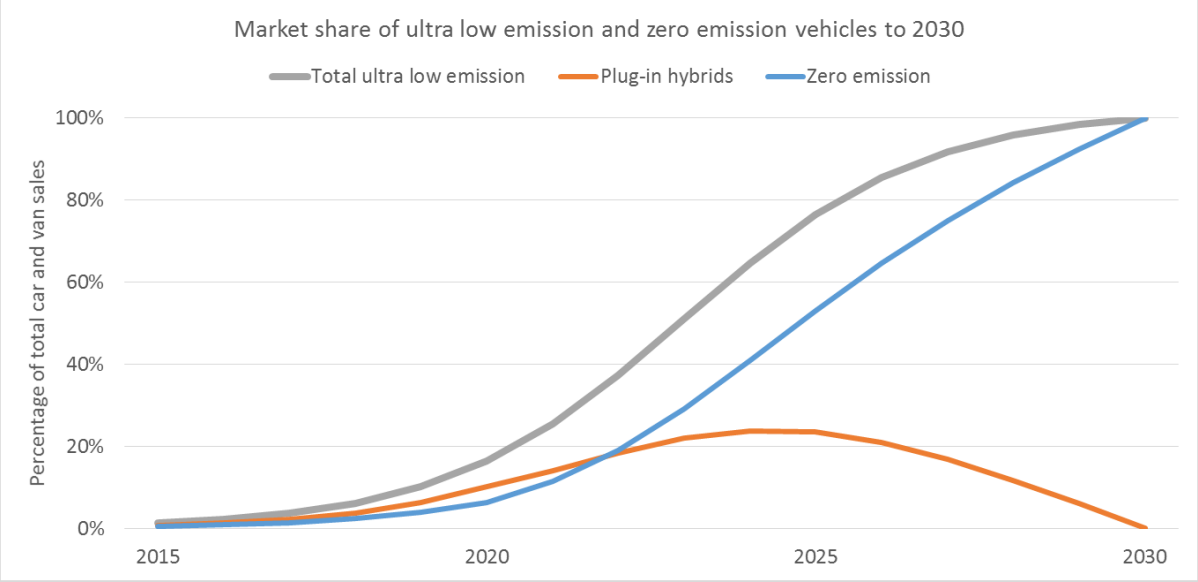
Projecting future oil imports if all new cars and vans are zero emission from 2030

The UK government recently committed to ban the sale of new conventional cars and vans by 2040. While this is a step in the right direction, some environmental groups have argued that it is not ambitious enough. If the government were to introduce targets and policies to achieve all new car and van sales to be zero emission vehicles (ZEVs), for example battery electric vehicles, by 2030 they could more than halve the UK's foreign oil imports in 2035 compared to if existing policies were followed.

With a target of 100% of new sales of cars and vans to be zero emission vehicles (ZEVs) by 2030, nearly 80% of cars and vans on the road will be ZEVs by 2035.

To calculate estimated projections of the percentage of the vehicle fleet that will be ZEVs we use a sigmoidal curve to project the growth in sales of ultra low emission vehicles (ULEVs) including both ZEVs and plug-in hybrid electric vehicles (PHEVs) as a percentage of total vehicle sales, up to 100% from 2030 onwards (Figure 1). We assume that sales of PHEVs as a percentage of total ULEV sales will decrease linearly from 67% for cars and 24% for vans in 2020, to 0% in 2030.[1] We assume that total vehicle sales will remain at 2016 levels[2] in future years and that vehicles will have a 13.5 year average life time on the road.[3]

Figure 1 Market share of ultra low emission and zero emission cars and vans to 2030



[1] We assume that the ratio of PHEVs to ZEVs in cars and vans in our 100% by 2030 scenario will be the same in 2020 as the ratio projected by the Committee on Climate Change in their 2013 report *Pathways to high penetration of electric vehicles.*

[2] This assumption is suitable for our purposes because we are interested in the percentage of the car and van fleet that will be ULEVs, not in the actual size of the fleet itself.

[3] Cambridge Econometrics, 2015, *Fuelling Britain's Future: A report for the European Climate Foundation*, p.11.

Using these assumptions we can project estimations of the size of the total vehicle fleet and ULEV fleet. Multiplying the total sales in each year by the percentage of sales that are ULEVs gives the total sales of ULEVs in that year, which are added together with the sales of ULEVs in the previous 12.5 years to give the total fleet size of ULEVs (Table 1).

Table 1 ZEV and PHEV fleet size (thousands)

	2020	2025	2030	2035
ZEV car fleet	363	4313	15474	28259
% of total car fleet	**1%**	**12%**	**42%**	**77%**
PHEV car fleet	722	3725	5277	3962
% of total car fleet	**2%**	**10%**	**14%**	**11%**
ZEV van fleet	116	947	2670	4367
% of total van fleet	**3%**	**19%**	**51%**	**84%**
PHEV van fleet	38	194	275	207
% of total van fleet	**1%**	**4%**	**5%**	**4%**

Combined with ambitious fuel efficiency improvements use this will reduce oil use by 25.6 mega tonnes of oil equivalent (Mtoe) in 2035, over one third of total primary oil demand.

To calculate reduction in oil demand we compare two scenarios:

1. 'Existing policies scenario'

The Department for Business, Energy and Industrial Strategy (BEIS) produce projections of UK energy demand up to 2035 under different scenarios.[4] We use the 'Existing policies scenario', which projects energy demand based on policies that have been adopted by government at the time the figures are produced.

2. 'Zero emission vehicles + fuel efficiency scenario'

This scenario takes the 'Existing policies scenario' as a starting point and adds the following conditions:

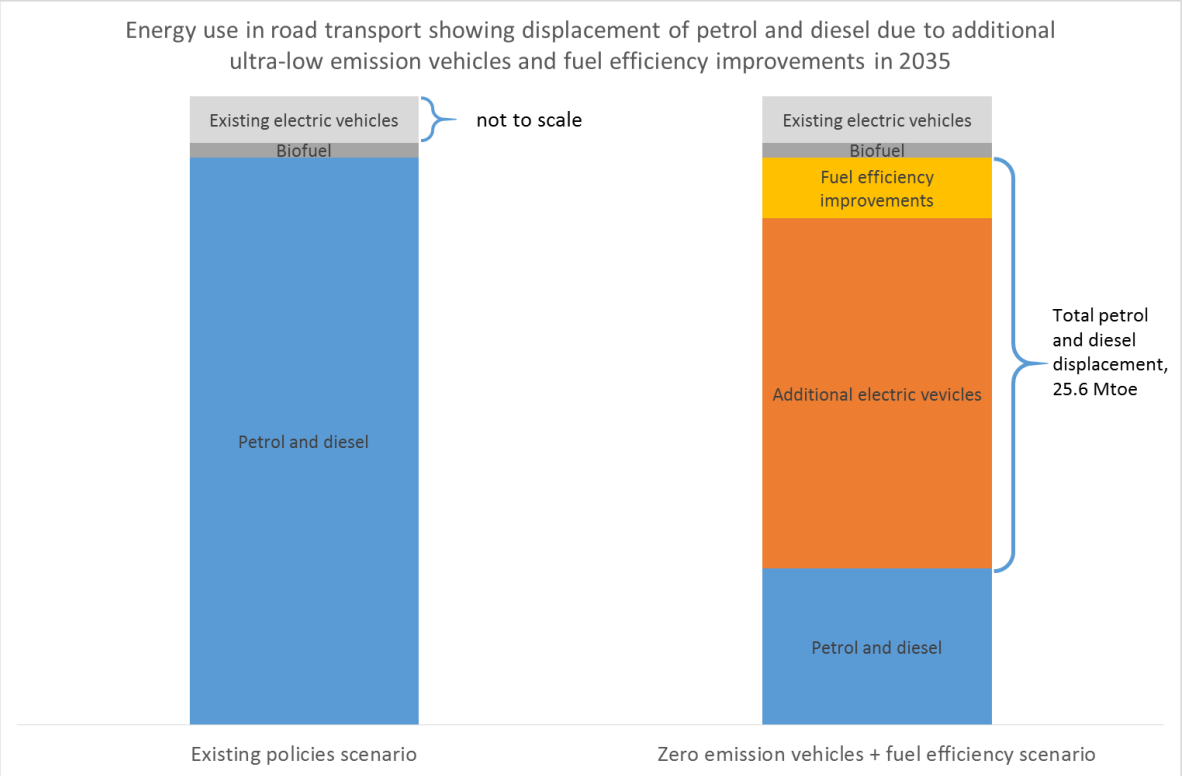
a. All cars and vans sold from 2030 onwards are ZEVs
b. Fuel efficiency of internal combustion cars and vans improves in line with the ambitions of the Committee on Climate Change[5]

[4] BEIS, 2017, *Updated energy and emissions projections: 2016.*
[5] Committee on Climate Change, 2015, *Sectoral scenarios for the Fifth Carbon Budget*. 37% and 33% fuel efficiency improvement for cars and vans respectively between 2010 and 2030. The BEIS projections assume fuel efficiency improvements of 22% for diesel cars, 31% for petrol cars, and 14% for diesel vans in the same period.

We calculate how much less petrol and diesel will be needed under these conditions (Figure 2, Table 2), starting with reductions due to fuel efficiency improvements. For petrol and diesel displaced by additional ULEVs we calculate the additional road miles that will be powered by electricity rather than petrol or diesel in this scenario compared to the Existing policies scenario. We assume that the percentage of the fleet which is ULEV corresponds to the percentage of vehicle miles which will be powered by electricity. This takes into account the percentage of vehicle miles travelled on electric power by PHEVs. We assume that vehicle miles travelled on electric power by PHEVs will rise to 80% from 2030 onwards, from 30% in 2015.[6] Using the petrol and diesel fuel efficiency assumptions used in the BEIS energy demand projections[7] we calculate how much oil these additional electric miles would displace. This calculation takes into account the fuel efficiency improvement to avoid double counting.

Finally, we convert these figures from final energy demand (i.e. fuel consumed in vehicles) to primary energy demand (i.e. the amount of oil needed to make the petrol and diesel consumed in vehicles).

Figure 2 Petrol and diesel displacement in the 'Zero emission vehicles + fuel efficiency' scenario in 2035



[6] IEA, 2017, *Global EV Outlook*.
[7] BEIS, *Personal communication,* 19/07/2017.

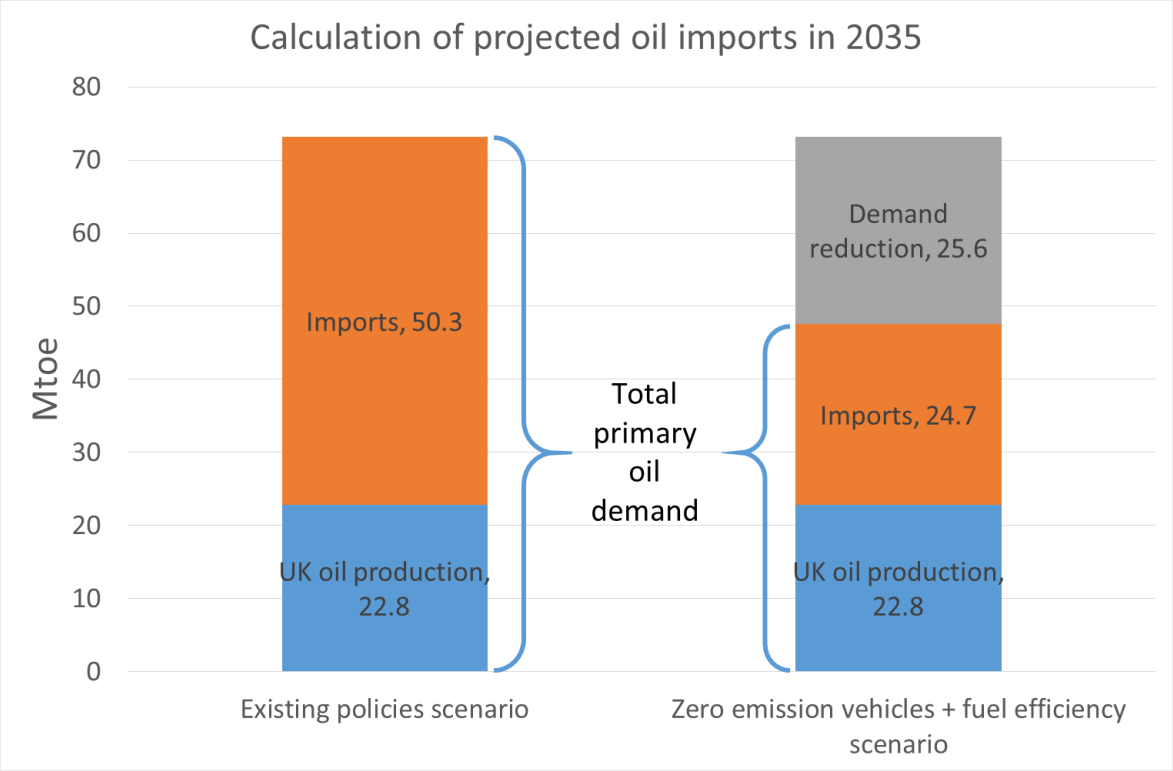
Table 2 Oil displaced by fuel efficiency improvements and additional ULEV and ZEV vehicles compared to if existing policies were followed[8]

	2020	2025	2030	2035
Oil displacement from fuel efficiency improvement (final demand, Mtoe)	0.5	1.8	4.4	3.8
Oil displacement from additional ULEV and ZEV vehicles (final demand, Mtoe)	0.5	4.5	11.1	17.6
Total oil displacement (primary demand, Mtoe)	**1.2**	**7.5**	**18.5**	**25.6**

Reducing primary oil demand by 25.6 Mtoe in 2035 would reduce projected oil imports by 51%.

We calculate projected oil imports by subtracting oil production projections from primary oil demand projections (Figure 3, Table 3, & Figure 4).[9]

Figure 3 Calculation of projected oil imports in 2035



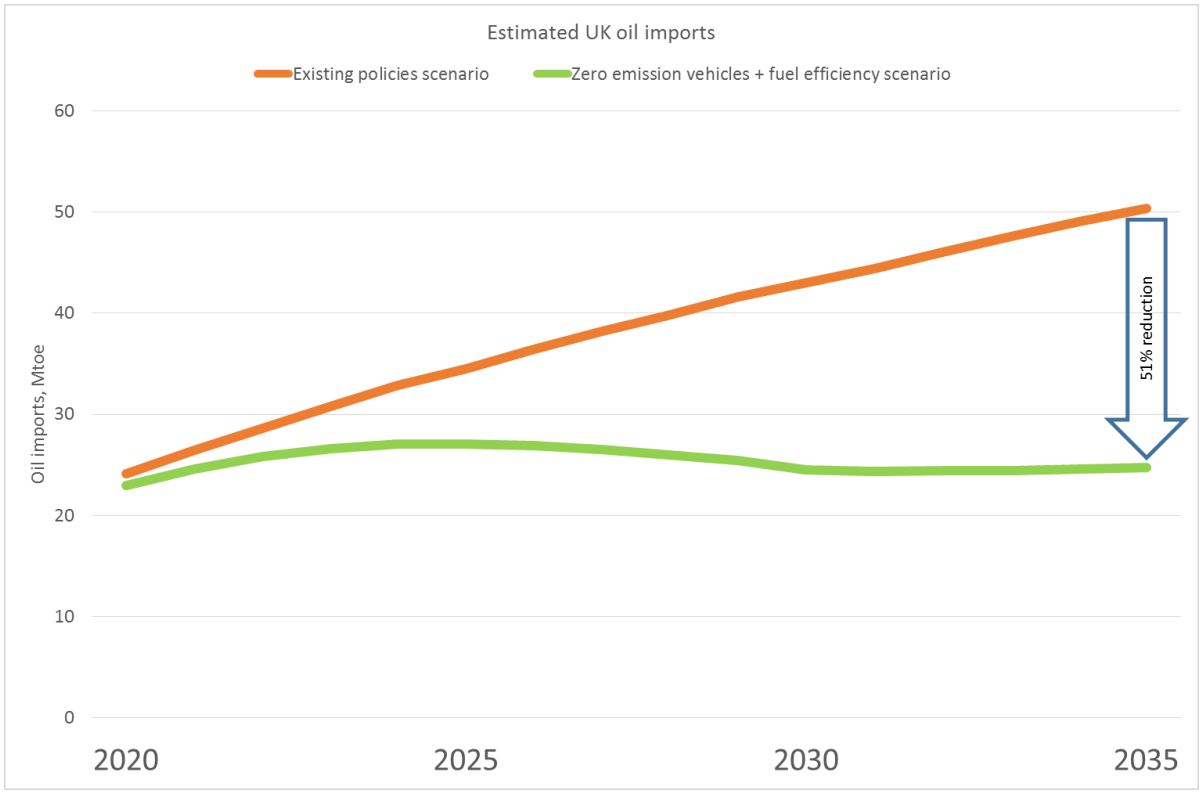
[8] Final demand refers to the energy contained in the fuel actually used in vehicles, primary demand refers to the amount of oil needed to make this amount of fuel. Final demand figures were converted to primary demand figures using the ratio of final demand to primary demand in the BEIS *Updated energy and emissions projections: 2016.*

[9] BEIS, 2017, *Updated energy and emissions projections: 2016: Annex E: Primary energy demand*; Oil and Gas Authority, 2017, *OGA production and BEIS demand projections, March 2017.*

Table 3 Projected oil imports in two future scenarios

	2020	2025	2030	2035
Imports Existing policies scenario (Mtoe)	24.1	34.5	43.0	50.3
Imports ZEV + fuel efficiency scenario (Mtoe)	23.0	27.0	24.5	24.7
Reduction imports	-4.9%	-21.7%	-43.0%	-50.9%

Figure 4 Estimated UK oil imports 2020 to 2035



Annex

Energy conversions

Energy (DUKES)	MJ per Litre (gross)	GJ per tonne (gross)	Litres per tonne
	MJ_Litre	GJ_Tonne	Litres_Tonne
Petrol (premium!)	34.45	47.2	1370
Bioethanol	23.59	29.7	1259
Diesel	38.27	45.7	1194
Biodiesel (ME)	34.43	38.7	1124
LNG		53.1	

	to_ktoe	to_TJ	to_GWh	to_mTh
conv_ktoe	1.000	41.868	11.630	0.397
conv_TJ	0.024	1.000	0.278	0.009
conv_GWh	0.086	3.600	1.000	0.034
conv_mTh	2.520	105.506	29.307	1.000

Kilo	1000
Mega	1000000
Giga	1E+09
Tera	1E+12
Peta	1E+15