

The economic black hole at the heart of the shift to electric vehicles

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The ban on the sale of new diesel and petrol cars and vans from 2040 is perhaps the most significant policy announcement made by the UK government in the past decade (with the possible exception of Brexit).



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It feels like a key moment in the fight against pollution and climate change, but the shift from petrochemicals to electric vehicles will be disruptive and extremely expensive. The ramifications need to be considered systematically.

The issue that springs most immediately to mind is that the UK's national taxation system will experience a major shock. The government [raised about £28 billion](#) from fuel duties over 2016/2017. It is the largest component of indirect taxation and pulls in about the same as tobacco, alcohol, gambling and vehicle duties combined.

The removal of diesel and petrol cars and vans will undermine this tax stream and it will need to be replaced. Tax on petrol and diesel currently accounts for [69% of the total price](#). To put it in context, one year's worth of fuel duty revenue pays for [more than 4m UK state pensions](#).



Charging more? [nrqemi/Shutterstock](#)

Electric dreams

One option to replace lost fuel duty might be a tax on electric vehicle charging. Currently, VAT on domestic energy consumption is charged at 5% – this will have to rise dramatically to cover the shortfall.

The government has been silent on this. The issue appears to have been taken for granted or perhaps overlooked. It may seem that 2040 is a long way off, and the transition will be softened by product lifecycles, but people's vehicle buying habits will start to change long before deadline day.



The timeline of autonomous vehicles

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A creative solution to the taxation deficit will have to be developed for every country pursuing a similar course.

Tax is not the only worrying unknown. The gradual replacement of more than 31 million diesel and petrol cars with electric or autonomous vehicles represents a moment of transformation that is arguably more of a threat to the UK automotive industry than Brexit.

During 2017, electric car pioneer [Tesla's market capitalisation](#) reached \$51-billion (£39-billion), briefly surpassed that of General Motors and is well above that of Ford. We are seeing the impacts of disruptive technologies on established and conventional automotive manufacturers. We simply don't know how this will play out in a UK sector which [directly employs 169,000 workers](#) and which generates annual turnover of more than £70 billion, but which has little or no exposure to this new industry. Where is the UK or European version of Tesla?

Grid lock

The 2040 ban presents another huge problem too. The [25,410,360 houses and properties](#) in England and Wales will need to be rewired. The current system will not be able to cope. Charging two cars for daily commuting could destroy existing domestic wiring systems given the demand placed on the system.

That means all houses, and the grid feeding them, may need to be altered to ensure that they have the ability to cope safely with the demands of charging electric vehicles. This would be a major cost and create more disruption.

It is possible to plug a vehicle into 13-amp domestic wall socket, but the charge time would be 12 to 15 hours and it carries a fire risk if the plug is old or unsuitable for the high loads required. Dedicated 32-amp charging points could be installed with a charging time [of five to seven hours](#), but does the UK have sufficient electricians to deal with all these alterations?

Those changes also assume there will be enough electricity in the first place. The UK has suffered from major under-investment in generation capacity [for more than two decades](#). As we stand right now, recharging millions of electric cars would result in blackouts and systemic failure across the grid.

This will require hundreds of billions of pounds of investment in additional generation capacity. Motoring organisation, the RAC, [estimates that in 2016](#), about 320 billion miles were driven on UK roads. If we imagine this was all driven by electric vehicles [requiring 33 kilowatts](#) of electricity for every 100 miles then Britain would need just under 100 billion megawatts of extra capacity to charge all those batteries. Now, this is clearly a worst-case scenario, but it is chastening to think that based on the [range of costs cited](#) for new electricity generation from 2020, the bill to meet that level of demand would be at least £6 trillion and most likely more. This is a challenge that must somehow be met just as the UK starts to lose a huge chunk of tax revenue from fuel duty.



Generational change. [Michael Oakes/Flickr](#) CC BY-ND

Rules of the road

The fundamental questions just keep coming. Roads and pavements will experience a major upheaval as electric vehicle charging points are installed. And what will happen to the UK's [8,500 filling stations](#)? Even if most become electric charging stations, they will have to be repurposed and decontaminated. There will also be a significant employment and economic loss as refineries close. This will affect the equivalent of 18,000 full-time jobs in Britain. More subtle changes will present themselves too. New approaches to etiquette will be needed – when can you use someone else's charging point for free, or for a fee?

The ban will require a dramatic restructuring of the tax system alongside massive new capital investment in infrastructure. Our estimate here of £1 trillion is a calculation based on the cost of new electricity generation combined with the installation of charging points. It is a starting point for discussion. No one has yet calculated, or perhaps could calculate, the full cost of this simple policy statement.

It might be that vehicle use alters in a way that means many of the potential investments will not be required – car ownership may be replaced by a car version of city bike hire schemes perhaps. But there are only 23 years for the UK to adjust to what will be the most significant transport, infrastructure, electricity generation and tax revolution since the arrival of personal computing and the internet.

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