JATO Dynamics

The future of the car industry as WLTP bites

November 2017

Alessandro Paolucci, Head of Service Innovation, Europe, JATO Dynamics

JATO

Where is the automotive industry heading amidst more stringent emissions targets?

WLTP, or the Worldwide Harmonized Light Vehicle Testing Procedure, is getting a lot of attention. Its application and ramifications are currently preoccupying the automotive industry. There are questions about what the testing means for vehicles that have already been produced, and how much the results will differ from the previous NEDC testing procedure.

But, the automotive industry's current focus on WLTP is reductive. In reality, WLTP is a symptom of a wider shift towards lowering emissions. One which has seen policymakers on a global, pan-European and national level pass regulations that aim to reduce emissions of all harmful air pollutants. This is the context in which WLTP should be viewed; it is a testing procedure not an emissions standard. It is a hurdle designed to bring about a lowering of emissions, not the answer itself.

The automotive industry therefore needs to ask a bigger question than "how can we meet the needs of WLTP?" Instead it needs to ask "how can we prepare our industry to reduce emissions over the next 30-40 years?"

This paper will look at the immediate impact of WLTP testing and what it tells us about the automotive industry's ability to meet emission standards. It will propose that the industry is at a crossroads and must find ways to innovate and create technologies that will lower emissions in the short and medium term, paving the way for the eventual move to electric vehicles.

Whilst WLTP is only a testing procedure, it could be a catalyst for a golden age of innovation in engine and battery design.

2020
The world's first zero-emissions zone planned in Oxford, UK.

2021
Target to get the fleet average emission down to 95g/km of CO_2.

2030
Demand for electric (as a result of EVs on the road) expected to surpass the capacity of Hinkley Point C (one of UK's biggest power stations).

2035
Some sources in the industry forecast that all new cars sold in Europe will be electric.

2040
Sales of diesel cars will be banned in UK and France.

2050
EU aims to reduce all greenhouse gas emissions by 80-95%.

Source: JATO Dynamics Ltd

The WLTP Microscope

JATO's analysis suggests that WLTP testing will mean that it will be exceptionally difficult for car makers to adhere to the EU's 2021 target to get the fleet average emission down to 95g/km of CO_2 . This is because the fleet target was based on NEDC testing.The introduction of the more accurate real-world testing procedure WLTP is unsurprisingly resulting in higher emissions readings, when the conversion to NEDC correlated data is performed using Co_2mpas which is already in progress.

As discussed in our previous paper[1] this could ultimately impact the relationship between OEMs and consumers. Prices will inevitably rise to take into account the current tax legislation in many EU countries, and also the fines that could hit car makers if the CO_2 fleet target is not met in the near future. JATO's data shows that those cars that have been re-tested under WLTP show a tangible increase in NEDC correlated values, versus those obtained under the NEDC test regime. Interestingly, this disparity is turning out to be greater than expected. Examples of vehicles tested under the WLTP testing procedure, where automakers have published NEDC correlated values, are detailed below.

MAKE	MODEL	VERSION	g/km OF CO_2		CHANGE OCT vs JUL		TYPE OF CHANGE
			JUL-17	OCT-17	in g/km	in %	
BMW	X5	3.0 XDRIVE30D A	156	183	27	17%	NEDC Corr
BMW	X5	3.0 M50D A	173	205	32	18%	NEDC Corr
BMW	X5	3.0 XDRIVE40D A	157	183	26	17%	NEDC Corr
BMW	X6	3.0 M50D	174	206	32	18%	NEDC Corr
BMW	X6	3.0 XDRIVE30D A	157	183	26	17%	NEDC Corr
BMW	X6	3.0 XDRIVE40D A	163	183	20	12%	NEDC Corr
PEUGEOT	308	1.2 PURETECH 130 ALLURE SW	111	124	13	12%	NEDC Corr
PEUGEOT	308	1.2 PURETECH 130 ACTIVE SW	106	121	15	14%	NEDC Corr
PEUGEOT	308	1.2 PURETECH 130 ALLURE	107	120	13	12%	NEDC Corr
PEUGEOT	308	1.2 PURETECH 130 ACTIVE	104	117	13	13%	NEDC Corr
VOLVO	XC60	2.0 D4 MOMENTUM GEARTRONIC 4WD	133	144	11	8%	NEDC Corr
VOLVO	XC60	2.0 D5 INSCRIPTION GEARTRONIC 4WD	144	152	8	6%	NEDC Corr
VOLVO	XC60	2.0 D4 INSCRIPTION GEARTRONIC 4WD	133	148	15	11%	NEDC Corr
VOLVO	XC60	2.0 D4R DESIGN GEARTRONIC 4WD	133	148	15	11%	NEDC Corr
VOLVO	XC60	2.0 D5R DESIGN GEARTRONIC 4WD	144	152	8	6%	NEDC Corr
VOLVO	XC90	2.0 D5 AWD INSCRIPTION GEARTRONIC	149	163	14	9%	NEDC Corr
VOLVO	XC90	2.0 D5 AWD MOMENTUM GEARTRONIC	149	173	24	16%	NEDC Corr
VOLVO	XC90	2.0 D5 AWR R DESIGN GEARTRONIC	149	163	14	9%	NEDC Corr

Source: JATO Dynamics Ltd

The industry is at a tipping point. There needs to be a way for car makers to reduce emissions of CO_2 while maintaining value chains and driver experience. Customers want the power output and the torque they expect from their vehicles, but the industry needs to avoid the emissions that this inevitably delivers.

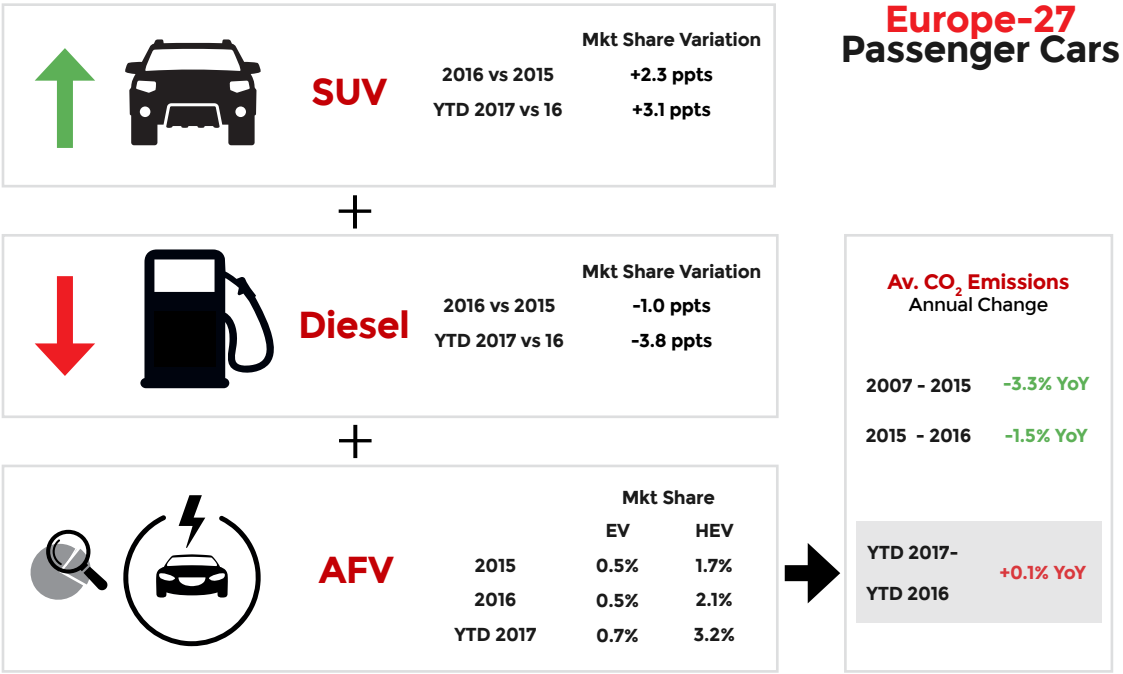
1 http://www.jato.com/wp-content/uploads/2017/07/JATO-WLTP-Whitepaper-The-Impact-on-Tax-and-Car-Design.pdf

A Complex Future

WLTP testing is one element of a broader drive to tighten emission reduction rules whilst also improving testing procedures. Regulation to reduce emissions in the automotive sector is expected to become stricter over the coming years, with the EU leading the way globally. The Euro 6 directive, introduced in September 2015, has the clear aim of reducing all emissions, including nitrogen oxide (NOx), carbon monoxide (CO), hydrocarbons (THC and NMHC) and particulate matter (PM). The latest iterations of this, EU6d temp and EU6d homologation apply to all mass-produced cars, and have the overarching aim of reducing pollutants, improving fuel economy and lowering CO_2 emissions.

These initiatives ultimately contribute to a target of 95g/km measured under NEDC. By 2050 the EU aims to reduce all greenhouse gas emissions by 80-95% and this will undoubtedly impact the automotive sector. It's clear that EU6 will continue to evolve and governments will be compelled to introduce more stringent measures to curb emissions. Most recently, in October, seven EU countries lobbied the EU Commission to strengthen limits on tailpipe carbon emissions. This was as the Commission planned for a benchmarking proposal to encourage carmakers to introduce zero-emission vehicles, in a form of crediting system linked to overall CO2 targets[2].

We're already seeing this with the news that multiple markets, including France and the UK, are planning to ban the sale of internal combustion engines within the next 20-30 years. Individual locations such as Oxford are leading the way, the UK city is planning to introduce the world's first zero-emissions zone via a ban on internal combustion engines as soon as 2020. With the tide seemingly turning against emissions, automotive manufacturers must take action in the short as well as the long term.



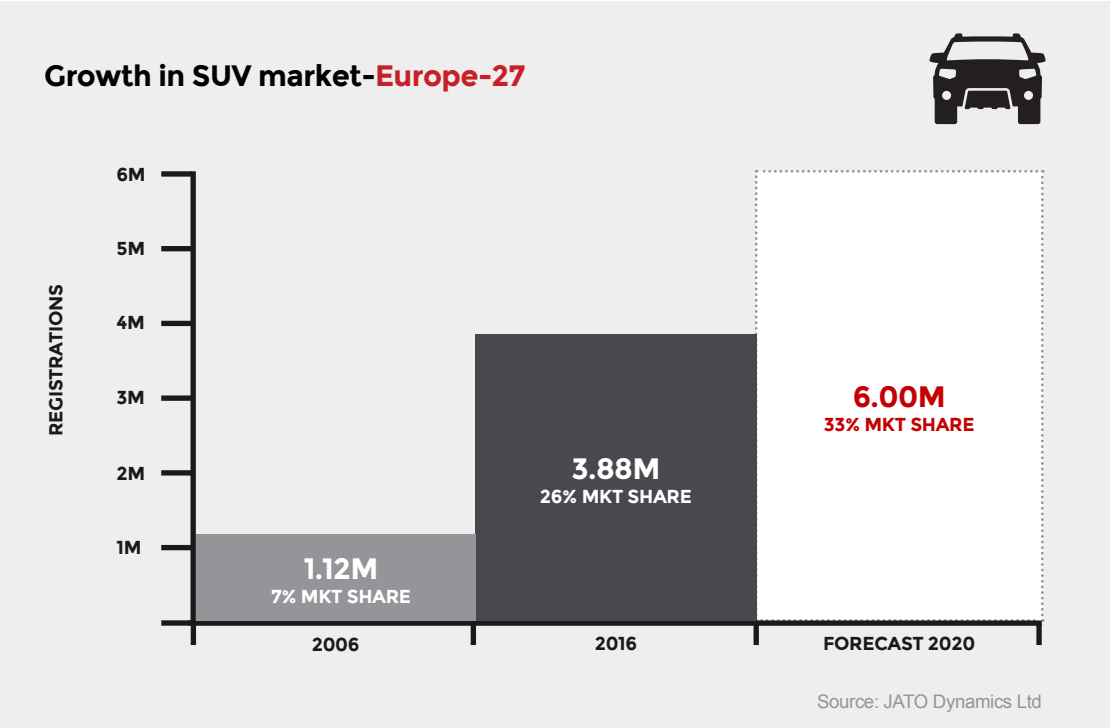
2 https://www.reuters.com/article/us-eu-autos-carbon/countries-urge-eu-to-cut-cars-co2-emissions-by-more-than-planned-idUSKBN1CW1AC

The End of the Road for Internal Combustion?

As automotive companies face a future of increased regulation and complexity, it is reasonable to ask whether the current approach to engine design is still up to the job. According to recent analysis by JATO Dynamics, 92% of internal combustion engines registered in Europe today produce emissions that are above 95g/km under the NEDC measures. This means that unless there is a significant step forward in engine design, the current iteration of the internal combustion engine could be seen to have reached its peak and the end of its evolution. The law of diminishing returns is kicking in.

The automotive industry has largely been built on the traditional combustion engine which has been dominant over the last century. But given that 92% of internal combustion engines exceed the target, a revolution is needed and the clock is ticking.

The SUV represents an interesting trend, as JATO's data shows that SUVs are the fastest growing vehicle segment. This has placed enormous pressure on carmakers to create an engine-transmission combination that is able to perform within the emission target, in vehicles that are heavier and are less aerodynamic than a conventional hatchback or sedan.

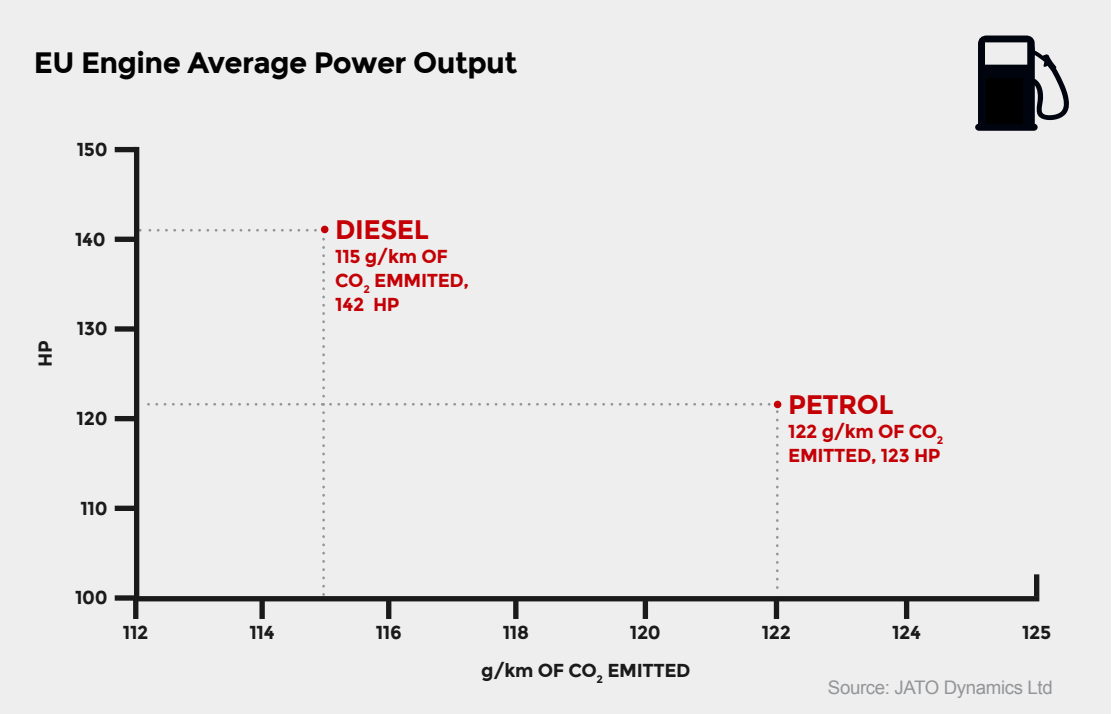


The Diesel Issue

The reputation of the diesel engine has been significantly damaged in recent years. The result is what some quarters refer to as the 'death of diesel' and has inspired moves by national governments, such as the UK and France, to ban sales of diesels by 2040.

However, to disregard diesel fuel-type powertrains hugely oversimplifies this complex topic.

Despite the reputational issues surrounding the fuel type, diesel engines can produce more power and torque with lower CO_2 rates when compared to traditional petrol-based engines. Today the average power output of a diesel engine registered in the EU is 142HP, and 115g/km CO_2 emitted. While the average power output of a petrol engine registered in the EU is 123HP, with 122g/km CO_2 emitted. However, it's fair to say that, diesels require more investment to reduce noxious emissions than petrol engines.



But the industry has long been aware of its responsibilities and has worked hard over recent years to develop cleaner versions of petrol engines. As a result, emission control systems such as air-fuel control and catalytic after-treatment have been devised. The cost of these technologies has fallen and is now relatively low. In contrast, reducing emissions for diesels - through features such as air-management, fuel injection and after treatment - is complex and requires significant investment.

Regulation around emissions is complex. Banning diesels to reduce PM (Particulate Matter) and NOx due to declining popularity could have a boomerang effect on CO_2 rates, unless an alternative propulsion system is available soon.

The Long Road to Electric Vehicles

The focus on emissions reduction in recent years has shone a spotlight on the electrification of vehicles.

There are some in the industry who are forecasting that all new cars sold in Europe in 2035 will be electric[3]. With this longer term view, it's easy to see why carmakers are investing significantly in electric vehicle development - Volkswagen has recently announced a €70 billion investment, for example. However, if we look at the current penetration of electric vehicles, and the infrastructure needed to support them as they become more mainstream, there are questions about whether the market is ready to be fully electrified.

- One major concern is power supply - the impact of all vehicles becoming fully electric could be an overburdened electricity sector. According to the UK's National Grid, by 2030, demand for electric as a result of EVs on the roads could outstrip the capacity of Hinkley Point C, one of the UK's biggest power stations. Despite investment, there are fears capacity can't match future demand. To take London as an example, £17 billion is being invested in upgrading the electricity network. But it's not clear whether this investment has factored in the capacity needed to meet the increased demand that electric vehicles will make[4].

- The infrastructure needed to support EVs is a major concern, particularly amongst consumers who fear that the drive range will not be enough. Governments and fuel suppliers are simultaneously investing to change this. Recently, it was announced that Hamburg would be investing in its 600th fast charging station. Meanwhile, Shell announced the rollout of its first EV charging points at UK petrol stations, in a clear sign that the company is putting its considerable weight behind the EV. However, these examples are representative of a broader push towards EVs. The market hasn't yet hit the critical point, when all motorists have access to affordable vehicles and the infrastructure needed to make them a viable option.

- Consumer confidence - consumers are still not entirely confident in the ability of EVs to match the freedom of use of traditional vehicles. This is because there are a range of fears around recharge times, performance and charging stations. Whilst governments and manufacturers are working to alleviate these, significant steps will be needed to alter the perception of EVs in the minds of consumers.

It's clear that EVs have huge potential and there is still a vast amount of innovation to be done in both the technology and its application, and it is certainly a solution for the industry's long-term CO_2 goals. But in the short-term, the sector needs to find a way to meet targets whilst maintaining consumer demand.

3 www.theguardian.com/environment/2017/jul/13/electric-cars-to-account-for-all-new-vehicle-sales-in-europe-by-2035
4 www.weforum.org/agenda/2016/08/can-cities-handle-an-electric-car-boom/

The 48 Volt Jolt

According to JATO's analysis, 48 Volt mild hybrid technology could bridge the gap between internal combustion engines, and EVs in the short-term. The so-called mild hybrids add a 48 Volt battery to internal combustion engines without the need for a drastic vehicle redesign, plant modification or reorganisation of the supply chain. The 48 Volt solution has three major advantages:

1. **Cost-effective solution**
   48 Volt vehicles are a cost-effective solution to a potentially expensive problem. 48 Volt batteries are estimated to cost less than 1,000 Euros per vehicle and are significantly cheaper than higher-voltage hybrids.

2. **Fuel consumption is reduced**
   48 Volt systems differ from other hybrid systems in that they can increase the fuel efficiency of an internal combustion vehicle by capturing energy lost when braking, increasing torque and improving the stop-start function of a vehicle and therefore significantly reducing emissions.

3. **Additional torque**
   The 48 Volt power solution enables the starter motor to act as a supplementary motor, so the vehicle can accelerate more quickly. This has the dual benefit of reducing emissions whilst also giving the driver an enhanced experience.

There are of course disadvantages to 48 Volt batteries. Driving range is limited and the battery needs to be connected to the grid for a full recharge. However, according to JATO's analysis, the technology could clearly help automakers to reach the 95g/km limit in just two years.

Preparing for the Future

In the context of increasingly strict emissions regulation, it's clear that the automotive industry needs a short-term solution to meet the CO_2 targets that are currently in place. CO_2 values are higher under the WLTP testing procedure than under the previous NEDC testing procedure, and the effects are already visible today as WLTP and RDE are also impacting NEDC correlate values.

The transition to WLTP is already underway and is bringing with it some side effects that are changing the value chain of automotive manufacturing. This is because correlated NEDC CO_2 values are increasing, and as such, local EU member state taxes are likely to rise.

According to a study conducted by JATO, the automotive industry would need fully electric vehicles to account for 15% of the market in 2021 in order to meet the 95g/km CO_2 target. This is striking considering that the current level of fully electric vehicles registered in the EU is 1% of the market. It's clear change needs to happen, considering the combination of the current trend of declining demand for diesels and the reduced diesel offerings from automotive companies, as well as the growth of the SUV segment and the slow progress of electric vehicles in the industry.

If the automotive industry in Europe and globally does not meet CO_2 targets, automotive manufacturers face a significant penalty that amounts to €1.5 billion per gram globally. It's clear that the industry is about to have a dramatic shift and that it needs to address to prepare itself for the future.

About JATO

JATO can provide the industry with up to date information on market trends and vehicle emission performances to help car manufacturers and leasing service providers create a product offer that complies with stringent legislation.

JATO also provides a simple solution to help the automotive industry navigate complex WLTP regulation, providing a clear picture of the competitive position that each manufacturer and retailer will need to consider to stay competitive in the market. JATO also provides data to help retailers and manufacturers keep track of their fleet emissions forecasts with a view to meeting new emission targets that will come into force in 2020.

JATO Dynamics Limited
Hunton House
Highbridge Estate
Oxford Rd, Uxbridge
UB8 1LX, United Kingdom

T +44 (0) 20 8423 7100
F +44 (0) 20 8423 2233

www.jato.com

Version 1.0.0 November 2017