." The investment not only reduces emissions but also the cost of energy, which has been identified as an important priority for the South Wales business to meet its challenge to compete on the global stage.



Images: Various

Metals - meeting the recycling targets

While steel currently contributes between 60% and 70% towards meeting the current 85% recovery and reuse target (depending on the vehicle model), the percentage of steel in cars has been reducing as higher strength steels are deployed to reduce vehicle weight. With increasing plastics content, and the desire for more electro-mechanical features, the 2015 ELV target of 95% is actually looking rather difficult to achieve.

However, considerable potential remains for increasing the recyclability of a modern vehicle without increasing vehicle weight. Corus Automotive Engineering at Warwick University has adapted an engineering cost and weight-down methodology called VA/VE (Value Analysis/Value Engineering) to help OEMs and their component suppliers identify vehicle recyclability and other improvements.

The approach offers OEMs options to increase recyclability while still meeting stringent weight and performance targets. Key VA/VE activities include:

1. Reviewing the whole vehicle structure to identify best materials and process technologies in each area, such as using High Strength (HSS) and Advanced High Strength Steels (AHSS) in major body components.
2. Identifying material substitution opportunities such as replacing plastics with HSS and AHSS in components such as fuel tank, drivers pedals, covers, and plenum chambers.
3. Wherever possible, identifying cost saving opportunities in other aspects of metal applications, such as capital expenditure needed for manufacturing and assembly tooling and component piece and assembly costs.

VA/VE; Design for recycling

With almost 500 million tonnes recycled globally every year (that's 180 Eiffel Towers a day) through a well-established infrastructure, steel is the most widely recycled engineering material in the world. Every steelmaking plant is in effect, a recycling plant. Unlike most other materials, steel can be recycled over and over again. That's why the world recycles over 80% of steel products that

been the tendency for increased strength steels to have reduced formability. However Corus are developing new materials aimed specifically at overcoming this trend.

Examples of these new materials are the Dual-Phase steels, TRIP (Transformation Induced Plasticity) steels and High Strength and Ductility (HSD)-steels. Initial design studies have shown around

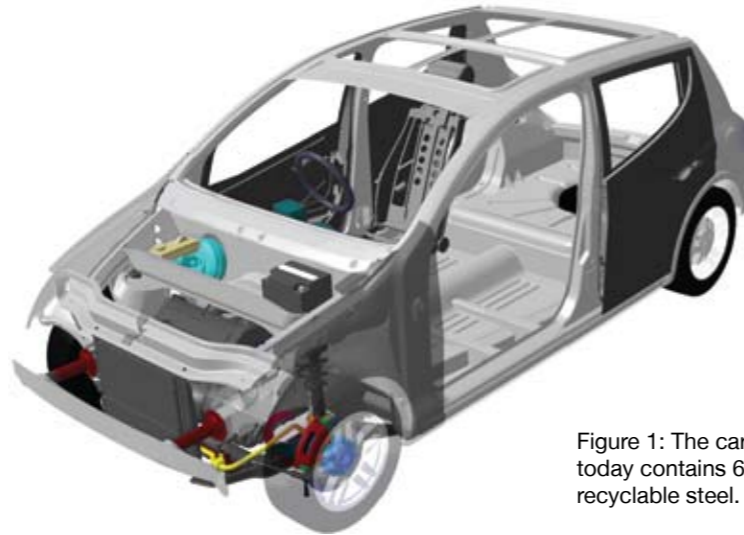


Figure 1: The car of today contains 65% fully recyclable steel.

have reached the end of their useful lives, including products from the automotive, construction and packaging industries. Instead of going to landfill, that steel is recycled to constitute 32% of new steel made each year.

There are several components made from plastics today that with the advances in materials and fabrication techniques over recent years could now revert cost-effectively to steel. Some examples include fuel tanks, pedals, engine covers, fluid reservoirs, front-end structures and bumper beams. Analysis shows that if just 25 key components were converted back to steel this could increase vehicle recyclability by 5%.

One of the limiting factors to the use of steel for non-structural components has

25kg per car could be saved using these materials in structural body-in-white components. Clearly, as these new steels replace non-structural plastic components, a significant increase in recyclability is also achieved without increased weight penalty.

Challenges for the industry

The ELV Directive presents significant challenges for the whole industry, not least the automaker, and steel offers easy solutions. As material producers with 16% of our business in the automotive industry, Corus possesses the materials and engineering expertise to turn environmental legislation compliance into a 21st century business opportunity.

Contact: Vernon John
Corus Strip Products UK
Tel: +44 (0) 1633 755329



Collaborative working style benefits XF

A series of investments at Corus' Automotive Service Centre in Wednesfield over recent years has meant another new contract win – this time for 24 parts for the highly acclaimed Jaguar XF, as launched at the end of 2007, including the roof panel blank - a major full-finish exterior part. The ability to supply a wide range of materials, particularly to press and supply complex panel blanks, has been a key factor.

Close working

During early production development of the XF, Corus worked closely with Jaguar's Design Engineers and tool makers based in the US and across Europe to evaluate a variety of blank shapes, based on the initial vehicle design. During these evaluations, Corus engineers also used their materials and automotive applications engineering expertise to assess how different grades of steel might perform – activity that helped Jaguar not only to determine the most appropriate grades of steel to use for different component applications, but keep start up costs to a minimum and ensure that production launch dates were met.

For one critical component, the result was a unique press-tool, over 4 metres in length – the only one of its kind in the UK - which was sourced from the US

after extensive trials. The tool is capable of manufacturing the blank required for the member front side outer part, a key component in the XF model. Corus also sourced a further 9 press-tools from across Europe, and assessed them to ensure that they would be capable of meeting Jaguar's high quality standards.

"...it demonstrates our ability to offer materials and production support expertise to help our OEM customers optimise their pressed blank production, which is delivered via our range of unique processing equipment and services..."

Alan Hutchinson, General Manager
Corus Automotive Service Centre

Delighted

"We are delighted to have secured this important contract with Jaguar for the XF", says Alan Hutchinson, General Manager of the Automotive Service Centre. "It underlines that we offer far more than just the supply of pressed components. Furthermore, it demonstrates our ability to offer materials and production support expertise to help all our OEM customers optimise

their pressed blank production, which is delivered via our range of unique processing equipment and services, including the development of complex blanking tools that are fit for purpose".

Corus has invested significantly in downstream facilities at its Automotive Centre in Wednesfield over recent years to enhance its press blanking line capability. As a result, it is in a strong position to meet the increasing demand from OEM customers for tailor welded blanks and full-finish skin panel blanks ready for pressing. At the start of 2008, the Automotive Service Centre announced another contract win to supply precision tailor welded blanks for the new Mini Clubman.

Corus' Automotive Service Centre boasts a comprehensive line-up of dedicated automotive processing facilities, featuring a range of press blanking lines from 150 tonnes to 600 tonnes, multi-strand blanking lines, trapezoidal/radial blanking lines, a slitting line and a number of pack turners. The site also boasts a dedicated laser welding facility - the first in the Europe to have the capability to manufacture production volumes of advanced, second generation, non-linear Nd:YAG (Neodymium: Yttrium Aluminium Garnet) laser-welded blanks.

Contact: Richard Down
Corus Commercial Manager
t: +44 (0)1902 698631

The current R&D situation in Chinese automotive industry

The current surge in research & development in the Chinese automotive industry is attributable to many factors, including marketisation and the introduction of foreign technologies. Chinese manufacturers are increasingly able to further their R&D capabilities either through the direct introduction of technology from overseas, outsourcing or self-development.

By He Ying and Xie Defan
Tongji University

Chinese JVs like FAW VW, Shanghai GM, Guangzhou Honda and ChangAn Ford etc, purchase technological data and tooling from their foreign partners. Though this approach requires substantial funds, there are some major advantages, including shorter development cycles, quick returns and the ability to follow market trends.

Foreign technologies

The purchase of foreign technologies such as NAC's purchase of MG and SAIC's acquisition of Rover and Ssangyong, mean Chinese carmakers can obtain their own intellectual property rights and brand, but it is costly to establish R&D capabilities based on purchased technology and therefore

"China's late entry into the automotive industry means that R&D in traditional vehicles falls well behind that of other countries, but in alternative energy vehicle technologies (such as fuel cell, hybrid and pure electric vehicle technologies) China is at the forefront in some areas..."

He Ying and Xie Difan
Tongji University



only an option for the largest of the automakers.

Chinese local brands

Self-development is the new focus of many Chinese R&D departments, with the impetus coming from Chinese local brands (Chery, Geely, etc.), higher education institutions (Tongji University, Qinghua University, Jilin University, etc.) and Chinese research institutes like the New Energy Vehicle Research Centre at Tongji University.

The Chinese government (State Ministry of Science and Technology) supports these institutions with leadership and funds through various government projects. For instance, Tongji University's current research project on fuel cells is carried out by both the College of Automotive Studies at Tongji and the University's New Energy Vehicle Research Centre, under the close guidance of the State Ministry of Science and Technology.

New energy level technologies

China's late entry into the automotive industry means that R&D in traditional vehicles falls well behind that of other countries, but in alternative energy vehicle technologies (such as fuel cell, hybrid and pure electric vehicle technologies)

China is at the forefront in some areas such as EVPS (electric vehicle power systems).

China has established a "three verticals and three horizontals" structure in terms of major EV R&D programmes since 2001, with fuel cell, hybrid and pure electric vehicles being the "three verticals", and multi-energy powertrain, driving motor and storage battery being the "three horizontals".

Self development platform

China has successfully built up a self-development platform in EV research, and particularly captured core technologies in EVPS and its major components. The main goal to have a alternative energy vehicle powertrain has already been achieved.

In conclusion, R&D in the Chinese automotive industry will, without a doubt, accelerate thanks to the various beneficial factors in government policy, market, research and overall social environment. The focus will certainly be on China's self-development, rather than borrowed technology, and that focus will carry forward China's desire to become a strong power in the world automotive industry.

Images: Tongji University



Volvo Car Corporation benefits from direct strain analysis

Corus has employed its wealth of expertise in the use of strain measurement systems by using its new strain analysis tool, to help Volvo Car Corporation optimise its press shop tooling at the company's Torslanda manufacturing plant in Sweden in support of the new XC60 crossover vehicle launch.

Argus is the latest strain analysis system deployed by Corus to help carmakers ensure consistent quality of complex formed body panels at the vehicle development phase for high confidence volume production.

Shorter press-shop setup times

Corus will supply Volvo with steel for the bodyside panels. The bodyside for the new XC60 crossover model is one of the most complex and challenging components to manufacture due to surface quality finish and formability requirements.

As part of Corus's commitment to offer added value services to its customers, engineers from the company's Product Application Centre (PAC), in IJmuiden, worked closely with Volvo during the tooling development of the XC60. This phase included the tool buy-off and home line tryout stage for the bodyside panels, to help Volvo better understand how the steel performs during pressing. Using the new system, Corus was able to suggest improvements to the tooling set up to help significantly reduce press shop set-up lead times.

Article: Corus

As with previous strain analysis systems, Corus combines expertise in 3D measurement technology with materials knowledge to help OEMs confidently process today's modern automotive steels. Corus engineers measured bodyside panels to check the repeatability of the pressing and fed back the first results to Volvo engineers within hours – a process that traditionally takes days. In addition, the information gathered by Corus's engineers can now be used by Volvo to assess any future potential changes which may be required in the production of the bodyside panels, such as if new grades of steel are considered

"Corus is able to offer carmakers the ability to reduce lead-times during the tryout stages resulting in a 'right first time' approach in the production of critical stamped parts".

Jamie Howles, Support Engineer,
Corus Strip Products IJmuiden

for introduction during the XC60's current life cycle. Another key benefit of the new system over more traditional methods of strain measurement is that it is easily portable and can be deployed and used on site in the Volvo production press shop.

Better understanding

Jamie Howles, Support Engineer, Corus Strip Products IJmuiden said: "With the growing use of high-tech steels in today's automotive press shops, it is increasingly important for carmakers to better understand how steel blanks will deform and flow as they are pressed. This is particularly important for large and complex components such as bodysides."

Jamie continues: "OEMs are also increasingly under pressure to find the right balance between quality and time. Through the use of unique strain analysis systems, which combine accurate measurement of 3D geometry with the latest forming analysis techniques and materials expertise, Corus is able to offer carmakers the ability to reduce lead-times during the tryout stages resulting in a 'right first time' approach in the production of critical stamped parts. We are delighted to support key customers such as Volvo Car Corporation try offering this added value service."

Track record

Corus has a long track-record of supplying on-site strain measurement support with other automotive customers, including recently, NedCar in the Netherlands and Ford's Genk plant in Belgium. In both cases, Corus helped to save the carmakers valuable time, cut costs and ensured more consistent quality.

Contact: Koen Wulfers
Corus Researcher Stamping Technology
t: + 31 (0) 2514 90377

Image: Volvo

Article: He Ying & Xie Difan

Climate change: renewed energy

Policy developments in the next few years will drastically change the way the public views transport and how OEMs will design cars.

By Tristan Honeywill

Who hasn't started to feel the debate on CO₂ is in danger of wearing itself out? Less than 12 months ago, advocating biofuels put you firmly on the side of the angels, today it's the opposite. Such dramatic reversals are unhelpful, casting doubt on sugar cane ethanol and even second generation biofuels. And they detract attention from the key issues: energy, emissions and economic growth.

In Copenhagen 2009, the world's leaders are due to gather and make decisions on a framework for global emissions trading. There has to be a break in the current deadlock, but according to the United Nations Environment Programme's (UNEP) executive director, Achim Steiner, progress through the formal negotiation process is behind schedule. In the meantime CO₂ emissions are growing at an unprecedented pace.

Steiner was speaking at an environmental forum organised jointly by Daimler and UNEP. Speakers from all sides of the issue – industry, science, environmentalists and government – gave a series of informed and often impassioned presentations on the issue of climate change and what needs to be done. Daimler CEO Dieter Zetsche opened by stating that climate change is manmade and that the industry must do more to address CO₂ emissions.

A pioneering era of engineering

Several speakers quoted Mahatma Gandhi's "You must be the change you wish to see in the world". Zetsche draws inspiration instead from the fact that with no realistic chance of oil ever becoming cheap again, we are entering a pioneering era of engineering, not seen since Gottlieb Daimler's days.

"Our engineers' innovation will make the change and we hope to see the benefits in our own lifetime," said Zetsche. "This isn't about being phoney corporate do-gooders, we want to be seen for what we are – a responsible partner for the community."

"But it would be reckless to give a date when 50 per cent of Daimler's vehicle sales will be emissions-free," said Zetsche. "The cars will be ready in the coming decade, but how many we sell depends on a lot of other factors. We're going to need new technology, infrastructure and a regulatory framework to coordinate it all. We need commitment and open minds."

Deadlines missed

However, it's legislative deadlines that will drive the industry in the future. When the industry missed the 2008 target of 140g/km it destroyed a lot of confidence in the industry's ability to self-regulate. And there is a lot of impatience with its subsequent negotiations over CO₂ targets and phase-in periods.

ACEA secretary-general Ivan Hodac made a valid point about the time it takes to introduce new powertrains and vehicle concepts in Europe – without clear tax incentives, the market is a lot more conservative than the idealists would have us believe. In Japan and the US fuel economy targets are given much longer lead times, a little more flexibility and OEMs get credit for fitting things like low rolling resistance tyres.

The view from Japan and USA

Masanobu Wada of the Japan Automobile Importers Association said: "Japan set its 2015 target of 138g/km in 2007. In the year that the target is set, that year's most fuel-efficient vehicle is taken as the basis for the target, excluding hybrids and manual transmissions. There are relatively loose penalties of around €5,000, but

severe social sanctions – companies that fail are named and shamed." Carole Browner, former head of the US Environmental Protection Agency (EPA), reckons that despite the US setting average fuel economy targets only recently, further greenhouse gas legislation is likely in the next two years. "The Senate is keen on a cap and trade approach and several committees in the House of Representatives are keen to engage on the issue," she says. "Whoever the next president is, they're likely to reverse Bush's denial of California's right to set its own tailpipe CO₂ emissions targets."

It's easy to forget that this isn't just a political question though. Speakers from the Intergovernmental Panel on Climate Change and other high-level think tanks emphasised the gravity of the issue – the "hockey stick" curves that signify massive increases in man-made CO₂ emissions in recent decades and the increases in temperatures that track them several decades later.

CO₂ vs. economic growth

The intractable problem is that these are the byproduct of economic growth. Dr Ottmar Edenhofer, an economist at the Potsdam Institute for Climate Impact Research said: "Normally a one per cent increase in capital wealth means a one per cent increase in CO₂ emissions. It's very linear, but it should be possible to decouple economic growth from emissions rises."

More wind, solar and nuclear energy will help. Emissions trading will too. There is a

general idea among policy makers that an average of 2 tonnes per person per year would be sustainable. It will be a key point at Copenhagen next year, but it will not be easy to achieve for several reasons. The international average CO₂ production is 4.5 tonnes per capita a year; in Germany the average is 9 tonnes.

EU oil imports - €1 billion a day

This and the fact that the EU's imports of oil has exceeded €1 billion a day means that European transport policy will take a drastic new direction in the next few years. MEP Ulrich Stockmann is a member of the European Parliament's transport committee: "Road transport is the second largest greenhouse gas contributor in the EU. It's one of the few sectors that consistently increase, slowing down progress on the targets set at Kyoto," he says. The fact that new cars account for just a couple of per cent won't wash either. "It's no good if airlines say we're only two per cent, truck firms say we're only 1.5 per cent and so on. You soon get to 100 per cent and nothing's been done," says Achim Steiner of UNEP.

The signs are that Daimler is going to be able to resist the trend towards heavier, less efficient cars. UNEP has joined Daimler in calling on the energy providers to get involved in establishing the necessary infrastructure for electric and hydrogen vehicles. "You can't expect Daimler, GM or Toyota to pull a patent out of the drawer at the last moment," says Steiner. "It's too much to put that responsibility on the shoulders of a single company. It's a far wider economic issue that needs broad political effort."



Steiner: Emissions trading negotiations behind schedule



Zetsche: Engineers' innovation will make the change



Browner: Clear targets spur industry to produce unforeseen solutions



Edenhofer: We can decouple economic growth from emission rises



Stockmann: Rising road transport slows progress on Kyoto targets

European CO₂ Legislation

In emotion issue 14 we took a look at the status of the proposed European CO₂ legislation and its likely effect on the major European OEMs. In this edition, we will compare OEM strategy and have a closer look at the competing CO₂ reduction technologies.

Progress to date

Under laws proposed by the European Commission, and currently under debate, every car manufacturer which sells large numbers of vehicles in Europe will be penalised for exceeding a set target for the average amount of CO₂ its new cars emit from 2012. The target is on a sliding scale, with heavier cars being allowed to emit more CO₂.

According to a report by T&E, BMW have made the most progress of any large European carmaker in cutting CO₂ emissions, with a reduction of emissions by 7.3% last year, and will have to cut CO₂ emissions by another 19% to meet their 2012 target.

Despite BMW's progress, German cars - including those made by BMW, Daimler and Volkswagen - emitted 10 grams of CO₂ more than the EU average. The French manufacturers are the closest to their targets, however they are making relatively slow progress: PSA cut emissions by 0.9% in 2007 and need to improve by 10% in the next five years, while Renault reduced by just 0.5%.

Four manufacturers will need to improve by at least 20%: Suzuki (25%), Daimler (24%), Mazda (24%) and Nissan (22%).

(Reducing CO₂ Emissions from New Cars: A Study of Major Car Manufacturers' Progress in 2007; T&E).

The European Manufacturers' view

ACEA, the Association of European Automobile Manufacturers, are pressing for an alternative approach to CO₂ reduction, wishing to avoid the EC's timescale and punitive measures. This is taken from the ACEA website:

Table 1: Cost of CO₂ saving

	Examples	Projected availability in medium to high volume	Cost of each technology (euro/car)	CO ₂ saving efficiency (euro/g CO ₂ /km)
1 Short term developments	Low rolling resistance tyres Low friction lubricants Optimised gearing Stop/start (micro hybrid)	Now	25 - 250	1 - 50
2 Medium term developments	Twin clutch gearbox Improved aerodynamics Mild and full hybrid	2012	250-2000	100 - 250
3 Long term developments	Lightweight bolt-ons (closures, chassis) Super lightweighting (Mg, C- fibre etc) Electronic engine valve control Plug in hybrid (range extended electric)	2020	2000-5000	500 -1250

.... European legislators need to provide a legislative framework that combines the benefits of new technologies with measures to increase the use of alternative fuels, enhance infrastructure efficiency, improve driver training and shape consumer demand through harmonised taxation schemes. This will lead to larger cost-effective CO₂ reductions quicker, while safeguarding manufacturing and employment in Europe.

To support their case, ACEA have also studied a number of available technologies and found some to be less favourable to European driving conditions. For example, petrol hybrids are more suited to the stop-start driving conditions found in Japan are not as fuel efficient as clean diesel. ACEA conclude:

.....The future will see a number of technological combinations entering the market, perhaps tailored for different usage, driving locations or circumstances

and consumer preference. (ACEA website)

A wealth of technologies

A study by Corus into the cost of CO₂ saving has found that the CO₂ reducing technologies available to the OEMs tend to fall into 3 groups: (see Table 1 above).

It is the highest cost technologies (group 3) that attract the most attention in the technical press. However, success in the short to medium term will depend on combining compatible low cost technologies (groups 1 and 2) for the appropriate volume and market segment.

For the purposes of this study, Corus have calculated the cost effectiveness of a wide range of CO₂ reducing technologies.

When expressed in euro/g CO₂/km, the range of cost effectiveness is quite remarkable.

The cost of weight saving

A hot topic among automotive engineers is the advantages of CO₂ reduction through lightweighting, a debate in two parts:

1. CO₂ reduction as a function of weight reduction: In a study* for the European Commission in 2006, TNO reported figures ranging from 0.17 to 0.70 for the percentage reduction of CO₂ for every 1% of weight reduction. The figure used in Corus's own calculations is 0.35 (% CO₂ for 1% weight saved), derived from TNO's own test programme.

2. Cost of weight reduction: In the same report a wide range of technologies were considered for small, medium and large vehicles. A 'strong' weight reduction was described as a 30% weight saving in the body in white, a resultant 9% saving on the kerb weight at an estimated cost of 418 euros for a large car. Corus's own calculations, also based on substituting steel for aluminium in a large car, gives a BIW weight saving of 23.5%, a kerb weight decrease of 3.9% at a cost of

*Source TNO report - 'Review and analysis of the reduction potential and costs of technological and other measures to reduce CO₂ emissions from passenger cars'

Table 3: Current sub 130g cars and their enabling technologies

Make/Model	CO ₂ (g/km)	Enabling Technology**
Ford Focus ECOnetic	115	Aero body kit Smaller wheels Spare wheel deleted Sports suspension
VW Golf BlueMotion	119	Aero body kit Optimised gear ratios Low rolling resistance tyres Sports suspension
BMW 118D	119	Active aerodynamics Stop/start Electric power steering Brake energy regeneration Lightweight engineering Optimum gear shift indicator

**As stated on company websites

Table 2: Alternative materials - potential weight saving vs cost

	steel (kg)	aluminium (kg)	magnesium (kg)	% weight reduction (part)	% weight reduction (vehicle)	% cost Increase (part)
Body in white (BIW)	285	218	N/A	23.5	3.90	250
Bonnet (assembly)	14.8	8.3	N/A	44	0.48	300
Door (assembly)	15.7	9.5	N/A	39	0.40	275
IP Beam (instrument panel support)	11.4	N/A	6.3	45	0.33	350

nearly 2,000 euros.

Since there is a large variation in the quoted figures for both CO₂ reduction as a function of weight reduction and cost of weight reduction, the combined value (described as CO₂ saving efficiency in Table 2 above) can vary considerably.

Latest trends

A substantial number of sub 130g cars have appeared on the European market in the last year. Some examples are shown

here (Table 3 below left) along with the CO₂ reduction technology as stated by each manufacturer.

Table 3 also illustrates the key differences between mainstream products (Golf and Focus) and premium products (BMW 1 series).

The premium market position of the BMW allows for the integration of higher cost technologies, including stop/start - also known as micro-hybrid.

As 2012 approaches, we would expect the short term developments to become more commonplace and the medium term developments to be rolled out in the higher priced and larger vehicles.

Contact: Andy Clough
Corus Senior Consultant, Automotive
t: + 44 (0) 2476 241215