The EQUA Index and use of PEMS for optimal market information and surveillance

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Background

- Dieselgate has had much graver consequences from Europe than the US
- New Real Driving Emissions regulation is tough
- But loss of confidence in emissions regulation is eclipsing the progress being made
- RDE is too late to solve the immediate air quality problem
- CO_2 reduction is being made harder as consumers switch from diesel
- Additional policy will be required if diesel is to be kept in the market
- Much rides on political decisions, for environment, economics and society
- A NO_x problem may be swapped for a CO_2 and PN problem
- What is the optimal and rational outcome?

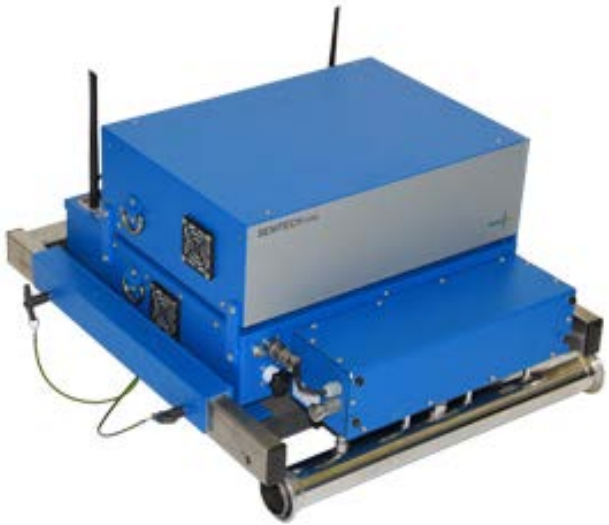
EMISSIONS ANALYTICS

Emissions Analytics' credentials

- Privately-owned international testing and ratings organisation
- Founded in 2011
- Headquartered in the UK
- Operations in UK, Germany, USA and South Korea
- Focused on on-road testing and data analysis
- Largest commercially available database of real-world emissions data
- Works with researchers, regulators, OEMs, Tier 1/2 suppliers, fuel and chemical companies, fleets, consumer media

Equipment

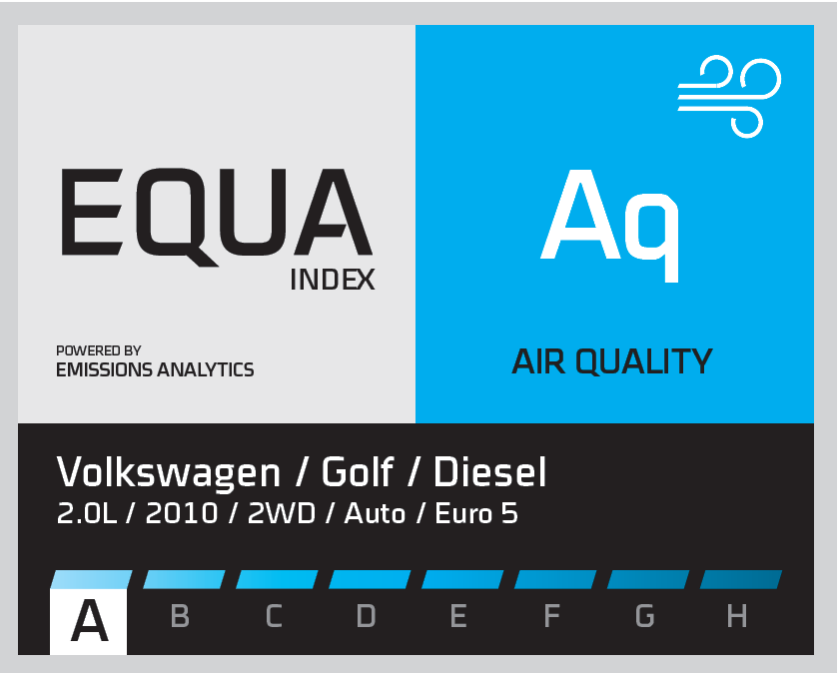
- SEMTECH range from Sensors, Inc.
- Portable Emissions Measurement System connects to tailpipe
  - Captures emissions for CO_2, CO, NO, NO_2, total hydrocarbons, particulates
  - At 1 Hertz
- Air temperature, pressure, humidity
- GPS for speed and altitude
- Engine data via CANBUS
- Fuel economy derived via carbon balance
- Weight addition 100kg

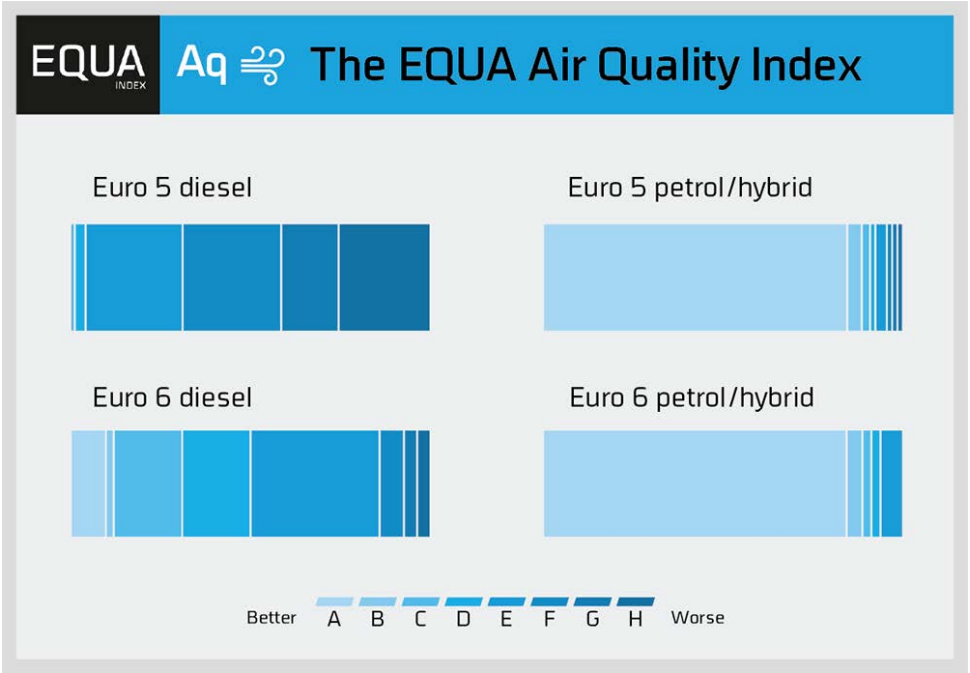


Key activities

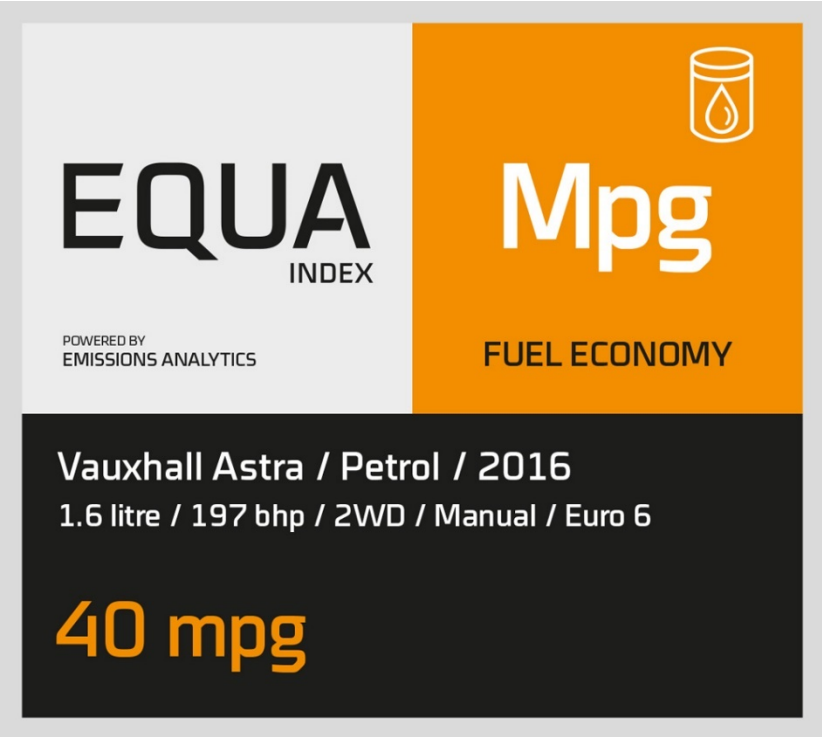
- Over 2000 passenger cars tested
- ~50 light commercial vehicles tested
- Heavy-duty commercial vehicles tested
- Agricultural equipment tested in service
- Newly-launched programme testing non-road mobile machinery, including generators, construction equipment
- Waterborne vessel testing commenced

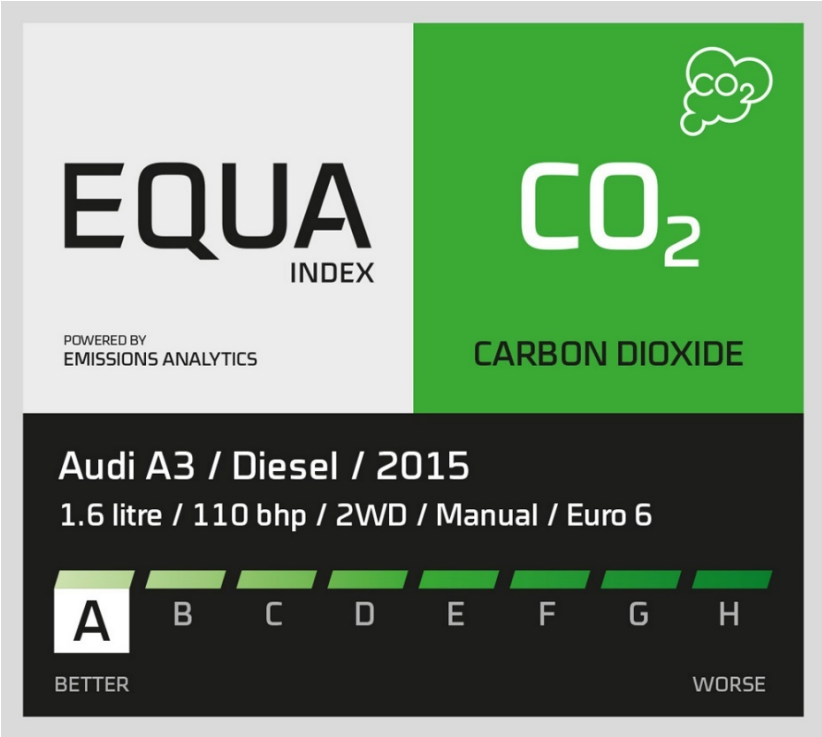
EQUA Aq


EQUA
INDEX
POWERED BY
EMISSIONS ANALYTICS
Aq
AIR QUALITY
Volkswagen / Golf / Diesel
2.0L / 2010 / 2WD / Auto / Euro 5
A
B
C
D
E
F
G
H


EQUA
INDEX
Aq
The EQUA Air Quality Index
Euro 5 diesel
Euro 5 petrol/hybrid
Euro 6 diesel
Euro 6 petrol/hybrid
Better
A
B
C
D
E
F
G
H
Worse

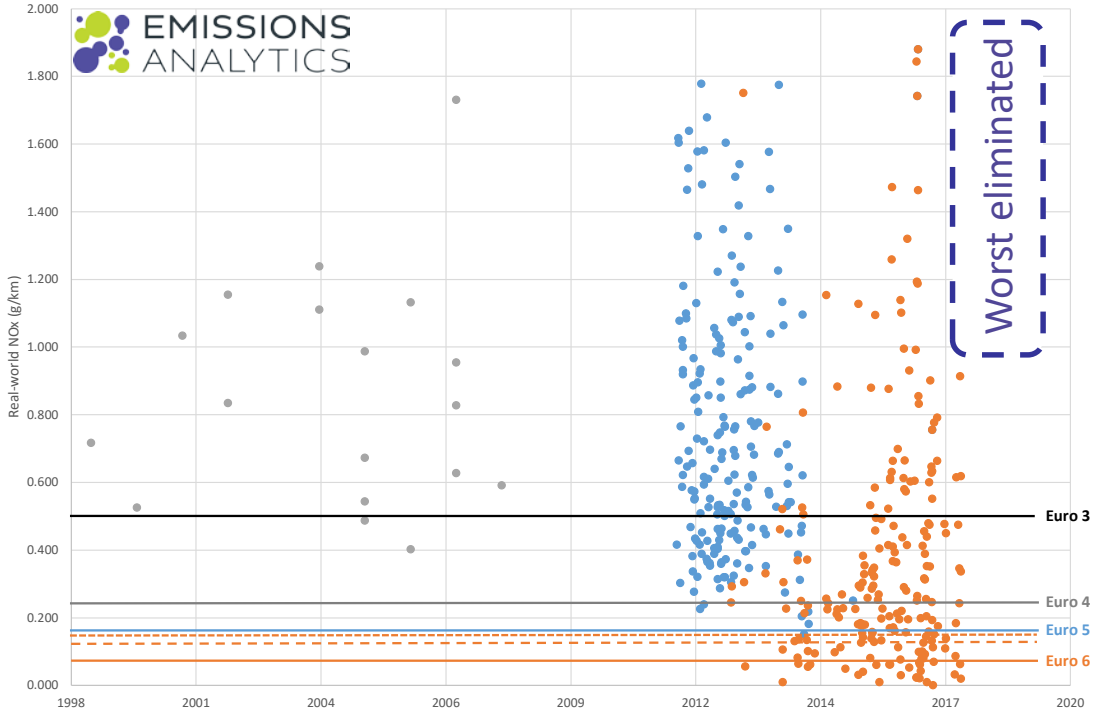
EQUA Mpg, EQUA 100, CO_2





URBAN AIR QUALITY

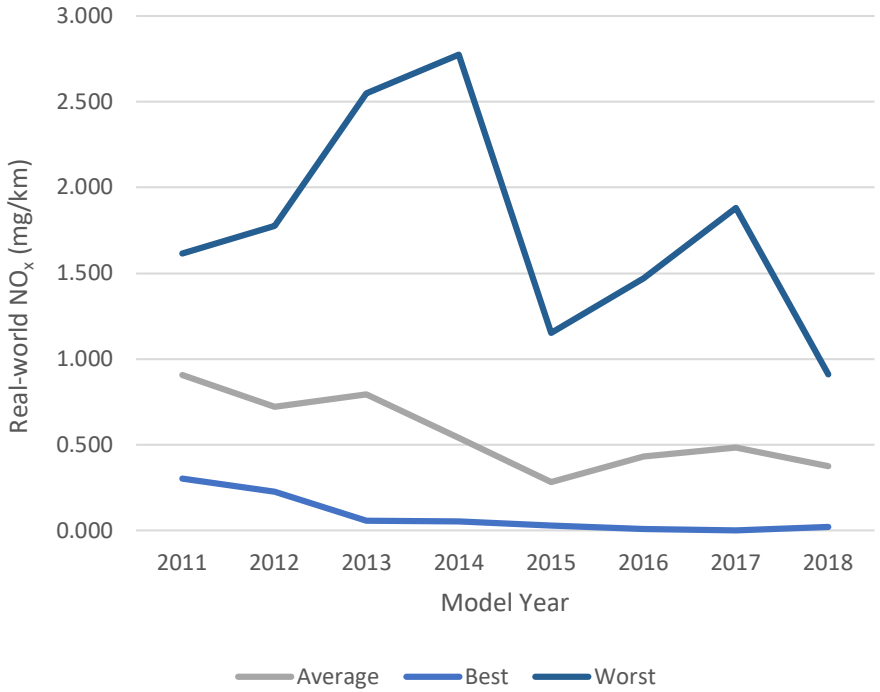
Installed base of dirty diesel



- In last year, worst new type approvals have been eliminated
- But many RDE monitoring phase diesels still dirtier than Euro 3/4
- Average Euro 6 emits 382 mg/km NO_x
- 51% lower on average than Euro 5 diesel

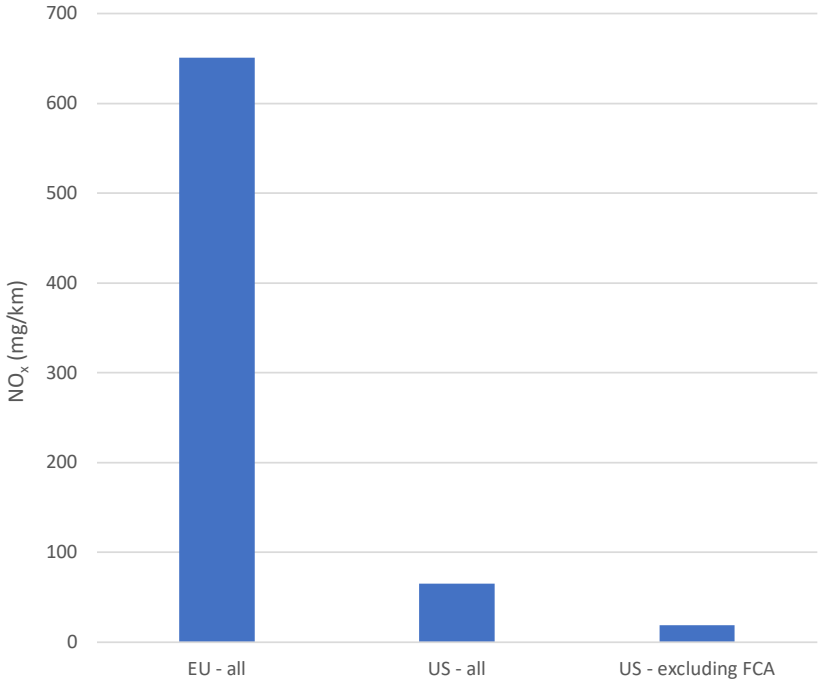
Divergent performance

- RDE vehicles tested so far are close to minimum in range
- Elimination of worst emitters is reducing average modestly
- Population of dirty diesels is likely to continue growing in 2019



Comparison to US

- Diesels sold are very low emitting for NO_x and particles
- Excluding those currently under investigation
- Around half the limit, and similar to many gasoline
- Lowest emitting EU vehicles now approaching NO_x emissions of typical US diesels



What about gasoline?

EMISSIONS ANALYTICS

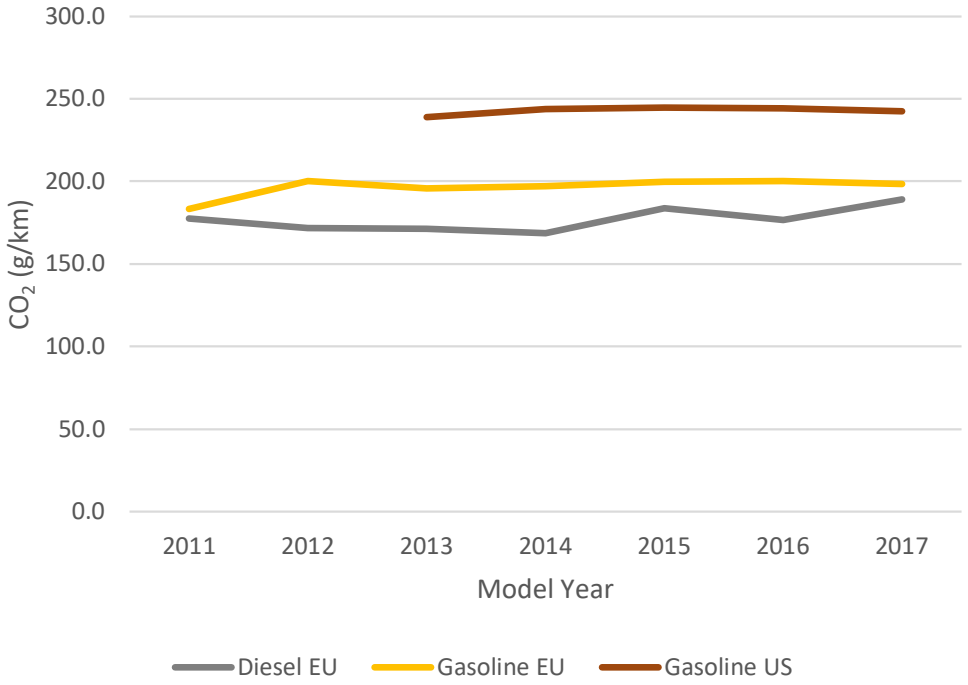
- Now 18% higher CO_2 per km than diesels
- This is can be mitigated by up to 7% by downsizing
- Challenge to control individual buying decisions
- Dirtiest 10% of gasoline emit 129 mg/km of NO_x
- Cleanest 10% of diesels emit 70 mg/km
- Cleanest diesels 46% cleaner than worst gasoline
- Some direct injection gasoline cars create more ultrafine particulates than diesels

➢ Individual model selection dominates technology in outcome

➢ Technology neutrality is essential

What about CO_2?

- Like-for-like CO_2 has not been falling in the EU or US
- Total CO_2 has fallen because of mix effects
- Downsizing, hybridisation and dieselisation
- Reversing over-downsizing can be good
- Reduced diesel share will increase CO_2, unless the shift is to hybrids



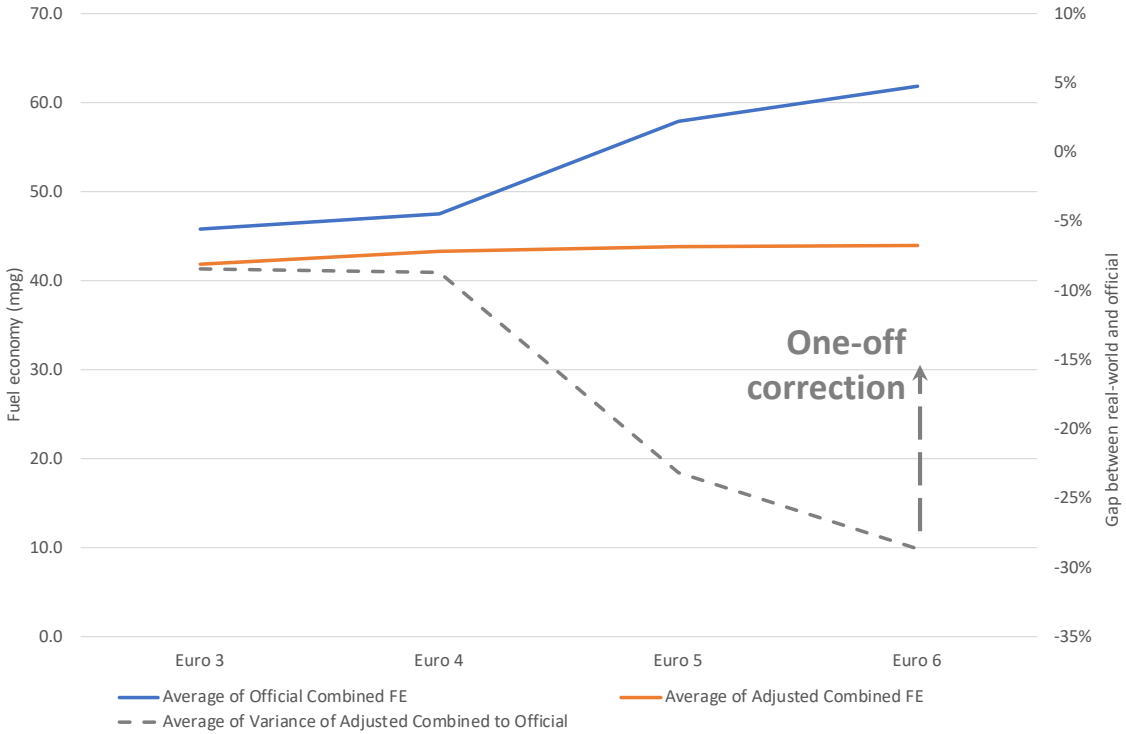
Effects of confidence loss

- Residual values of diesels are falling
- Sales of used diesel cars are increasing
- Sales of gasoline vehicles are increasing
- Governments are making policy more technology-specific
- To neutralise the in-built preference of diesels in EU regulations
- OEMs are subsidised to develop EVs, despite having no rapid air quality benefit
- Cities planning to ban diesels in different ways
- National governments trying to standardise bans
- Vehicle owners suffering capital losses and inconvenience
- Industrial and employment effects to follow

FUTURE

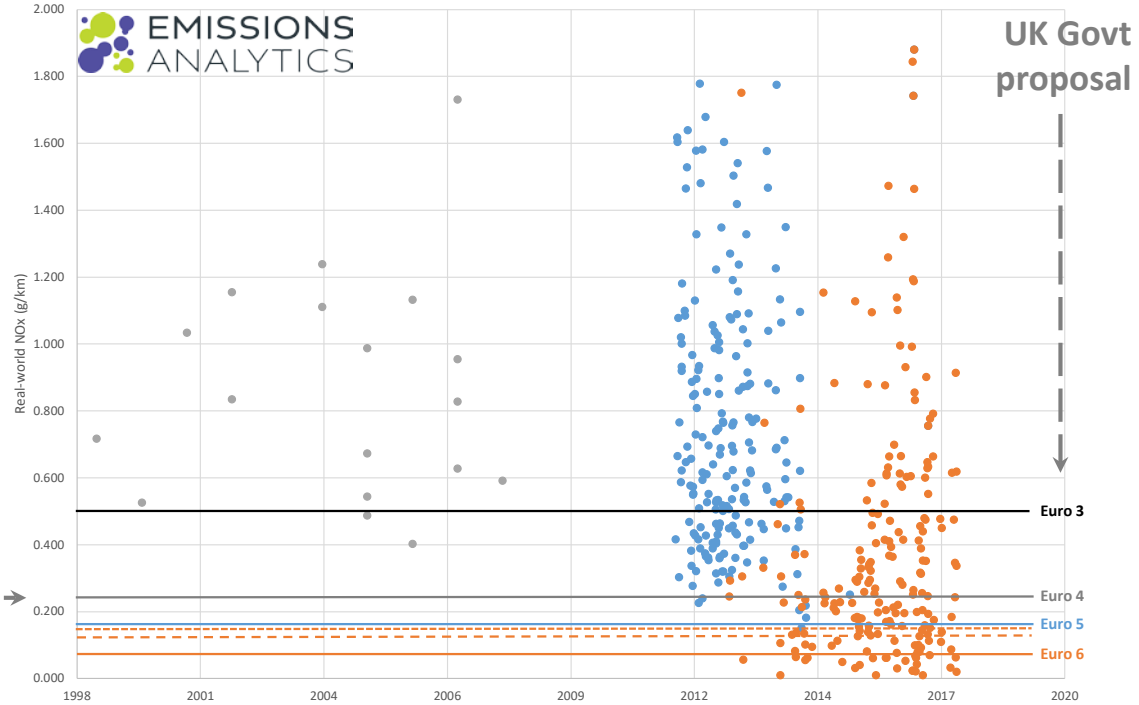
WTLP is challenged

- WLTP is likely to increase cynicism and consumer distrust
- One-off correction will still leave ~15% average gap in real-world
- Effect of WLTC may undermine good work of RDE in rebuilding regulatory credibility
- Will negatively rebound on manufacturers



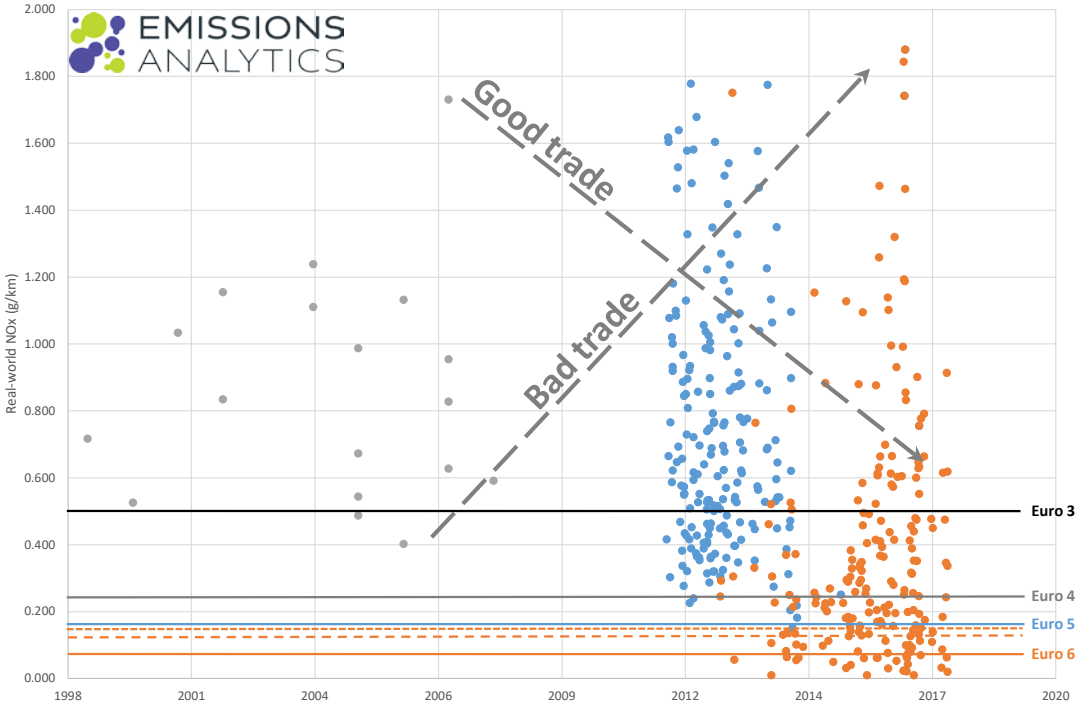
Policy proposal

- Restrict diesels with EQUA Aq ‘E’ rating or worse
- Real-world NO_x needs to be less than 250 mg/km (Euro 4 limit)
- Affects ~90 of Euro 5 diesels, ~50% Euro 6
- 87% reduction in total emissions
- Quick and fair

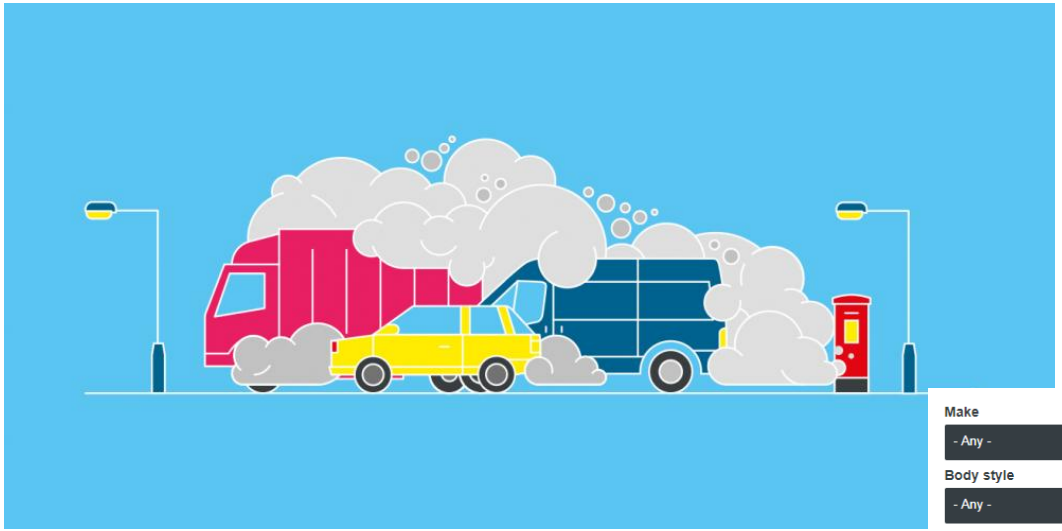


Retrofits and scrappage

- Is efficient only to fix dirty cars, in such a way that makes them clean
- Worst vehicles are hardest to software retrofit, as have no SCR
- Typical 20% benefit from software retrofit – not enough
- Scrappage can only work if trades are beneficial



Mayor of London



- Cleaner Vehicle Checker
- Launched October 2017
- Complement to T-Charge and proposed ULEZ
- New A+ rating if 60 mg/km met

Make - Any - | Model - Any - | Model year - Any - | Fuel - Any - | Transmission - Any -

Body style - Any - | Engine size - Any - | Reset

Click on any row in the table below to get more information about a vehicle.

Make	Model	Model year	Fuel	Transmission	Body style	Engine size	Power	NO_x rating	Official CO_2 emissions
Alfa Romeo	4C	2017	Petrol	Automatic	Coupe	1.7L	240BHP	A+	157 g/km
Alfa Romeo	4C	2017	Petrol	Automatic	Convertible	1.7L	240BHP	A+	161 g/km
Alfa Romeo	4C	2016	Petrol	Automatic	Coupe	1.7L	240BHP	A+	157 g/km

The hybrid solution

Rating	Volkswagen Passat 1.6 litre diesel, Euro 6	Hyundai Ioniq 1.6 litre petrol full hybrid, Euro 6	Tesla 3
EQUA Mpg	52.6	58.1	123 (UK MPGe)
EQUA CO_2	B	A	A++ at tailpipe
EQUA CO	A++	A+	A++
EQUA Aq (NO_x)	A+	A+	A++
Retail price	From £23k	From £20k	£35k?? minus subsidy

Optimal response?

- Diesel could endure for ~10 years to buy time, so long as you discriminate
- Progressive transition to variants of hybrids over 10-20 years
- Pending deeper electrification 20+ years for CO_2 reduction (not necessarily BEVs)
- Gives time for market to adjust
- Minimises economic and social distributive effects
- Cost falls more on those manufacturers who produced dirtier cars, rather than owners!

- Anti-diesel narrative and battery evangelism obscuring the right policy response
- allowAIR.org

Allow Independent Road-testing

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