

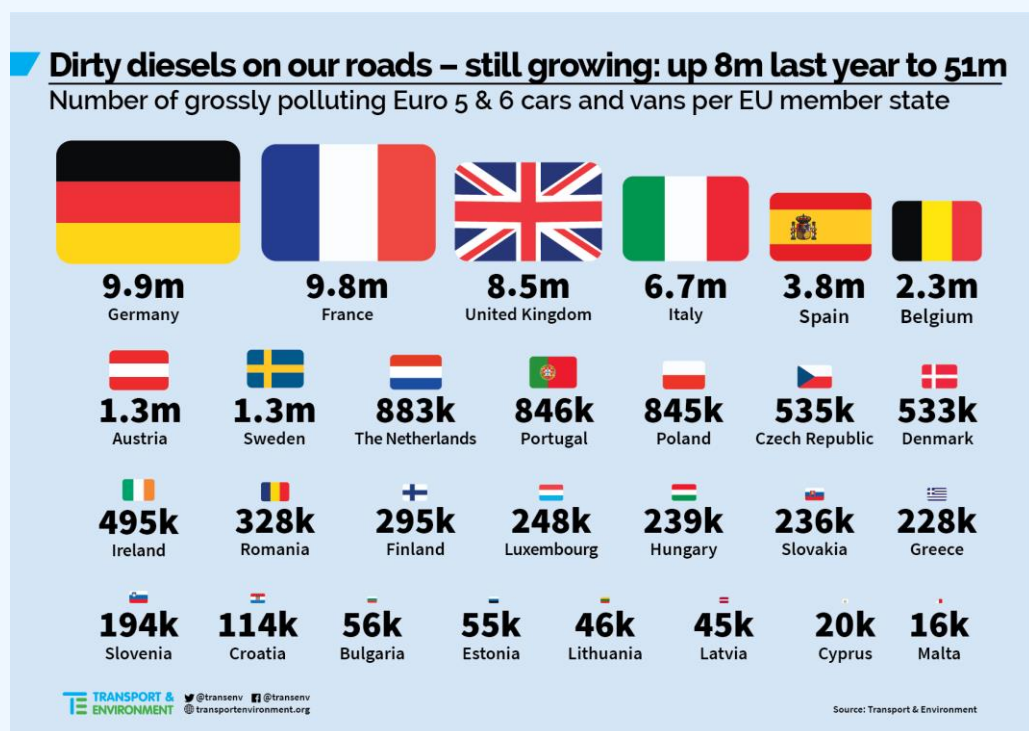
# Dirty diesels grow to 51 million across EU, as carmakers still put profit before clean air

Four years after Dieselgate broke out manufacturers still refuse to get clean

September 2019

## Summary

Four years after the Dieselgate scandal began, the number of grossly polluting diesel cars and vans<sup>1</sup> on Europe's roads still continues to grow and now totals up to 51 million. T&E's analysis of new real-world emissions data and official recalls shows an increase of 18% over the past 12 months and a stark 74% rise since 2016. The increase is in part due to new sales over the past year, and in part to new evidence on real-world emissions of more diesel models. Almost one fifth of these polluting cars and vans circulates in Germany (9.9 million), followed by France (9.8 million) and the UK (8.5 million). When numbers for Italy, Spain and Belgium are added, these 6 countries represent 81% of the whole EU dirty diesel fleet. The updated analysis also finds that the Volkswagen Group is responsible for more than a fifth of all grossly polluting diesel cars and vans in the EU (11.6 million). French carmakers Renault-Nissan (8.1 million) and PSA Group (7.2 million, without Opel and Vauxhall) also account for a major share of the dirty vehicles. Even if today's questionable software recalls are incorporated, the numbers of dirty diesels would only drop slightly by 16% to 42.5 million, provided these are carried out in full and to the uniform quality required across all Member States.



<sup>1</sup> Defined as Euro 5 and 6 diesel vehicles with NOx emissions at least twice above the limit (for NEDC tests) or at least three times above the limit (for real-world data)

These stark numbers show that the Dieselgate scandal is far from over, as not only the legacy remains largely untackled but more dirty cars continue to be sold by the industry and allowed by the national regulators. This is unacceptable given that the solutions have been available for years. Recalls could long have been coordinated across the whole EU to require effective fixes like in the US, while national vehicle authorities could have easily stopped dirty models from being registered by e.g. refusing end-of-series exemptions. Moreover, recent developments mean that there are no more excuses not to get clean: hardware retrofits for 60 diesel models have been approved over the past months in Germany and have been shown to reduce NOx emissions by 60-95%. Moreover, new electric models - which offer clean alternatives - get better and more affordable, and are expected to more than triple within the next three years (from 60 to 214 models) as T&E's recent research showed. Finally, a broader makeover of mobility patterns is underway, combining walking, cycling and public transport with new forms of new mobility and shared services, which will reduce the very need to own a car in the future.

## 1. Introduction: Dieselgate is still dragging on in Europe

Today, it's been exactly four years since the systematic cheating of the world's biggest carmaker Volkswagen (VW) was first revealed in the United States. What started with a few models of one company soon turned into one of the largest industry scandals in history. Numerous carmakers were found to manipulate diesel cars and vans in order to pass official air pollution tests but disabled or turned down exhaust after-treatment systems in real-world driving on the road.<sup>2</sup> This cheating resulted in additional pollution posing a serious threat to human health and the environment,<sup>3</sup> inflicted substantial financial damage to millions of consumers<sup>4</sup> and undermined trust in the car industry.

Regulators in the United States took resolute action to address the wrongdoings by Volkswagen. The company was forced to fix or buy back the cars whose emissions after-treatment systems only worked properly under laboratory test conditions. The company also had to pay fines, penalties and civil damages which total more than 25 billion euros.<sup>5</sup> In Europe, in contrast, regulators have barely held the car industry accountable although the continent is by far the world's largest market for light-duty diesel vehicles.<sup>6</sup> Fines imposed on carmakers have been small compared to the USA<sup>7</sup> and whereas many American consumers were compensated (between \$5,100 and \$10,000 in addition to the estimated value of the vehicle<sup>8</sup>), no large-scale settlement has been offered to drivers in Europe. Numerous court cases are still pending. At the same time, the recall of polluting diesel cars and vans is far from complete and has even stalled, as T&E's recent analysis showed.<sup>9</sup> At the current pace, it would take another two years to finish all ongoing recalls, which in turn cover only about one fifth of all grossly polluting diesel vehicles in Europe.

There is hence no reason to turn the page. On the contrary. Not only do new accusations that were made public last week accuse Volkswagen of also having manipulated Euro 6 diesels<sup>10</sup> but also does our new analysis below show the dangerous legacy of Dieselgate is still growing. The majority of grossly polluting Euro 5 and 6 diesel vehicles remains unfixed on Europe's roads and carmakers have even continued to sell new polluting diesel cars and vans. Moreover, cars that are replaced with newer ones are often exported to

<sup>2</sup> T&E, [Diesel: the true \(dirty\) story](#), September 2017

<sup>3</sup> Anenberg et al., [Impacts and mitigation of excess diesel-related NOx emissions in 11 major vehicle markets](#), Nature International Journal of Science, Volume 545, Pages 467-471, May 2017

<sup>4</sup> European Court of Auditors, [The EU's response to the "dieselgate" scandal](#), February 2019

<sup>5</sup> National Consumers League, [America's consumers left out of latest Dieselgate compensation](#), December 2018

<sup>6</sup> T&E, [Diesel: the true \(dirty\) story](#), September 2017

<sup>7</sup> Reuters, [Volkswagen fined one billion euros by German prosecutors over emissions cheating](#), June 2018

<sup>8</sup> Reuters, [U.S. appeals court upholds Volkswagen's \\$10 billion diesel settlement](#), July 2018

<sup>9</sup> T&E, [Diesel recalls have stalled in the middle of an EU air quality crisis](#), May 2019

<sup>10</sup> SWR, [Neue Manipulationsvorwürfe gegen VW - Konzern dementiert](#), September 2019

other parts of Europe - namely Central and Eastern Europe as T&E showed last year<sup>11</sup> - or to other continents like namely Africa. This means these cars will continue to pollute for many years to come. Four years after the scandal broke, a comprehensive solution for the legacy of Dieselgate is more than overdue.

## 2. Carmakers continue to sell dirty diesels in Europe

Since the first anniversary of the Dieselgate scandal in 2016, T&E has been estimating the number of grossly polluting Euro 5 and 6 diesel cars and vans on Europe's roads that were approved based on the former NEDC laboratory procedure. We have now updated the estimation, building on the figures presented in earlier reports,<sup>12</sup> with the addition of the EEA's 2018 provisional database<sup>13</sup> and an updated version of T&E's database that compiles NOx results from a wide range of sources.<sup>14</sup> In order for diesel models to be considered as dirty, their NOx emissions on independent tests have to be at least 2 times above the Euro standard limit for laboratory or on-road NEDC tests or, alternatively, at least 3 times above the Euro standard limit when measured in on-road Real Driving Emissions (RDE) tests or remote sensing campaigns. Models that are officially being recalled after being registered are automatically counted in the estimation as well.<sup>15</sup> These recalls have so far only required carmakers to carry out software updates which have been shown to be of limited effectiveness, at best.<sup>16</sup>

The methodology used to build these numbers can be found in the Annex.

Compared to last year's Dieselgate anniversary report,<sup>17</sup> the current T&E analysis has been enriched by new results from the market surveillance programme by the UK government;<sup>18</sup> and emissions testing programmes by the European Commission's Joint Research Centre<sup>19</sup> and from the research institution TNO that lately measured Euro 6 diesel vans for the Dutch government.<sup>20</sup> This briefing paper also includes updates from the CONOX remote sensing database analysed by the TRUE Initiative with the addition of results from the London measurement campaign<sup>21</sup> but also the latest results from Emissions Analytics' EQUA AQ and LCV indexes.<sup>22</sup>

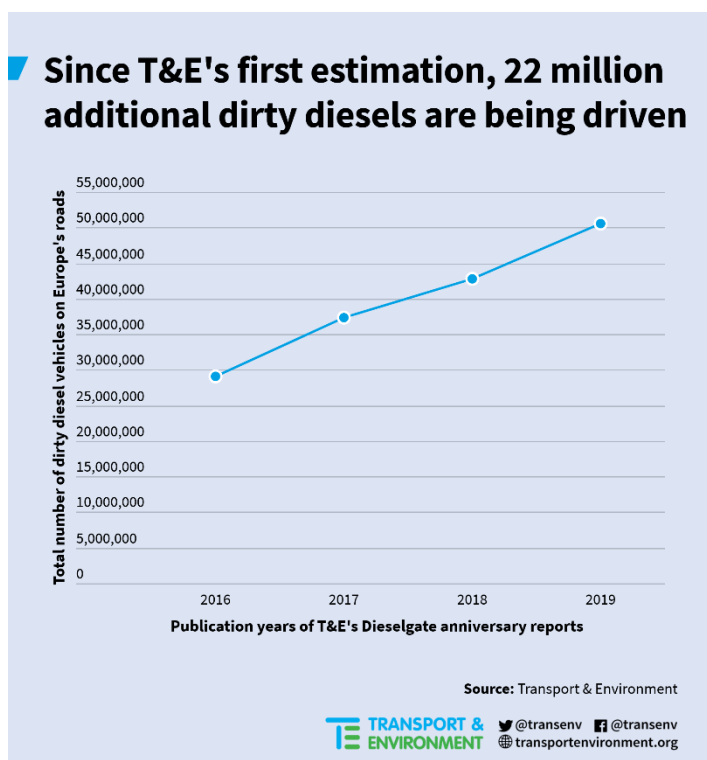


Figure 1

<sup>11</sup> T&E, [Western Europe brushes its dirty diesel cars under the Polish carpet](#), October 2018

<sup>12</sup> T&E, [Dieselgate, three years on: 43 million dirty diesels on our roads – and still growing](#), September 2018

<sup>13</sup> EEA, [Monitoring of CO<sub>2</sub> emissions from passenger cars – Regulation \(EC\) No 443/2009](#), June 2019

<sup>14</sup> See more information about the sources below or in the Annex

<sup>15</sup> European Commission, DG GROW, [Progress overview on recall actions related to NOx emissions](#), State of play of the recall actions related to NOx emissions - Revision 12, August 2019

<sup>16</sup> German Federal Environment Agency, [Reale Stickoxid-Emissionen von Diesel-Pkw nach wie vor zu hoch](#), 2019

<sup>17</sup> T&E, [Cars with engines: can they ever be clean?](#), September 2018

<sup>18</sup> UK's Driver and Vehicle Standards Agency, [Vehicle Market Surveillance Unit programme results, 2018](#), July 2019

<sup>19</sup> JRC, [Joint Research Centre 2017 light-duty vehicles emissions testing](#), 2018

<sup>20</sup> TNO, [NOx emissions of eighteen diesel Light Commercial Vehicles: Results of the Dutch Light-Duty road vehicle emission testing programme 2017](#), TNO 2017 R11473, December 2017

<sup>21</sup> TRUE Initiative, [Remote sensing of motor vehicle emissions in London](#), December 2018

<sup>22</sup> Emissions Analytics, [EQUA Index](#), Retrieved on September 4<sup>th</sup> 2019

## A growing number of dirty diesels on Europe's roads

Member State		Rounded number of dirty diesels
EU-28		50,560,000
Germany		9,897,000
France		9,809,000
United Kingdom		8,519,000
Italy		6,673,000
Spain		3,846,000
Belgium		2,264,000
Austria		1,317,000
Sweden		1,253,000
Netherlands		883,000
Portugal		846,000
Poland		845,000
Czech Republic		535,000
Denmark		533,000
Ireland		495,000
Romania		328,000
Finland		295,000
Luxembourg		248,000
Hungary		239,000
Slovakia		236,000
Greece		228,000
Slovenia		194,000
Croatia		114,000
Bulgaria		56,000
Estonia		55,000
Lithuania		46,000
Latvia		45,000
Cyprus		20,000
Malta		16,000

**Note:** This estimation includes Euro 5 and Euro 6 dirty diesel cars and vans. Cars are counted from 2008 to 2018, while the counting for vans start from 2012 and ends in 2018.

**Source:** Transport & Environment

**TRANSPORT & ENVIRONMENT** @transenv @transenv [transportenvironment.org](http://transportenvironment.org)

Figure 2

The results of the analysis show:

- As of September 2019, the total number of grossly polluting Euro 5 and Euro 6 diesel cars and vans on EU roads has grown to 51 million. Based on the European Commission's information,<sup>23</sup> if all recalls that have been ordered to date were carried out in full (100% cars) and to the quality required - which so far is often not confirmed by evidence - the total number would only drop to 40 million. Instead, only 78% of the required recalls (i.e. 8 million) have actually been carried out, putting the total to 42.5 million. Crucially, these recalls are mere software updates, whose effectiveness has so far been limited at best and proven futile in certain independent post-recall tests.<sup>24</sup>
- Since our first Dieselgate anniversary report, the ranking of Member States only slightly changed, with Germany overtaking France as Europe's champion of the number of dirty diesel vehicles with about 9.9 million Euro 5 and 6 cars and vans or one fifth of the EU's total number. France is now the second Member State, closely following with about 9.8 million and the UK with about 8.5 million. When numbers for Italy, Spain and Belgium are added, these 6 countries represent 81% of the whole EU dirty diesel fleet.
- Since last year's estimation, the EU number has increased by 18% with 8 million additional vehicles. Half of this increase is due to the addition of new NEDC-approved vehicles that were sold in 2018, while the other half is the result of new evidence on real-world emissions that leads to the addition of more diesel engine families classified as grossly polluting (e.g. the Euro 6 version of FCA's 1.2-litre diesel engine). Compared to our first estimate in 2016, the increase amounts to 22 million (+74%).
- Based on Element Energy's vehicle stock model,<sup>25</sup> not all cars remain strictly on the road as some leave the stock early for instance due to accidents, faults or because of high mileage usage (e.g. taxis). If the effect of such "scrapped vehicles" is taken into account, the actual number of dirty diesel cars and vans strictly found on EU roads would drop from 51 million to almost 48 million at EU level.

<sup>23</sup> From the European Commission's list of recalls, only the ones with an EU-wide number of vehicles available are taken into account for this analysis

<sup>24</sup> German Federal Environment Agency, [Reale Stickoxid-Emissionen von Diesel-Pkw nach wie vor zu hoch](#), 2019

<sup>25</sup> Element Energy, [Batteries on wheels: the role of battery electric cars in the EU power system and beyond](#), Annex, June 2019

The finding is clear: the data show that rather than getting better the situation on Europe's roads still keeps deteriorating.

## Carmakers refuse to clean up their act - and Member States tolerate it

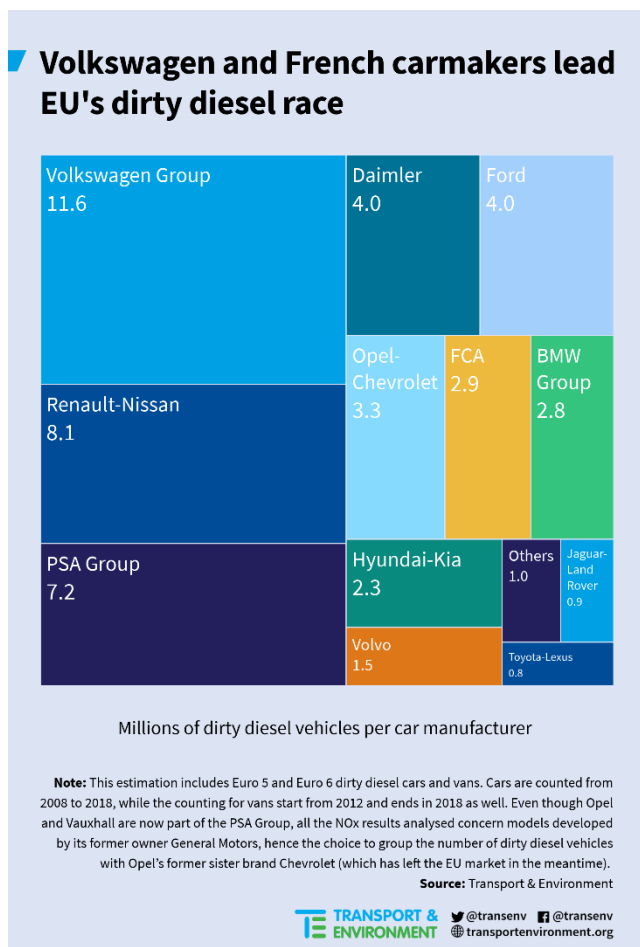


Figure 3

The updated analysis shows the Volkswagen group is responsible for more than a fifth of all grossly polluting diesel cars and vans on Europe's roads, followed by French carmakers Renault-Nissan and PSA Group (without Opel and Vauxhall<sup>27</sup>).

### 3. Solutions are overdue and available

There are no excuses for this continued increase in the number of grossly polluting diesels on Europe's roads. Solutions have been available for years and additional ones have been added recently. Solutions that have existed for years were not only presented at the European Diesel Summit that T&E co-hosted in November 2018<sup>28</sup> but also in the EU's first official 'roadmap towards clean vehicles' (from March 2019).<sup>29</sup> The measures proposed in the roadmap namely include carrying out vehicle recalls across the whole EU, which requires national authorities to coherently implement recalls issued by their peers. These measures should be coordinated by the European Commission until it will be given its new powers to issue EU wide recalls as

<sup>26</sup> European Commission, [Directive 2007/46/EC](#), Article 27

<sup>27</sup> Even though Opel and Vauxhall are now part of the PSA Group, all the NOx results analysed concern models developed by its former owner General Motors, hence the choice to group the number of dirty diesel vehicles with Opel's former sister brand Chevrolet (which has left the EU market in the meantime).

<sup>28</sup> T&E, [The European Diesel Summit - Fast routes to clean air](#), September 2018

<sup>29</sup> European Commission, [Roadmap towards clean vehicles](#), March 2019

of September 2020.<sup>30</sup> The roadmap also calls for requiring proof of fixes during the periodical technical inspections (PTI), the registration of a vehicle (for 2<sup>nd</sup> hand vehicles) or the renewal of insurance or registration. Moreover, the EU roadmap underlines the need to compensate consumers, calling for progress in agreeing on a “New Deal for Consumers” proposed by the European Commission.<sup>31</sup>


In addition to these solutions that have been available for years, new ones have been added recently, ranging from hardware fixes to a surging choice of electric vehicles and alternative forms of clean mobility, see below.

## Apply new hardware retrofits wherever sensible - not only in Germany

Until recently most carmakers and regulators refused to consider hardware fixes that are more expensive but also much more effective than updates of the software used in cars.<sup>32</sup> The effectiveness and feasibility of hardware fixes has already been demonstrated by the measures Volkswagen agreed to apply in the United States<sup>33</sup> as well as by independent testing carried out by national authorities in the EU<sup>34</sup> as well as T&E’s German member organisation *Deutsche Umwelthilfe*.<sup>35</sup> Fitting an SCR catalyst has been found to reduce emissions by 60-95% on the vehicles tested and currently costs around 3,000 euros for the retrofits that have already been approved.<sup>36</sup> As many of the grossly polluting diesel cars and vans are only a few years old and will stay on roads in Europe and elsewhere for many more years it makes environmental and economic sense to fix, and not scrap, many of these cars.

Car manufacturer	Models	Supplier of the retrofit	Cost of the hardware retrofit
Audi	A1, A3, A4 with EA189 engine	Baumot Group <sup>a</sup>	Around €3,333
BMW (approval procedure ongoing)	318d/320d/325d, 518/520/525d, X3 2.0d with N47D20 engine	Dr. Pley <sup>b</sup>	Around €3,100 <sup>c</sup>
Mercedes-Benz	C220 CDI, C250 CDI, E220 CDI, E250 CDI, GLK220 CDI with OM651 engine	Dr. Pley	Around €3,100
Škoda	Fabia, Roomster, Rapid, Octavia, Superb, Yeti with EA189 engine; Octavia with EA288 engine	Baumot Group	Around €3,333
Seat	Ibiza, Leon, Toledo, Altea XL, Exeo with EA189 engine; Leon with EA288 engine	Baumot Group	Around €3,333
Volkswagen	Polo, Caddy, Golf, Touran, Jetta, Beetle, Passat, Sharan, Tiguan, T5 with EA189 engine; Golf and Amarok with EA288 engine	Baumot Group	Around €3,333
Volvo	S60, V60, S80, V70, XC60, XC70 (D3/D4/D5)	Dr. Pley	Around €3,100

Source: Transport & Environment


 TRANSPORT & ENVIRONMENT
 
[@transenv](https://twitter.com/transenv)

[@transenv](https://www.facebook.com/transenv)

[transportenvironment.org](https://www.transportenvironment.org)

**Table 1 - Overview of models for which retrofits for SCR catalysts (that reduce NOx emissions) have been type-approved<sup>37</sup>**  
<sup>a</sup>Aktion “Hardwarenachrüstung” - <sup>b</sup>Dr. Pley, [Produkte](#) - <sup>c</sup>Dr. Pley, [Shop](#)

<sup>30</sup> European Commission, [FAQ – Type approval of vehicles](#)

<sup>31</sup> European Commission, [Review of EU consumer law - New Deal for Consumers](#)

<sup>32</sup> DUH, [NOx- und CO2-Messungen im realen Fahrbetrieb, Wirksamkeit von Software-Updates und Hardware-Nachrüstungen](#), August 2018

<sup>33</sup> Unearthed, [VW’s dieselgate fix for US cars is ‘far more effective’ than its European one](#), March 2018

<sup>34</sup> German Federal Environment Agency, [Reale Stickoxid-Emissionen von Diesel-Pkw nach wie vor zu hoch](#), 2019

<sup>35</sup> DUH, [NOx- und CO2-Messungen im realen Fahrbetrieb, Wirksamkeit von Software-Updates und Hardware-Nachrüstungen](#), August 2018

<sup>36</sup> German Federal Environment Agency, [Reale Stickoxid-Emissionen von Diesel-Pkw nach wie vor zu hoch](#), 2019

<sup>37</sup> KBA, [Nachrüstung von NOx-Minderungssystemen mit hoher Minderungsleistung](#)

The situation has evolved recently as the German government gave up its opposition to hardware measures and carmakers decided to offer technical and financial support for hardware retrofits under certain conditions. As a result, the German type-approval authority (*Kraftfahrtbundesamt, KBA*) approved a series of hardware retrofits over the summer of 2019 and further approval processes are ongoing.<sup>38</sup> **Table 1** provides an overview of currently 60 models for which retrofits of SCR catalysts have been type-approved. These retrofits must be used, but their quality and the uniform implementation of retrofit programmes must be transparent and controlled by the authorities.

In Germany, some carmakers have accepted to contribute to the costs of these hardware retrofits under certain conditions. **Table 2** summarises which financial support that carmakers currently offer to drivers and the conditions that apply. It shows that so far only drivers from Germany are eligible provided that they live or work in or close to cities with high levels of air pollution and (potential) diesel bans. The German Federal Government has defined a list of these cities.<sup>39</sup>

Car manufacturer	Offer	Conditions	Eligible drivers
Daimler	Up to €3,000 to contribute to the costs of a hardware fix <sup>d</sup>	Hardware retrofit for Euro 5 engine approved by German regulator Retrofit will allow driver to enter cities/streets defined by the German government as “cities with intense levels of pollution” and where diesel bans are considered Vehicle was registered on the name of the applicant before 2 October 2018	Consumers who own a Mercedes-Benz or Smart Euro 5 diesel car (M1) or van (N1) And have their primary residence in one of the “cities with intense levels of pollution” as defined by the German Federal Government, Special rules apply to persons with a handicap and commuters <sup>e</sup>
Volkswagen (similar offers for the other brands of the Volkswagen Group)	Up to €3,000 to contribute to the costs of a hardware fix <sup>f</sup>	Hardware retrofit for Euro 5 engine approved by German regulator Retrofit will allow driver to enter cities defined by the German government as “cities with intense levels of pollution” Vehicle was registered on the name of the applicant before 2 October 2018	Consumers and corporate clients who own a Euro 5 diesel car (M1) or van (N1) of the brand and whose place of residence is in one of the cities with “intense pollution” Or in a neighbouring regional district and studying, working or having close family ties in the cities defined as “cities with intense levels of pollution” Persons with a handicap living within a range of 100 km of these cities

Source: Transport & Environment

TRANSPORT & ENVIRONMENT @transenv @transenv @transportenvironment.org

**Table 2 – Financial support from carmakers for SCR retrofits**

<sup>d</sup>Daimler, [Daimler Zuschuss für Hardware-Nachrüstungen: Fragen & Antworten](#), July 2019

<sup>e</sup>Daimler, [Zuschuss der Daimler AG für Hardware Nachrüstungen](#)

<sup>f</sup>Volkswagen AG, [Informationen zu Hardware-Nachrüstungen zur NOx-Reduzierung für Diesel-Fahrzeuge](#)

This situation is unacceptable given that the same cars are sold and used all across the EU Single Market and that 15 EU Member States have been taken to court by the European Commission for failing to respect legal limits for air pollution. In response to this air pollution crisis, more than 250 cities across Europe have already introduced Low-Emission Zones.<sup>40</sup> It is important to make drivers eligible for hardware retrofits beyond a handful of German cities. And the new EU guidelines for Sustainable Urban Mobility Plans (SUMP) officially encourage the use of such policies.<sup>41</sup>

Currently, the European Commission has no power to order recalls and retrofits across the EU and has to rely on national action. In response to the Dieselgate scandal, improved rules for approval and market surveillance for type-approval under the new regulation n°2018/858 were however adopted.<sup>42</sup> But they will only enter into force in September 2020 and almost exclusively concern new types approved after this date. The European Commission will then have the power to check vehicles on the road and issue EU-wide recalls.

<sup>38</sup> KBA, [Nachrüstung von NOx-Minderungssystemen mit hoher Minderungsleistung](#)

<sup>39</sup> German Federal Ministry of Transport (BMVI), [32 Antworten auf die wichtigsten Fragen zur Diesel-Einigung](#)

<sup>40</sup> T&E, [City bans are spreading in Europe](#), October 2018

<sup>41</sup> European Platform on Sustainable Urban Mobility Plans, UVAR and SUMPs - Regulating vehicle access to cities as part of integrated mobility policies, draft of July 2019

<sup>42</sup> Official Journal of the European Union, Regulation n°2018/858, May 2018

If used appropriately, this will bring significant improvements and may help prevent similar scandals in the future. In the meantime, governments should force carmakers to contribute to tackling the legacy of Dieselgate cars not only in Germany but all across the EU.

## Leap to zero-emission vehicles as electric car models to triple in Europe

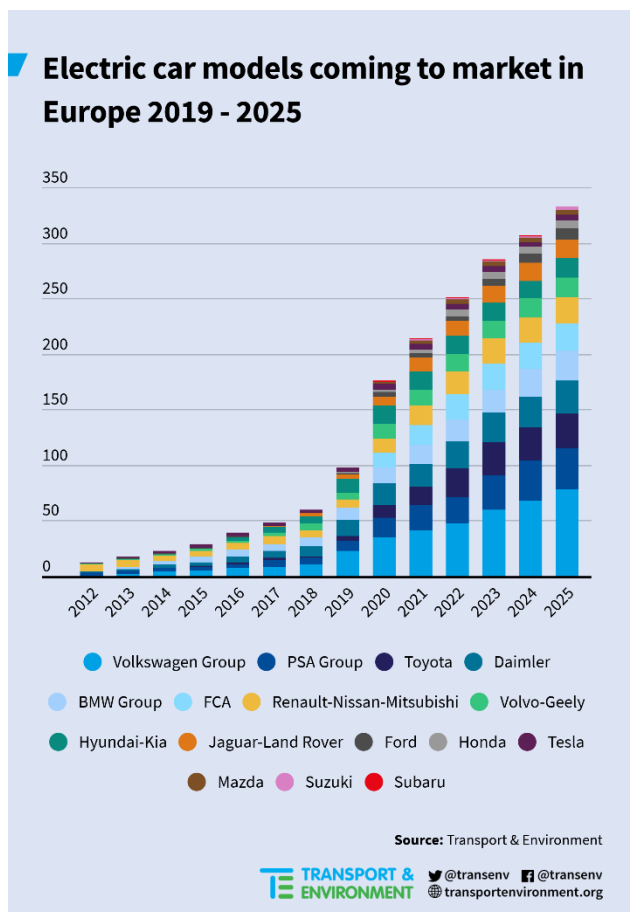


Figure 4

high-mileage market segments such as corporate fleets and taxis to displace the maximum of fossil-driven kilometres. On the other hand, incentives for a switch to zero-emission vehicles must be socially equitable and promote affordable EVs to help consumers with lower purchase power. Incentives should not pay for luxury but for necessity, e.g. by price caps (that could depend on range).<sup>44</sup>

## Replace car use with zero-emission mobility more broadly

But even replacing diesel cars with zero-emission vehicles will not be enough. Tackling the dangerous legacy of Dieselgate goes beyond cars. If cities are to become healthy, sustainable and liveable places, a more profound change of mobility patterns will be needed. T&E's modelling shows that new technologies - namely electrification and autonomous vehicles - will only deliver the desired benefits if rides are shared and integrated into a new approach to urban planning.<sup>45</sup> Otherwise, new technologies would just lead to an increase in kilometres driven and emissions.

This namely means boosting walking, cycling, new forms of micro-mobility and shared and electric public transport. A scheme agreed in Germany shows what is possible: several German carmakers have agreed to contribute up to 250 million euros to a special federal fund designed to help cities deal with air pollution.<sup>46</sup>

<sup>43</sup> T&E, [Electric surge: Carmakers' electric car plans across Europe 2019-2025](#), July 2019

<sup>44</sup> For details, see the recommendations in T&E's recent report on [the surge of electric vehicles in the EU](#)

<sup>45</sup> Upcoming research

<sup>46</sup> Federal Cabinet of Germany (Bundesregierung), [Mehr Geld für saubere Luft in Städten](#), September 2017



The fund can not only be used to retrofit vehicles owned by local authorities but also to develop public transport projects, reduce ticket fares or improve urban planning.

There is no reason why such funding could not be put in place in other countries or even agreed at EU level because the same polluting cars have been sold across the European Single Market. More and more European cities understand the need for a broader change in mobility policies and T&E's recent analysis showed that five EU capitals (London, Paris, Madrid, Amsterdam and Brussels) have already set course towards zero-emission mobility in their centres.<sup>47</sup> This is a future-proof way of tackling the legacy of Dieselgate and should serve as an example to other European cities.

## 4. Conclusions

Four years after the Dieselgate scandal was first uncovered it is clearly too early to turn the page. The legacy of systematic cheating by large parts of the car industry has still not been properly addressed and the number of grossly polluting diesel cars and vans on Europe's roads has increased further. Carmakers have decided to continue to maximise profits and regulators have not held them accountable, thereby siding against environmental and consumer interests. A whole range of solutions are available and if the car industry wants to repair its damaged reputation and truly turn the page, it must first sort out the legacy of Dieselgate.

## Further information

Jens Müller  
Air Quality Manager  
Transport & Environment  
[jens.mueller@transportenvironment.org](mailto:jens.mueller@transportenvironment.org)  
Tel. +32 (0)488 367 353

Florent Grelier  
Clean Vehicles Engineer  
Transport & Environment  
[florent.grelier@transportenvironment.org](mailto:florent.grelier@transportenvironment.org)  
Tel: +32(0)488 829 411

---

<sup>47</sup> T&E, [Low-Emission Zones are a success – but they must now move to zero-emission mobility](#), September 2019

## Annex: Methodology to estimate the number of dirty diesel vehicles registered in Europe

The modelling T&E's has been developing and updating for the last years is detailed in this annex and summarised with the **Figure 5** below. This methodology allows to estimate the total number of dirty Euro 5 and Euro 6 diesel cars and vans being driven in the EU and is divided into 3 steps:

- How one diesel vehicle is considered as dirty?
- How the NOx results are grouped together?
- How vehicles are counted?

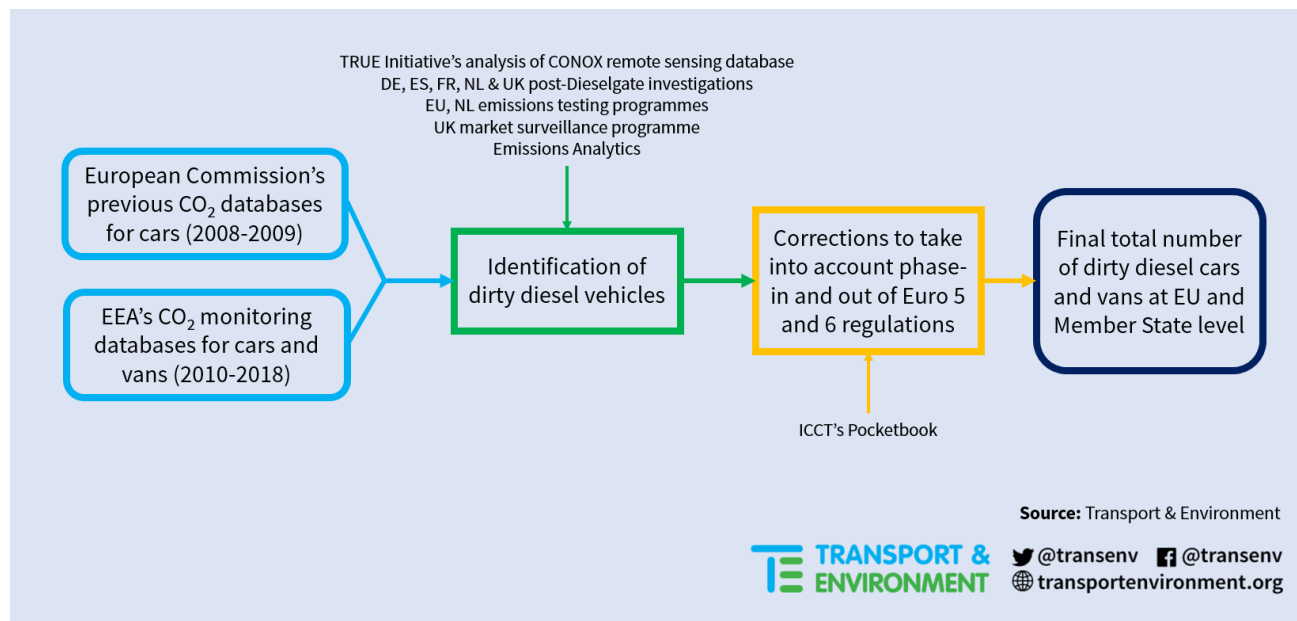


Figure 5

It has to be noted that all the analysis in this briefing paper is based on Euro 5 and Euro 6 diesel vehicles approved based on the NEDC laboratory test procedure. The scope of this paper does not include any of the newest vehicles approved with the new EU laboratory (WLTP) and on-road (RDE) test procedures.

### How one diesel vehicle is considered as dirty?

T&E has been collecting NOx data from various sources:

- the CONOX remote sensing database analysed by the TRUE Initiative<sup>48</sup> (which data was already analysed in further details in T&E's Dieselgate anniversary report published last year<sup>49</sup>) with the addition of results from the London measurement campaign;<sup>50</sup>
- the national investigations that were on-going after the exposure of the Dieselgate scandal, including France, Germany, the Netherlands, Spain and the UK;
- the emission testing programmes by the European Commission's Joint Research Centre<sup>51</sup> and by TNO, a public Dutch research institute, at the request of the Dutch government;<sup>52</sup>

<sup>48</sup> TRUE Initiative, [Determination of real-world emissions from passenger vehicles using remote sensing data](#), June 2018

<sup>49</sup> T&E, [Cars with engines: can they ever be clean?](#), Section 2.2, September 2018

<sup>50</sup> TRUE Initiative, [Remote sensing of motor vehicle emissions in London](#), December 2018

<sup>51</sup> JRC, [Joint Research Centre 2017 light-duty vehicles emissions testing](#), 2018

<sup>52</sup> TNO, NOx emissions of Euro 5 and Euro 6 diesel passenger cars – test results in the lab and on the road, TNO 2016 R10083, March 2016 & [NOx emissions of Euro 5 diesel vans – test results in the lab and on the road](#), TNO 2016 R10356, May 2016 & [NOx emissions of fifteen Euro 6 diesel cars: Results of the Dutch LD road vehicle emission testing programme 2016](#), TNO 2016 R11177, October 2016

- the results of the market surveillance programme by the UK government;<sup>53</sup>
- public data from Emissions Analytics through its EQUA AQ and LCV indexes.<sup>54</sup>

Apart from the remote sensing data, all results from these sources consist of on-road Real Driving Emissions (RDE) tests with an on-board Portable Emissions Measurement System (PEMS), used to measure few pollutant emissions at type-approval, or a Smart Emissions Measurement System (SEMS), an alternative developed by TNO and Horiba.<sup>55</sup> National investigations also results from NEDC tests made on chassis dynamometer in a lab or outside on a road or a test track.

Finally, remote sensing (RS) technology optically measures emissions through the exhaust plume of a passing vehicle from the side or above the road. Compared to a PEMS used for EU RDE tests, RS collects a snapshot of information on the emissions rather than making measurements over a comprehensive range of driving conditions. However, RS allows to collect data from hundreds of thousands of vehicles on the road in a cost-effective manner and within a relatively short timeline.

To be considered as dirty, NO<sub>x</sub> emission results should be at least 2 times above the Euro standard limit for in-lab or on-road NEDC tests and at least 3 times above the Euro standard limit for RDE tests and remote sensing measurements. Apart from Emissions Analytics' data, all NO<sub>x</sub> results are available as numbers. For Emissions Analytics, the public version only includes letters (from A to H) that represent ranges of NO<sub>x</sub> emissions from on-road tests (all ranges are detailed on their website). In the case where the 3-times-above-the-limit threshold is between the minimum and maximum value of a given letter then the next upper letter is taken as the minimum score to consider a diesel vehicle as dirty. For instance, D refers to all NO<sub>x</sub> results between 180 mg/km and 250 mg/km. For Euro 6 diesel cars, the 3-times-above-the-limit threshold should be 240 mg/km (80 mg/mg times 3) so here, these vehicles would be considered as dirty for all NO<sub>x</sub> results from E, i.e. from 250 mg/km of NO<sub>x</sub>.

### How the NO<sub>x</sub> results are grouped together?

Even though T&E's NO<sub>x</sub> database grows every year, this analysis remains an extrapolation as all existing models and variants cannot be measured or tested individually. In order to make this estimation robust and relevant, all diesel NO<sub>x</sub> results are grouped per engine family with the following common characteristics:

- same group of carmaker (e.g. BMW Group);
- same type of vehicle (car or van);
- same European regulation used as a basis for approval (Euro 5 or Euro 6) and;
- same diesel engine (identified with the engine size and origin).

This way to group results together is valid given that engines and after-treatment devices (i.e. hardware) are shared between several models of a carmaker's range, in order to benefit from the economy of scale, an important concept for the automotive industry. This means that once a diesel vehicle is considered as dirty then all vehicles within the same family are considered as dirty as well, except if, for a given model, all NO<sub>x</sub> results are found to be below the thresholds described above. In addition, if a model is concerned by a recall in the European Commission's list<sup>56</sup> then this model is automatically counted as dirty (e.g. the Audi Q7 II fitted with the Euro 6 version of the 3.0-litre diesel engine but this engine was already considered as dirty based on T&E's NO<sub>x</sub> database).

---

& [NO<sub>x</sub> emissions of eighteen diesel Light Commercial Vehicles: Results of the Dutch Light-Duty road vehicle emission testing programme 2017](#), TNO 2017 R11473, December 2017

<sup>53</sup> UK's Driver and Vehicle Standards Agency, [Vehicle Market Surveillance Unit programme results, 2018](#), July 2019

<sup>54</sup> Emissions Analytics, [EQUA Index](#), Retrieved on September 4<sup>th</sup> 2019

<sup>55</sup> TNO, [Measuring real-world emissions with TNO's Smart Emissions Measurement System \(SEMS\)](#)

<sup>56</sup> European Commission, DG GROW, [Progress overview on recall actions related to NO<sub>x</sub> emissions](#), State of play of the recall actions related to NO<sub>x</sub> emissions - Revision 12, August 2019

## How vehicles are counted?

The previous step maps which brands, models and diesel engines to target when counting the total number of vehicles. This is done mainly thanks to the registration data gathered and published by the European Environment Agency (EEA) to monitor the CO<sub>2</sub> emissions from brand new cars and vans, since 2010 and 2012 respectively until 2018 included.<sup>57</sup> However, these databases do not include information about which Euro stage each vehicle corresponds to. This is covered by using the ICCT's Pocketbook<sup>58</sup> which gives the yearly split between Euro 5 and Euro 6 sales for cars and vans, either at EU level or at national level until 2017 included. It is assumed by using this data that these EU-wide and national Euro 5/6 splits are the same regardless of the car manufacturer.

For 2018, it is assumed that all registered cars and vans answer to the Euro 6 regulation. As T&E's NOx database regards vehicles that were approved on the basis of the former EU NEDC laboratory test procedure, all vehicles with a WLTP CO<sub>2</sub> value in the 2017 and 2018 databases are excluded from the counting process.

Besides, in order to take into account early sales of Euro 5 cars, the former database published by European Commission's DG Clima is also used for 2008 and 2009 but only with figures at EU level.<sup>59</sup> Given that this database is not as exhaustive as the EEA's ones that followed, 2008 and 2009 registrations are corrected for each engine family with the 2010 ratio between the number of dirty vehicles over the total registrations. In addition, as for the other years, figures are corrected on top with ICCT's data in order to take into account the fact that a low proportion of these sales were actually Euro 5 compliant these two years.

## Limitations of the methodology

Only registrations of brand new vehicles are counted. It is assumed that the vehicles registered in one Member State stay in the same country (e.g. flows of second-hand diesel vehicles exported from Western to Central and Eastern Europe are not taken into account<sup>60</sup>). The effects on the EU-wide 51 million figure from software recalls happening in the Union or from vehicles being scrapped or unregistered is briefly mentioned in Section 2.

---

<sup>57</sup> EEA, [Monitoring of CO<sub>2</sub> emissions from passenger cars](#) & [Monitoring of CO<sub>2</sub> emissions from vans](#), April-May 2018

<sup>58</sup> ICCT, [European vehicle market statistics 2018/2019](#), December 2018

<sup>59</sup> European Commission, DG CLIMA, [Reducing CO<sub>2</sub> emissions from passenger cars](#), Monitoring of CO<sub>2</sub> emissions - Decision 1753/2000 (repealed), 2009: Excel summary tables

<sup>60</sup> T&E, [Dirty diesels heading East: Polish edition](#), October 2018