

Infineum Trends

Part 2 of a 2-part series

Power Transmissions

Improved fuel economy and performance, are driving transmission development trends. Forecasts suggest that the market domination of manual and automatic transmissions will be eventually challenged by the emergence of increasingly efficient dual clutch, automated manual, and continuously variable transmissions. In this section of Trends we are going to zero in on just one of these emerging technologies – the dual clutch transmission or DCT.

The global transmission market is forecast to reach 91 million units per year by 2017 – with over 80% being conventional manual, and automatic systems. Clearly these technologies will dominate the market for the foreseeable future. Over the same period, DCT is forecast to have the greatest percentage growth, albeit from a small base, reaching 5% market share by 2017.

In a survey of 1000 leading transmission experts at the 2009 International CTI Symposium for Innovative Automotive Transmissions which was held in Germany, 40% said they believed that dual-clutch transmissions will be the leading gearbox by 2020. This is against a backdrop of somewhat mixed fortunes for the DCT, which is currently being embraced by some OEMs, but treated with caution by others. Since 2003 Volkswagen has spearheaded the introduction of DCT in Europe with its Direct Shift Gearbox (DSG) for VW, SEAT and Skoda vehicles and the S-Tronic for Audis. Ford, with Getrag, has also been forging ahead with multiple DCT programs and many other manufacturers including Daimler, Fiat, GM, Nissan and Renault are incorporating DCTs into their mainline vehicles. The technology is also being used in low volume niche sports cars like Porsche, Ferrari and Bugatti – where reduced weight and faster shifts means it can help to improve acceleration times.

The lubrication of DCTs with a separate sump for the clutch or those with dry clutches can be met with current manual and

automatic transmission fluid technology. However, DCTs with wet clutches and a single sump require specialized DCT fluids. These fluids must combine the qualities of both manual and automatic fluids with both good paper clutch friction and the gear, bearing and synchroniser performance of a Manual Transmission fluid.

Heavy Duty Diesel Oils

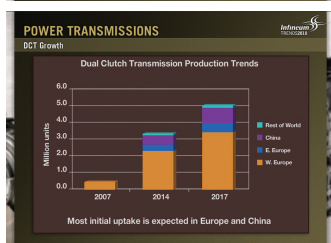
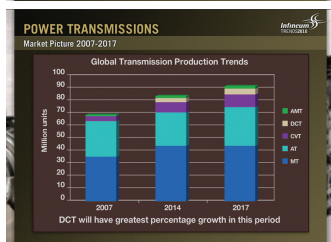
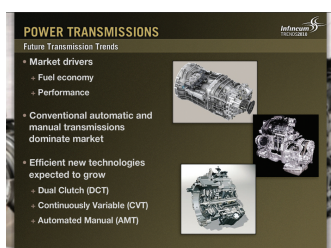
The truck industry experienced a difficult year in 2009. New truck sales are at an all time low – the global truck market fell from a high of some 2.4 million units in 2007 to under 1.4 million in 2009 – leaving many engine manufacturers to operate in survival mode. Recent upturns in the global economy have shown a glimmer of hope that the commercial vehicle market will rebound in the second half of 2010 – but it will likely be a long time until full recovery.

China appears to be bucking this trend with strong commercial vehicle sales late in the year. API CJ-4 oils were developed to protect 2007 emission-controlled engines and their exhaust after treatment devices. OEM acceptance of these oils has been excellent.

Starting this year, all on-highway diesel engines must meet significantly lower levels of NOx emissions. Most US engine manufacturers have chosen to use Selective Catalytic Reduction with Diesel Exhaust Fluid as their primary NOx control technology. However, Navistar has chosen to continue the use of heavy EGR combined with advanced combustion controls instead of SCR.

The 'no new category' position was confirmed by API at a meeting in late January. API CJ-4 oils were unanimously endorsed for use in all 2010 and beyond on- and off-road engines. In recognition of the long term use of this category, planning to support CJ-4 testing through 2015 was initiated. While no formal request is currently contemplated, the possibility of a new category for mid-decade was discussed.

In Europe, because the 2007 version of the ACEA sequences met pretty much all the needs of Euro V engines the ACEA 08 revisions contained no changes in severity for E4, E6 and E7. The E2 category has been dropped and a new E9 category – which contains SAPS limits intended to help protect engines fitted with diesel particulate filters has been added. While E6 already has low SAPS limits it also has a very high performance level for piston deposit control. ACEA E9, which has a good level of piston deposit control, and higher performance levels for soot, viscosity and wear control, has been introduced for engines where heavy EGR produces soot that is more difficult to properly disperse than the soot from earlier designs. This category, which takes up a number of elements from API CJ-4, including the chemical limits



and some of its engine tests, demonstrates ACEA's willingness to draw on best practice from around the world to build specifications specifically optimised for European engines, fuels and driving patterns.

New engine tests have also been included in these latest specifications where existing engines are no longer available or are obsolete. Again it's good to see a sensible approach being taken here, with the new tests being applied with the same severity as the old. In the OM646 engine test the limits set are not more than those specified by Daimler, and only CEC parameters have been included, while in the OM501 the Daimler limits have been followed exactly and although non-CEC parameters have been included there is a footnote to this effect.

While they may not always be a perfect match, grandfathering, which allows existing data to be used to support new claims, has been allowed for all E categories.

One test requested by ACEA members that did not make it into the 2008 revisions was the new turbocharger deposit control test, which was delayed due to a lack of appropriate reference oils and as a direct result a lack of correlation to field performance. Before any further work is carried out on this test the CEC must ensure that the test is a meaningful predictor of real world performance and is able to discriminate between known good and poor field performing oils. This is recognised by CEC and the test development group has been closed. In addition, the causes of deposit formation need to be better defined and the various approaches to resolving the issues need to be explored.

The 2010 revisions to the ACEA specifications are expected to be minor and will simply be a tidying up exercise.

So in this long gap between major specification updates lubricant marketers have an opportunity to turn their attention to value added solutions. Understanding OEM technology directions is the first step towards having the right products available to meet their needs – so just what are the OEMs focussing on?

Despite the very difficult business situation many OEMs are continuing to invest heavily in new products – not only the next generations to current models but also in the development of new environmentally friendly drive system technologies.

In the US, hardware changes to meet the new emissions controls are an area of current focus and here 2010 engines and aftertreatment systems are thought to be adding somewhere between 7-10 thousand dollars to the manufacturing cost of every engine – something that will be tough to swallow in the current economic climate.

In Europe the focus is on moving to Euro VI and most OEMs will need to use a combination of SCR, EGR and particulate traps – all technologies for which current oils have been designed and tested. There will be differences, with some OEMs looking to maximise SCR efficiency to minimise the EGR rates and others maximising the use of EGR. Optimising fuel injection and combustion will play a part too.

As we already mentioned, Diesel fuel prices look set to rise again in 2010 and as they account for in the region of 30% of all operating costs so improving fuel economy is becoming an increasingly important area of focus.

Every part of the vehicle is under scrutiny – tyres, aerodynamics, transmissions – and engines must play their part. Friction in the engine must be minimised, and here coatings, design and fluid choice all have in impact. There is an emphasis on thermal management which can increase the thermal stress on the oil. Increasingly OEMs are aware of the importance of lubricant choice, as part of the holistic optimisation of engine fuel economy whilst maintaining optimum performance and durability throughout the life of the engine.

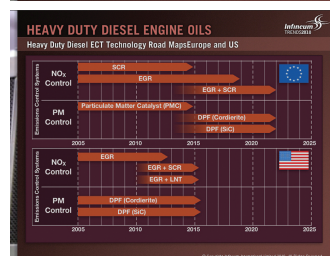
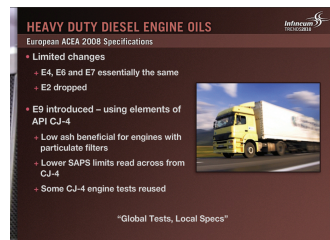
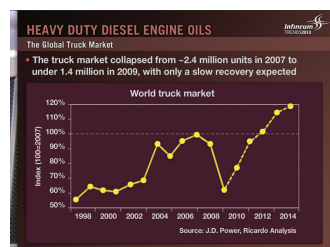
As the emission limits get tighter, technology must evolve to meet these requirements. However it is an evolution rather than a revolution, as the existing technologies, EGR, SCR and traps will increasingly be used all together. This will also mean a convergence of European and US technology.

SCR technology will need to change, with iron replacing vanadium. We will need to ensure that the catalyst is compatible with chemical limits.

Sensor technology will need to advance too, to meet new OBD requirements. Soot sensors and sensors for ammonia slip will need to be improved and their lubricant requirements assessed.

As for next generation technology, with the promise of lower fuel consumption, low emissions and a low noise level many OEMs are actively pursuing Hybrid technology – with many moving these designs from concept into production. Daimler Trucks has launched its Mercedes Benz Atego BlueTec Hybrid in Europe and the Fuso Canter Eco Hybrid in Japan. Mack's Granite model diesel-electric hybrid powertrain demonstrates as much as a 30 percent fuel economy improvement, depending on the truck's application and is being used by the US Air force. Volvo Truck has relaunched an optimised version of its Hybrid vehicle following 18 month testing, with small scale production now expected in 2012.

OEMs are also looking to achieve environmental improvements by using alternative fuels including biofuels and Natural gas. Kenworth and Mack both have gas-powered models based on



the Cummins Westport ISL G natural gas engine Mercedes already has its Econic natural gas vehicle in service in Europe – which the OEM says can deliver lower CO₂ emissions, zero particulate emissions and a low noise level versus comparable diesel powered vehicles.

With recent funding from the US Department of Energy, Daimler Trucks has also launched both Hybrid and gas vehicles in North America.

In 2011 Volvo in Sweden begins field testing its diesel engine fuelled by a mixture of methane gas and diesel that it says is the first engine of its type to meet the strict Euro 5 exhaust emission standards and which the company says will deliver energy efficiency, improved driveability and lower maintenance costs.

Global Markets

Brazil is one of the top ten automobile manufacturing countries in the world by volume – and in 2009 the country produced over 3 million vehicles. The year also saw an increase in domestic vehicle sales which, bolstered by tax incentives, rose by 11% on 2008 figures. However surging imports and lagging exports meant that 2009 production was down by 1%. Nevertheless, with the outlook in Brazil better than in most other markets, the ever-optimistic industry plans to increase capacity by about 25%.

Brazilian emissions standards for on-road vehicles, called PROCONVE, are based on European regulations. The regulating body, CONAMA, is tightening emissions legislation so that by January 2012 HDD vehicles will need to meet levels equivalent to Euro V. The organization also has plans to introduce Euro V limits for passenger cars in the future.

Brazil is also trying to improve the quality of its fuels. Although diesel fuels with sulphur levels of 1800 and 500ppm are still in use – 50ppm sulphur diesel fuel is now available for urban transport fleets in selected cities, and 10ppm diesel will be available from 2013. There is some concern that the availability of diesel fuel containing different sulphur levels may cause confusion and misuse.

Biofuel use has been promoted for some 40 years in the region and ethanol use in gasoline grades is currently E25 and E100. As for biodiesel, mandated levels are expected to rise gradually to B10 by 2015.

These changes in fuel quality present new challenges for auto makers and fuel retailers, with concerns being expressed over the availability of low sulphur fuels and SCR fluids as well as the quality, consistency, handling and storage stability of biodiesel containing fuels.

Russia had been forecast to become the third largest global car market following the US & China. However, the economic downturn resulted in an almost 50% sales reduction in 2009.

In spite of implementing more modern standards, only 50% of the current fleet of 30 million vehicles is running at above Euro 2

emissions levels. Passenger car diesel sales are expected to grow due to pollution concerns and the desire for improved fuel economy. The fuels industry is ready, with most, if not all diesel sold in Moscow and other big cities already at 50 ppm sulphur. There is no biodiesel market in Russia and seeds grown in the region are exported to the rest of Europe.

Russia currently produces over two and a half million tons of lubricants each year, around 67% of which is for domestic consumption. Recent figures show that domestic production, consumption and export volumes have all dropped, whilst imports – generally of top tier products has increased. Three major local lubricant marketers account for almost three quarters of the market with ExxonMobil and BP holding the lions share of the meagre 240 k ton import market.

Historically some 80% of the vehicle population has been made up from domestic brands and a large proportion of the lubricants used were of API SG/CD quality. But as the population of foreign vehicles increases so higher quality lubricants like ACEA C sequences or API SL or SM will be required to protect the advanced engine hardware.

Now to India, where the economic situation has remained fairly resilient despite the global downturn, this positive performance was aided by robust private consumption and substantial fiscal stimulus. GDP growth is expected to have been around 6.6% in 2009.

Vehicle production and sales figures in India are dominated by two wheelers – predominantly motorcycles. That dominance may be challenged by the introduction of the Tata Nano and other low cost cars. Production increased slightly to just over 11 million vehicles last year.

Plans are in place to grow local production, but the auto industry has recently been hit with labour problems. Under India's Automotive Mission Plan, which provides a framework for automotive sector development until 2015, the government has reduced import tariffs on components in an attempt to boost exports. Hyundai currently exports about half of the vehicles it makes in India to Europe and other car makers will certainly be targeting exports to reap the advantages of low production costs in India while selling in markets where the price is still attractive. However, it is not all smooth sailing in the Indian auto industry with costly disputes and poor infrastructure causing problems.

Certainly the economic downturn has taken its toll on auto manufacturers, with some projects being pushed back or halted.

The second phase of the Renault-Nissan factory in Chennai for example has been suspended – reportedly not because of uncertainties in the potential of India's domestic or export markets, but because of the decline in the global automotive market.

While Renault has put its plans on hold, Nissan is set to produce the small Micra from the Chennai plant in 2010. As for Bajaj's plans to produce an Ultra Low Cost Car that can

achieve 70mpg – apparently the project is alive and well – if somewhat delayed. However, it now appears that the car will cost \$3,000 – which is around \$1,000 more than its rival the Nano.

Speaking of the Nano, the first was delivered in July 2009 and Tata has announced that over 17,500 units were delivered in the year and that it now plans to ramp up production rates in 2010.

Several other automakers including Daimler, Volkswagen, Suzuki, Toyota and Reva also have plans for significant investments in India.

In 2009 China's GDP grew to almost 5 trillion US dollars with a year on year change of just under 9%.

They certainly got it right where the automotive market is concerned – in 2009 predictions that China would overtake the US as the world's biggest market came true, and figures released in January 2010 showed that China's auto sales had surged past the United States to reach record levels. Government incentives including slashing taxes on cars with engines smaller than 1.6 litres and subsidising clean-technology vehicles bolstered demand – making this a bright spot for carmakers that were otherwise severely battered by the financial crisis in other regions of the world. Vehicle sales in China reached a record 13.6 million units – an increase of more than 46% compared with 2008 figures and well above their target of 10 million units. Vehicle production also rose dramatically from 9.3 to 13.8 million.

These increases are also reflected in the total vehicle population which increased by 18%, reaching 60 million in 2009 – a trend that is forecast to continue well into the future. Car sales have mushroomed in China due to rising incomes – which have put private car ownership within the reach of many. In Beijing alone the number of registered cars exceeds 4 million – which means about a quarter of the capital's 16 million residents now own a car – something, not so long ago, many would have considered an unaffordable luxury.

With high fuel prices and government incentives for the purchase of small engine cars Chinese customers are increasingly looking for new vehicles with better fuel economy. The five best-selling models in China in 2009 from BYD, Hyundai, Buick and Volkswagen – all come with engines smaller than 1.8 litres.

In 2008, the poor economy hit commercial vehicle production in China and around 100,000 fewer trucks were produced – but in 2009 there was a complete turn around. The growing economy has driven up production – which shot up by a massive 1.4 million units to reach just over 3 million.

Both light and heavy duty Emissions standards have progressed from Euro II through Euro IV, and plans are in place for Euro V in 2012 for HD applications.

In 2009 Korea's gross domestic product grew by 0.2%. This growth was driven by rising consumer spending and strong industrial output, especially by the automotive and computer chip

industries. While domestic production fell in 2009, sales rose to 1.4 million units. Hampered by the global economic downturn, export production was off about 20%.

Market leader Hyundai Motor Company accounted for almost 80% of the country's domestic sales. And the company increased its market share by 77% in 2009 – mainly owing to its aggressive marketing strategy and the fact that it has not suffered from the same financial problems as many other OEMs.

Hyundai Motor Company's production capacity of some 6 million vehicles comes from plants in the local region, USA, China, India, Slovakia and Turkey – and most recently in the Czech Republic. And, with plans to expand production in Russia, China and Brazil, it is expected that these figures might top 6.8 million units by 2012.

Korean emissions standards are based on European specifications, with new trucks, buses and small cars now having to meet Euro V. The same requirement for large cars and light-duty trucks will be introduced from September 2010. As for the existing fleet, the standards will take effect from six months to two years later.

To help meet these standards both gasoline and diesel fuel came under new specifications in 2009 with tighter limits on sulphur, benzene, lubricity and cetane number.

As for CO₂ emissions, a Fleet Average System or FAS was introduced in January 2009, which is based on the US CAFE standards. The new system allows OEMs to produce cars with various emission levels as long as their average emissions meet the FAS limit. OEMs will receive credits for lower emission averages, which they can then deposit when their average gets above the limit.

Korea has had mandatory use of biodiesel since 2006. Plans call for gradual increases to B3 by 2012, and require the bio component to meet EN14214.

