

# Accelerating Retrofit Solution Development

Data correct as of 08/11/2018

Hosted: <https://www.lowcvp.org.uk/projects/bus-working-group/a-nox-reduction-through-retrofit-.htm>



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# Purpose

This presentation aims to highlight bus engine models that do not have approved retrofit solutions currently under the CVRAS scheme.

This data highlights engine models that are numerous enough to justify the business case for a retrofit solution to be developed.

The data presented is sourced from the largest operators in England and Wales.

All data has been amalgamated and anonymised.

Data correct as of 08/11/2018 – Data will be updated quarterly based on new approvals

# What Euro VI equivalent solutions for NOx reduction under CVRAS are available today compared with actual fleet data...

## Aim

Analyse English and Scottish bus fleets and identify the availability of approved systems for NOx reduction to Euro VI equivalence under CVRAS and present in anonymised format.

## Operators

England: First Group, National Express, Arriva, Stagecoach, Trent Barton, Nottingham City Transport, Go Ahead

Scotland: First Group, Stagecoach, Lothian, National Express, McGill's, Westcoast Motors

Using JAQU approved **Energy Savings Trust - Clean Vehicle Retrofit Accreditation Scheme (CVRAS)** list of approved retrofit solutions for NOx reduction based on Engine type and Euro Standard.

- E.g. Cummins ISBe 6.7 Euro V (not model and OEM of bus e.g. Enviro 400)

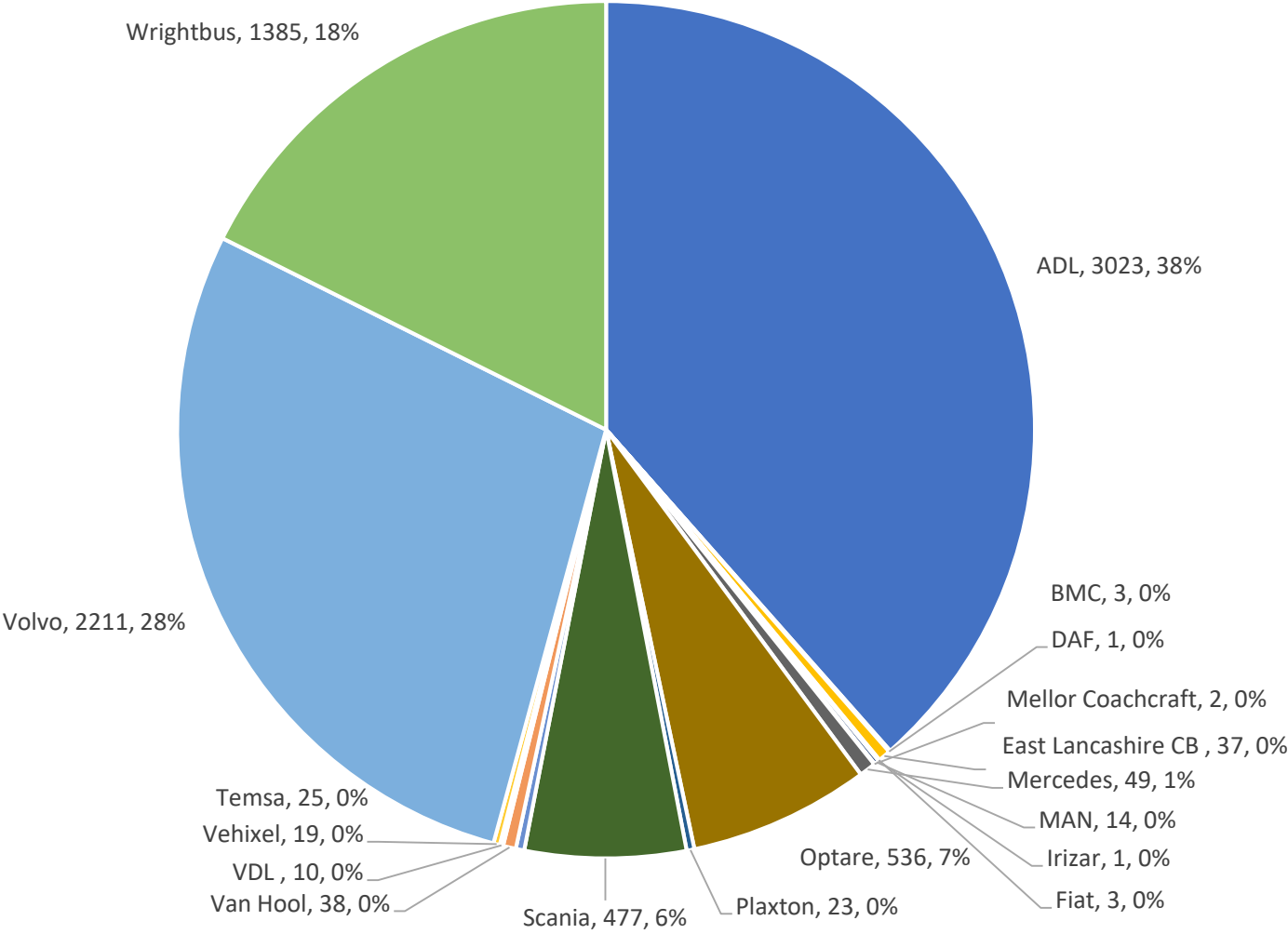
Energy Savings Trust asking for **worst case** in engine class to qualify i.e. most polluting

- Euro III : **Four** different engine model solutions approved
- Euro IV & V: **Nine** different engine model solutions approved

**NB:** Looks at SCR only solutions

(Magtec can convert to EV but exercise has assumed operators will retrofit using SCR aftertreatment systems)

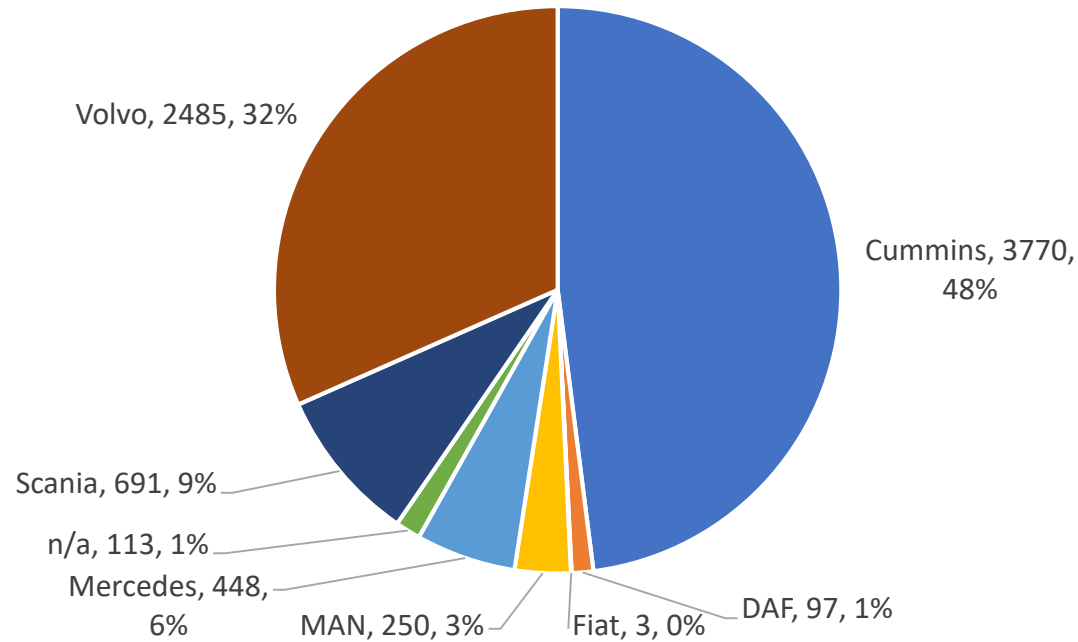
# Combined English and Scottish Fleets by Bus Manufacturer



Manufacturer	Qty Buses
<b>ADL</b>	<b>3023</b>
BMC	3
DAF	1
East Lancashire CB	37
Fiat	3
Irizar	1
MAN	14
Mellor Coachcraft	2
Mercedes	49
<b>Optare</b>	<b>536</b>
Plaxton	23
Scania	477
Temsa	25
Van Hool	38
VDL	10
Vehixel	19
<b>Volvo</b>	<b>2211</b>
<b>Wrightbus</b>	<b>1385</b>
<b>Grand Total</b>	<b>7857</b>

# Fleets by Engine Manufacturer

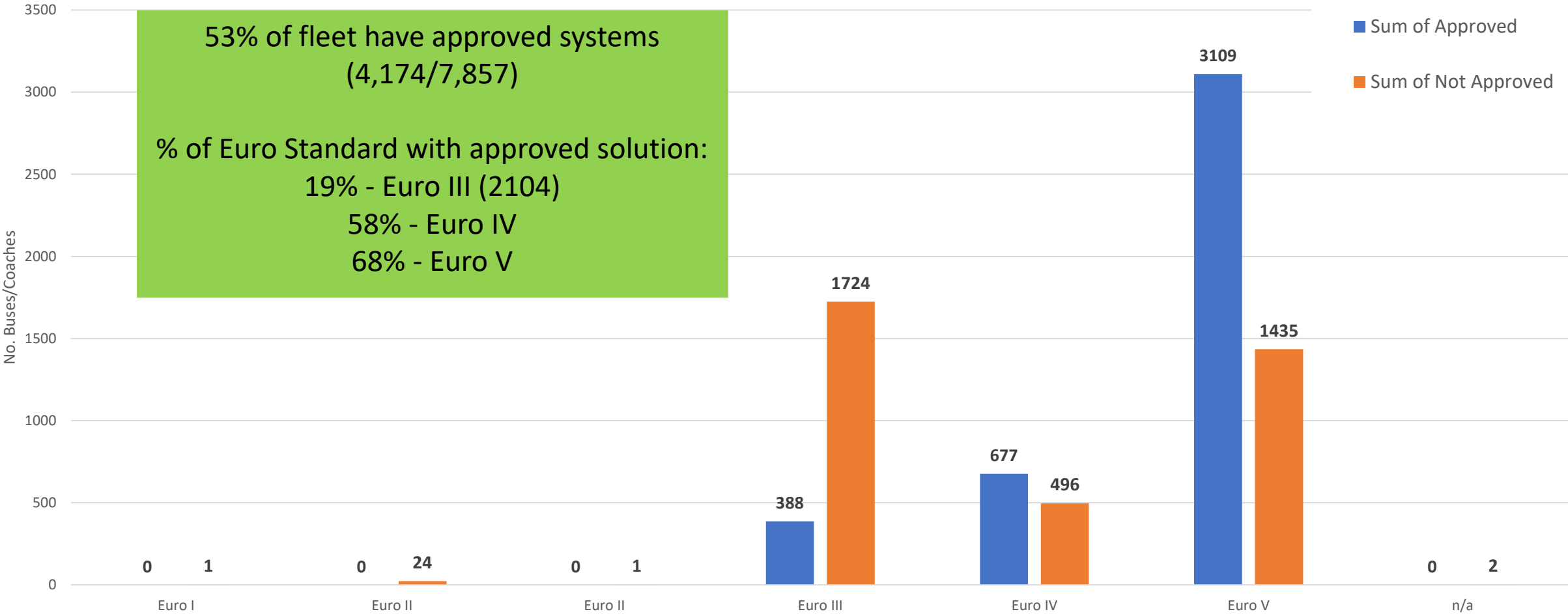
Split of systems by Engine OEM



Engine OEM	Total No. Engines	Sum of Approved	Sum of Not Approved
Cummins	3770	2597	1173
DAF	97	0	97
Fiat	3	0	3
MAN	250	0	250
Mercedes	448	0	448
n/a	113	0	113
Scania	691	670	21
Volvo	2485	907	1578
<b>Grand Total</b>	<b>7857</b>	<b>4174</b>	<b>3683</b>

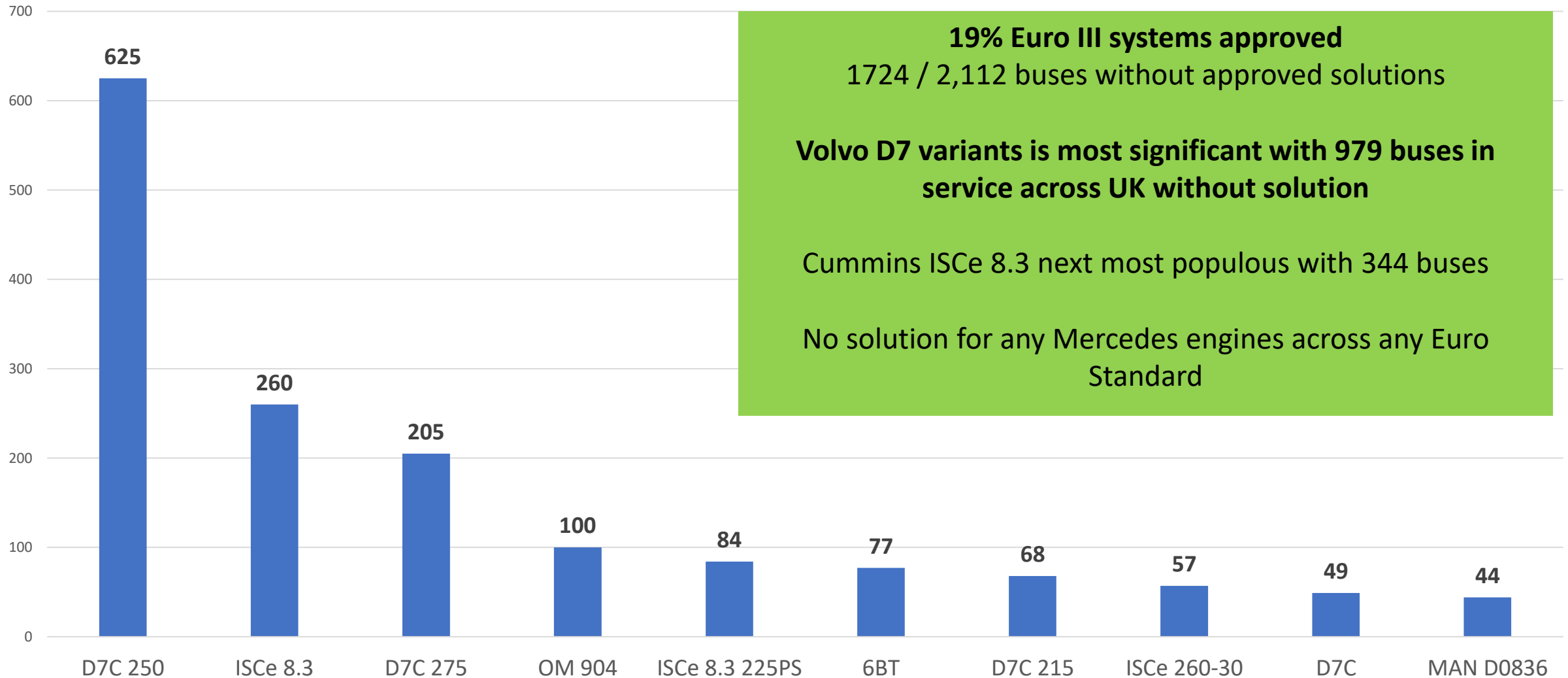
# English and Scottish Fleets Combined: 7,857 buses with 99% engines identified

English and Scottish Fleets - comparison of approved and not approved systems



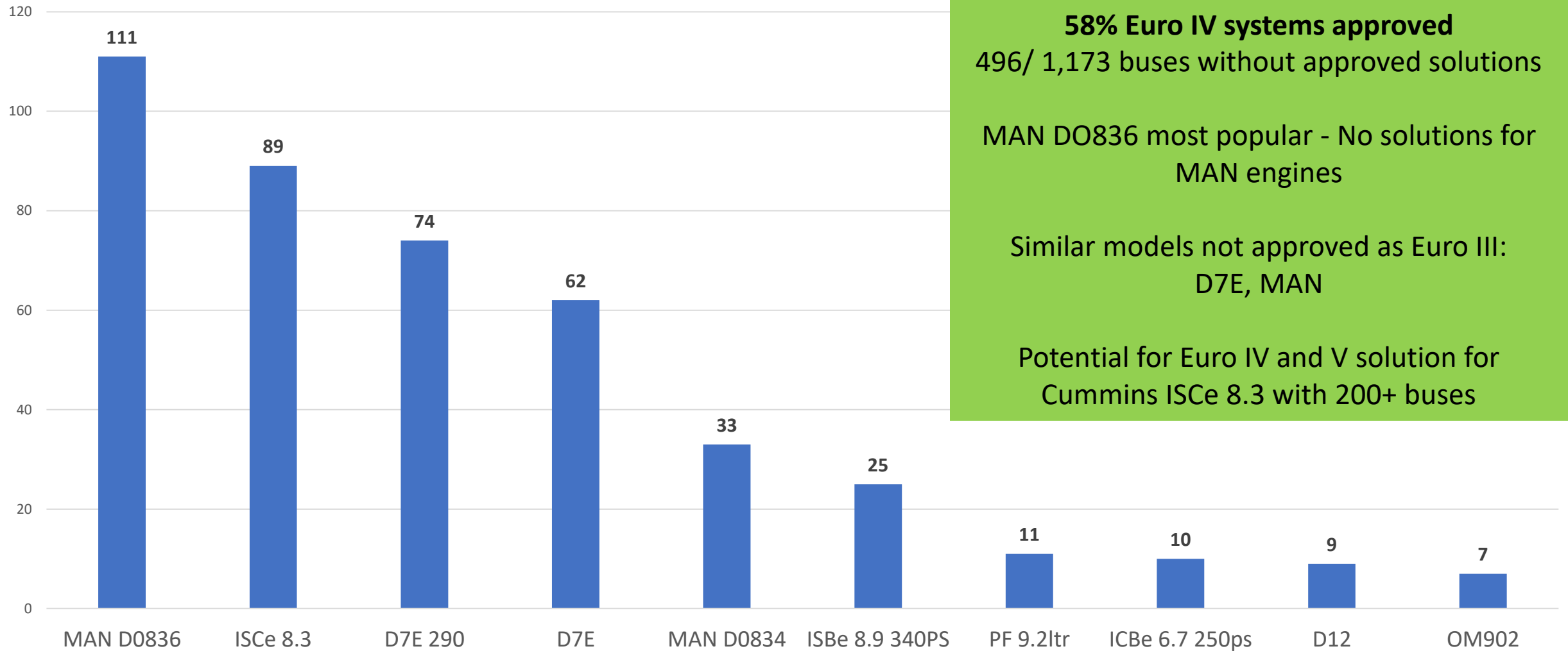
# English and Scottish Fleets Combined

## Euro III: Engines without approved systems



# English and Scottish Fleets Combined

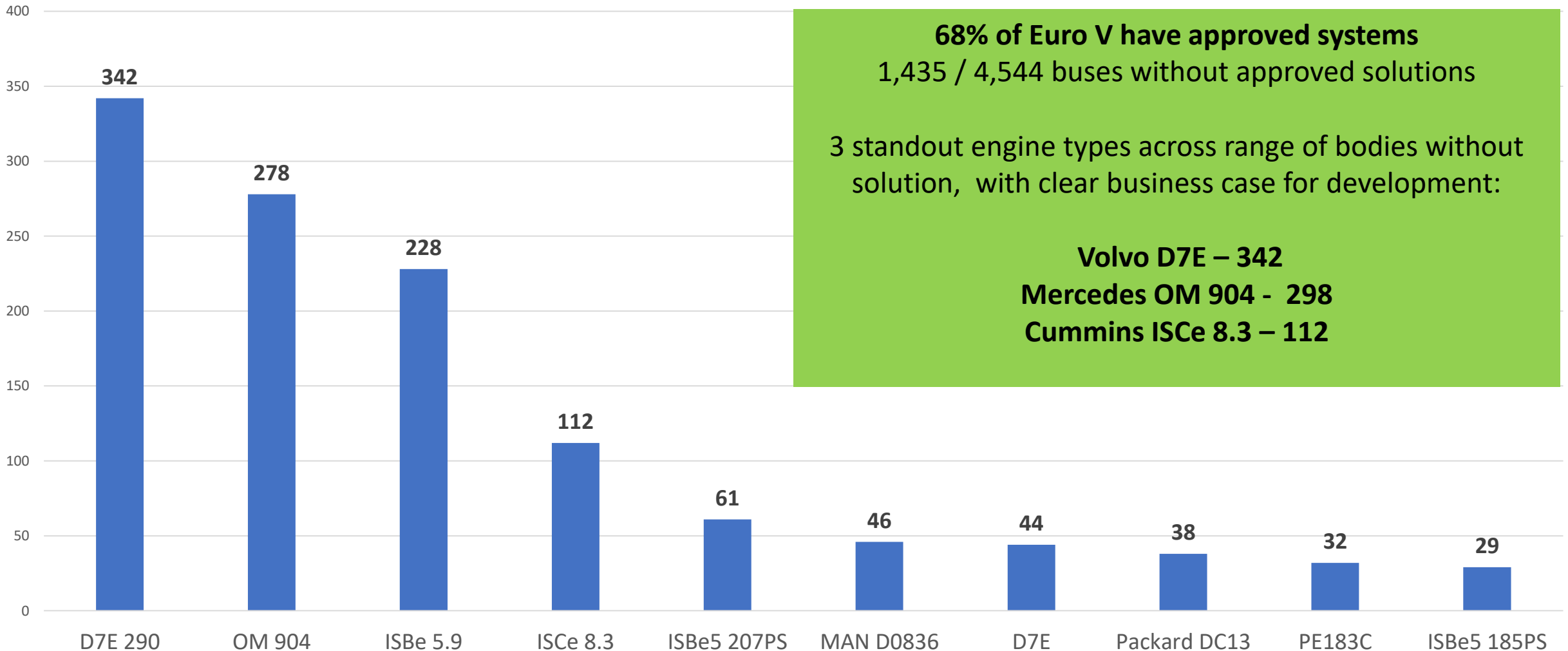
## Euro IV: Engines without approved systems





# English and Scottish Fleets Combined

## Euro V: Engines without approved systems



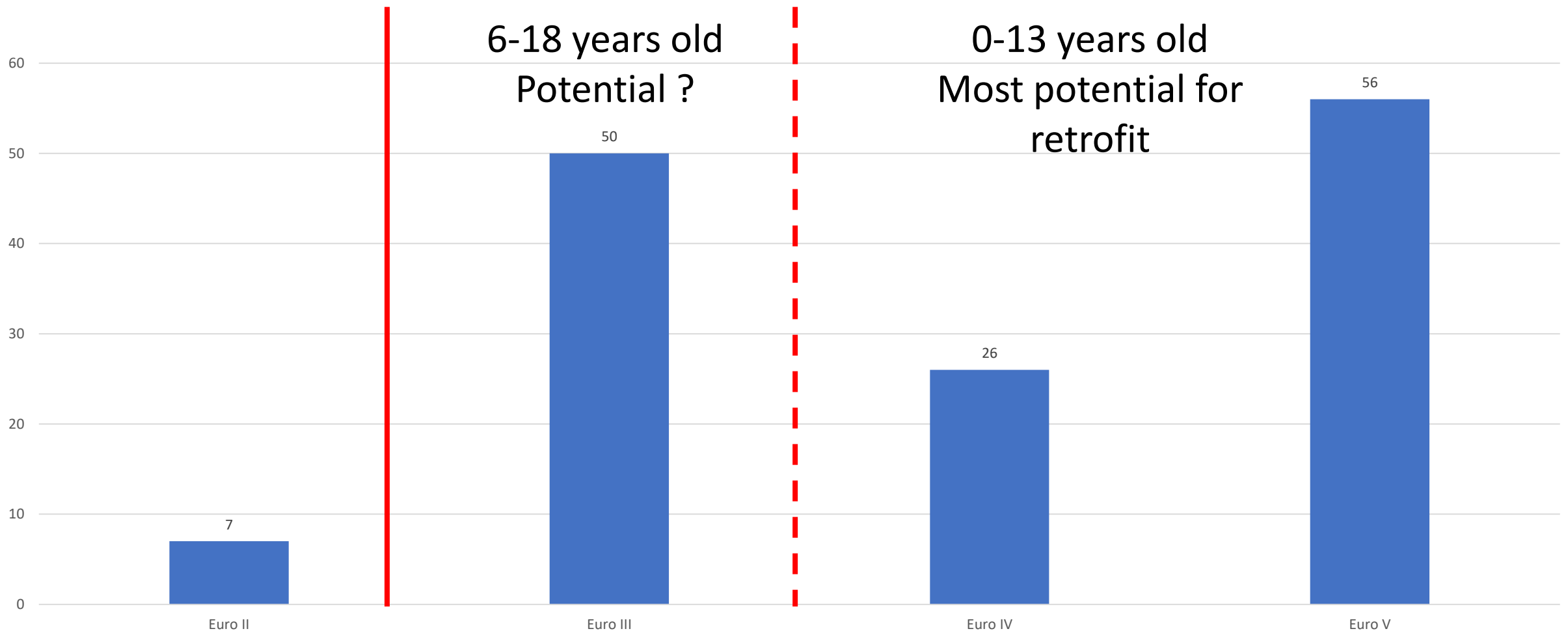
# English Fleets – 5,930 buses total

Euro Standard	No. Buses	Different Engine Model
Euro II	24	7
Euro III	1399	50
Euro IV	968	26
Euro V	3537	56
n/a	2	1
<b>Grand Total</b>	<b>5930</b>	<b>140</b>

Manufacturer	No. Buses
ADL	2076
BMC	3
DAF	2
Mercedes	105
Optare	413
Scania	534
Volvo	1338
Wrightbus	295
Iveco	19
EAST LANCASHIRE	8
<b>10 Chassis OEMs</b>	<b>4793</b>

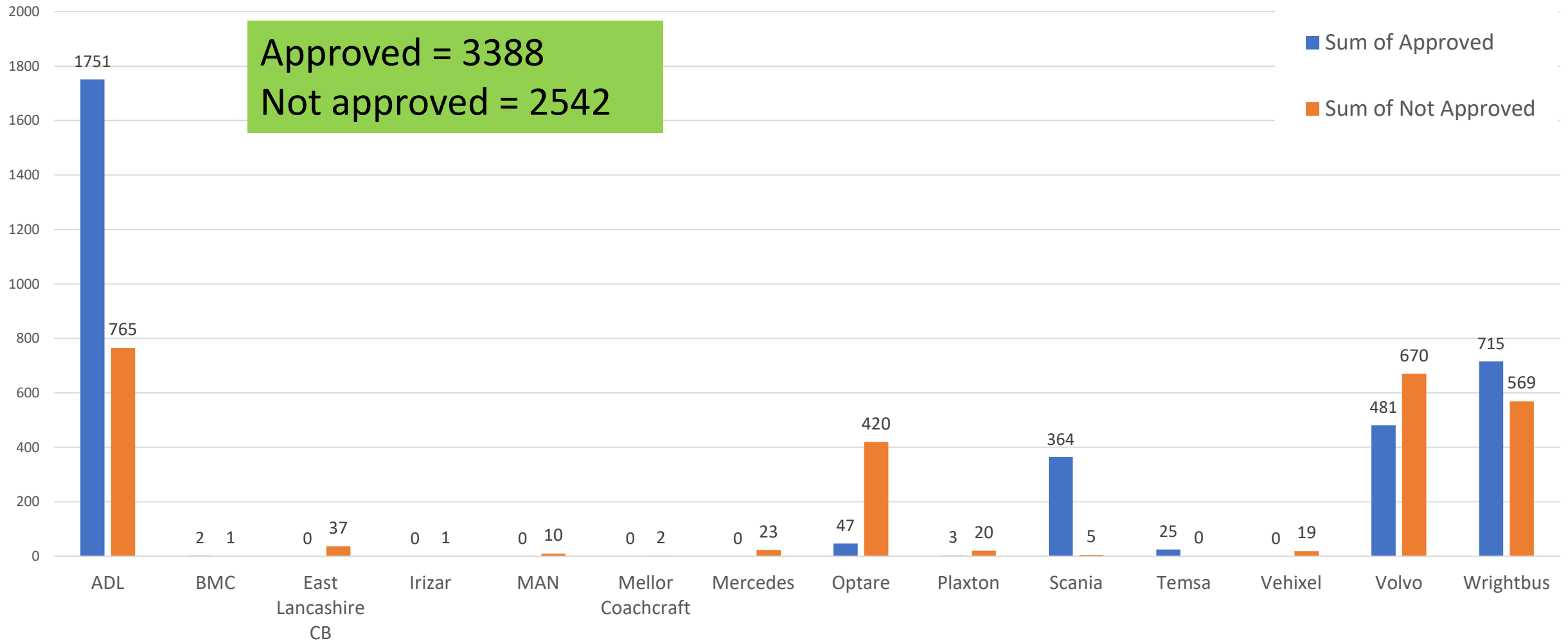
# England: 140 Engine Types

Engine variants by Euro Standard



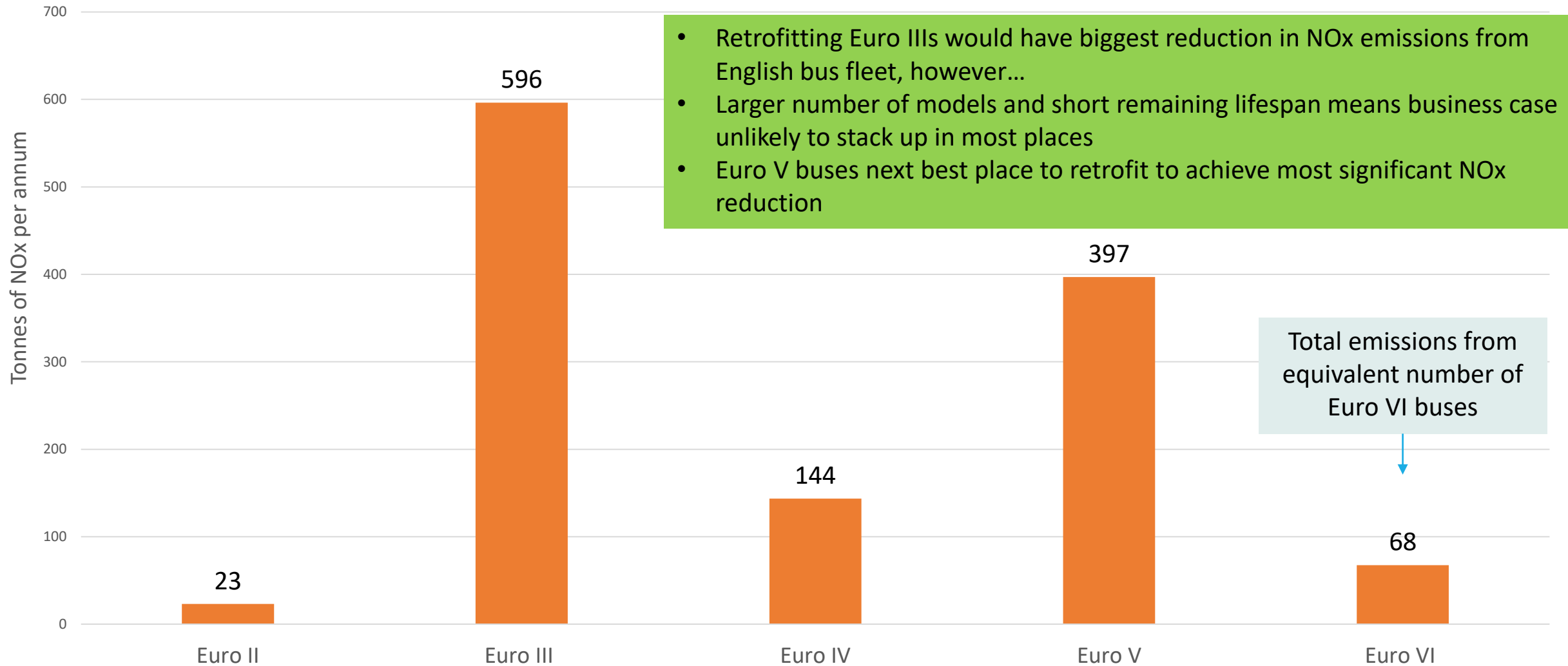
# England: Retrofit Solutions

Solutions comparison by OEM



# England: Where to concentrate?

Annual NOx emissions from non-approved engines (only inc. more than 50 buses)

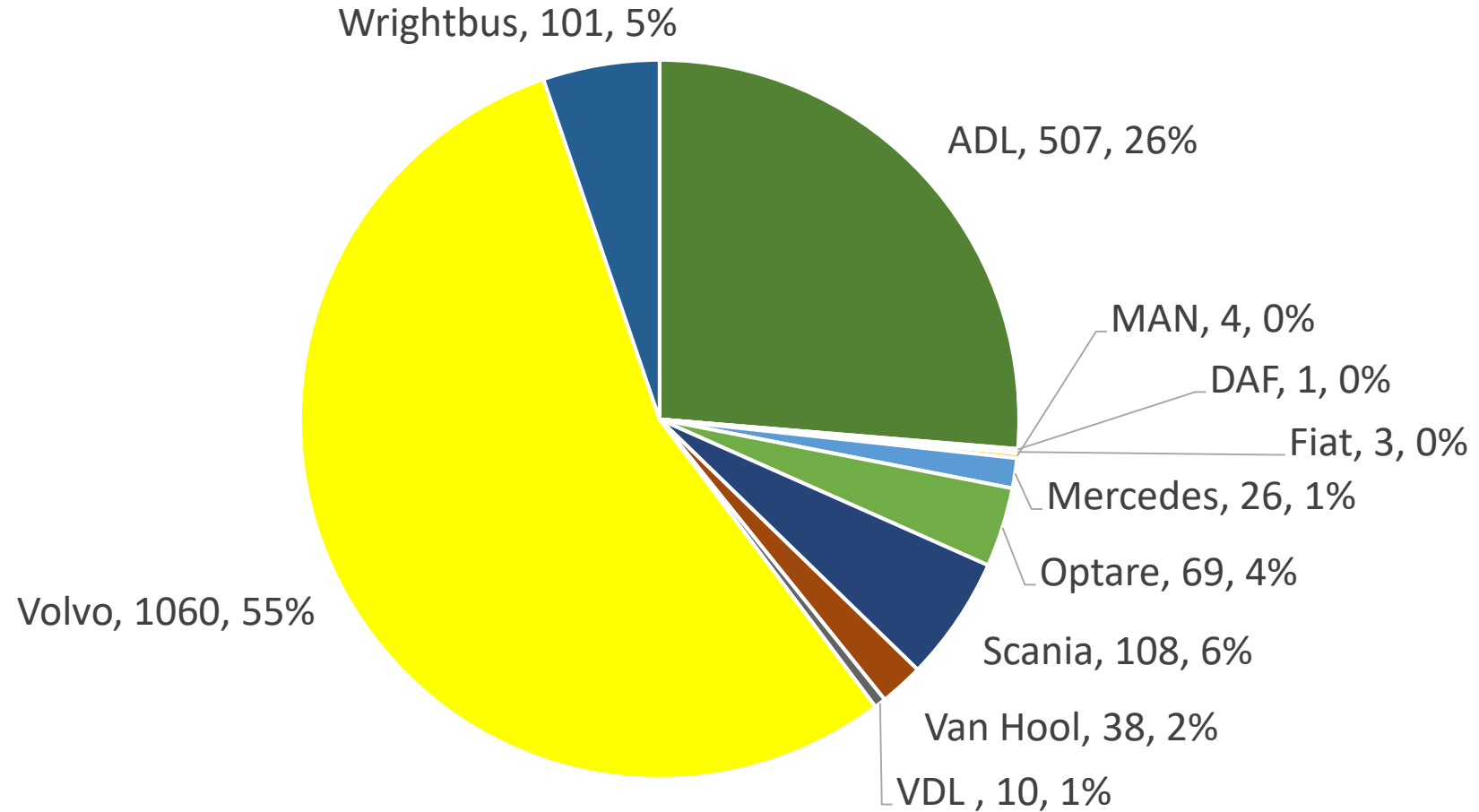


# Scottish Fleet: Buses operating in or near Low Emission Zones

Euro Standard	No. Buses	No. Engine Types
Euro I	1	1
Euro II	1	1
Euro III	713	17
Euro IV	205	12
Euro V	1007	24
<b>Total</b>	<b>1927</b>	<b>57</b>

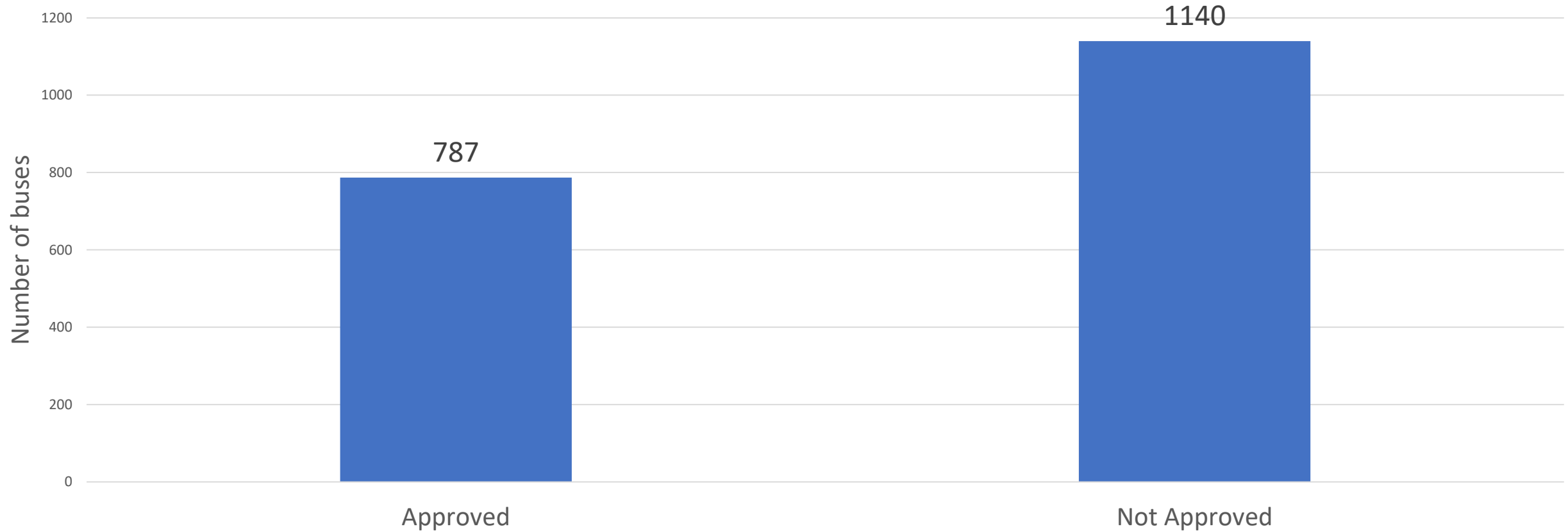
Manufacturer	No. Buses
ADL	507
DAF	1
Fiat	3
MAN	4
Mercedes	26
Optare	69
Scania	108
Van Hool	38
VDL	10
Volvo	1060
Wrightbus	101
<b>11 OEMs Total</b>	<b>1927</b>

# Scottish Fleets by Manufacturer: 1,927 total number of buses in/near LEZ



# Scottish Fleet: CVRAS Approved Solutions?

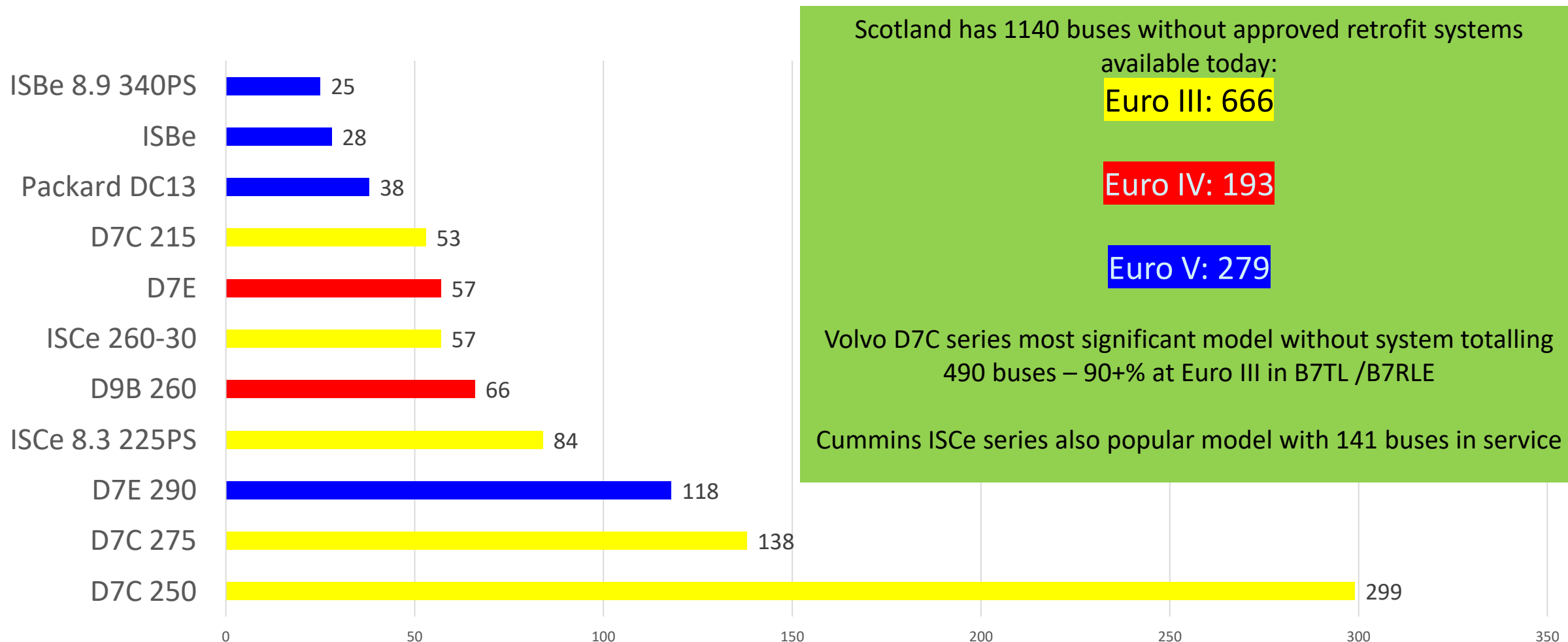
Scotland: Number of buses\* in service with approved systems under CVRAS scheme  
(approved list taken from EST website)



[EST CVRAS approved systems list](#)



# Most common engines in Scotland without approved retrofit system



# Conclusions

- 7,857 vehicles in potential CAZ operating areas in England & Scotland
- No approved solutions for 3,683 vehicles: 1,296 Euro IV & V with commercial potential to be retrofitted (more than 50 identified)
- Dataset identifies 6/7 engine models with clear business case for retrofit solution development
- Volvo D7 series is easy win across Euro standards, Cummins ISBCE 8.3, MAN OM904(Euro V)
- Greatest NOx reduction achieved through Euro III retrofit ...
  - Worthwhile given lifetime of vehicle? Replaced by Euro VI within next few years?
- Euro V would provide next biggest impact for NOx reduction
- Next steps – collate Welsh bus fleets into dataset