UKERC
UK Energy Research Centre

Review of Energy Policy: 2018

A UKERC Policy Briefing

December 2018



Summary of recommendations

The government needs to take urgent action to ensure that the UK continues to meet statutory emissions reduction targets, and goes further to achieve net zero emissions. This not only requires new policies to fill looming gaps in the portfolio, it also requires much greater emphasis on sharing the benefits and costs of the low carbon transition more equitably. Our main recommendations are:

1. We repeat our call for a heat and energy efficiency White Paper, and recommend that the Industrial Strategy mission to reduce building energy use is extended to existing buildings.
2. A better, more targeted approach to the energy needs of low-income households is required. Energy efficiency investment for these households should be funded via general taxation.
3. Urgent large-scale trials of heat decarbonisation using hydrogen are required to understand whether it could be technically, economically and socially viable.
4. A dashboard of indicators is needed to monitor gas security during the energy transition. The current one dimensional approach is not sufficient.
5. Future electricity policy should build on the Electricity Market Reform policies that have worked well, and adapt them in the light of changes in technologies and costs.
6. Changes in incentives for 'black start' and other ancillary services are necessary to ensure that the electricity system remains resilient as it changes.
7. The target for phasing out conventionally fuelled vehicles is inadequate and does not fit with our emissions targets. The 2040 date should be brought forward and linked to accelerated investment in networks and charging.
8. The Industrial Strategy needs to be strongly linked to market creation policies for low carbon technologies. Carbon capture and storage is in particular need of such policies to progress beyond its current holding pattern.
9. To ensure widespread support for the energy transition, there needs to be more focus on equity and justice. The UK government should consider setting up a process similar to Scotland's Just Transitions Commission to achieve this.
10. Continued vigilance is required to mitigate any negative impacts of Brexit, particularly those that could affect integration with European energy markets.

Executive summary

Jim Watson

As we reach the end of 2018, the scorecard for UK energy policy is mixed. Optimists can point to rapid emissions reductions, cost falls in renewables and the centrality of clean energy within the Industrial Strategy. Ten years after the Climate Change Act was passed (see box), UK greenhouse gas emissions have fallen by 43% from the level in 1990. The UK is on the way to meeting the first three carbon budgets, and a transformation of the power sector is well underway.

However, if we turn our attention from the rear view mirror, the outlook is more pessimistic. As the Committee on Climate Change pointed out in June, there are an increasing number of policy gaps and uncertainties. If not addressed promptly, meeting future carbon budgets will be much more challenging. For some of these gaps, there is a particularly clear and immediate economic case for action. For example, analysis by UKERC and the Centre for Innovation and Energy Demand concluded that cutting household energy use by 25% by 2030 would have a net benefit of £7.5bn[1].

This policy hiatus has been compounded by Brexit. Not only is it creating uncertainty for investment (e.g. in new electricity interconnectors), Brexit could also have other negative impacts. These could include upward pressure on energy prices if electricity and gas market integration is reversed, risks to the regulation and licensing of nuclear power, and a reduction in research and innovation funding. There is also a much broader impact on the policy and political 'bandwidth' available for the development and implementation of new policies.

The referendum on EU membership has also highlighted economic and social inequalities across the UK. It is no coincidence that UKERC research is focusing much more on the energy policy implications of inequality than in the past. Taken together, the results show just how important it is to pay attention to the social and economic justice when implementing policies. A much more integrated and targeted approach is needed for low income households, particularly when upgrading the energy efficiency of homes. Government also needs a much more coherent strategy about the distribution of costs and benefits across different income groups and regions. The Scottish government's new Just Transitions Commission offers one way to consider all these questions in an integrated way.

Box: 10 years of the Climate Change Act (Paul Ekins)

Ten years after it was passed into law, we can see just how effective the Climate Change Act has been. Supported by the equally effective Renewable Energy Directive from the European Union, UK renewable electricity generation has increased from a few per cent in 2008 to its current level of 30%. The first three carbon budgets, the third extending to 2022, has been, or will be met. No other developed country has been able to match the UK's achievement of consistent economic growth with substantial carbon emissions reduction since 1990. It hasn't all been due to climate policy, but it is clear that the Climate Change Act has played a major role in keeping the feet of successive governments to the fire of emissions reduction.

However the major tests are yet to come. The projected UK emission trajectory is worryingly wide of the fourth and fifth carbon budgets, and the present government seems to have little time or appetite for the major policy initiatives required to both hit these budgets (which run through to 2032), and prepare the ground for the even bigger emission reductions that will be required thereafter. Where are the big plans to overhaul the energy efficiency of the UK housing stock, to demonstrate at scale new household heating technologies, and what are the sanctions for Government if it stubbornly refuses to put in place the measures that will enable the statutory emission reductions to be achieved?

But these are questions for another day. This year it is important to celebrate a landmark piece of legislation that has made the UK one of the relatively few countries that is taking its climate responsibilities seriously.

1 Rosenow, J et al (2017) Unlocking Britain's First Fuel: The potential for energy savings in UK housing. Policy briefing. London: UKERC and CIED.

During the past year, there has been increasing attention to the role hydrogen could play in the decarbonisation of heat and industry. A series of reports and feasibility studies have been published, and new government R&D programmes announced. As UKERC research has shown, this enthusiasm for hydrogen is partially driven by the gas network and appliance companies. A key question for policy in the medium term is how to maintain investment and security of the UK's gas infrastructure, especially if its use continues to decline.

The lack of real-world experience of hydrogen solutions means that claims about its potential should be treated with caution. A priority should be to deploy more established technologies whilst demonstrating hydrogen systems at scale to find out whether they will be technically, economically and socially viable.
To complement this, further action is needed to create a market for carbon capture and storage (CCS). Thirteen years after the first government strategy for CCS, policy is still in a holding pattern of R&D funding, small demonstrations and advisory group reports. The government's new action plan for CCUS is welcome, but is short on detail on how market creation will be achieved.

Electricity policy is also poised to go through another period of reform. In his recent speech, the Secretary of State, Greg Clark, provided a response to the Helm Review. The four principles for future policy set out in the speech were familiar, perhaps with the exception of his call for a more agile approach to regulation. This is a welcome acknowledgement that the pace of change in the power sector requires a more flexible approach than in the past. The speech politely kicked many of the Helm Review's recommendations into the long grass. As we argued in our response to the Review[2], it is important to build on the policy tools that are already available – partly because they are working, but also because revolutionary reforms would take time to develop and implement. Above all, further investment and regulatory incentives need to follow quickly so that momentum towards a low carbon, flexible electricity system is not curtailed.

A significant reason for this need for agility and flexibility is the prospect of rapid change in the transport sector. Here, there is another disconnect. Whilst there is a lot of optimistic rhetoric about electric vehicles, transport emissions are rising and the sales of low carbon vehicles remain low. Whilst the Department of Transport's Road to Zero strategy is welcome, it is a missed opportunity for UK leadership. It could have included a much more ambitious target for the phase out of conventional vehicles and a more comprehensive approach to sustainable mobility. The recent IPPC report on 1.5 degrees emphasised the need for rapid change. Seen through this lens, a 2040 phase out target is not good enough.

2 Watson, J et al (2018) UKERC Response to the Cost of Energy Review. London: UKERC.

A roadmap for UK gas security

Michael Bradshaw and Grant Wilson

The UK still lacks a clear roadmap for the future role of natural gas in the energy transition. Events in March 2018 demonstrate this remains essential to providing the capacity, flexibility and resilience necessary to ensure future UK gas security. However, debate continues around the future role of gas infrastructure, fuelled by uncertainty regarding the role of low carbon gas in the decarbonisation of heat (see p6).

Globalising UK gas security

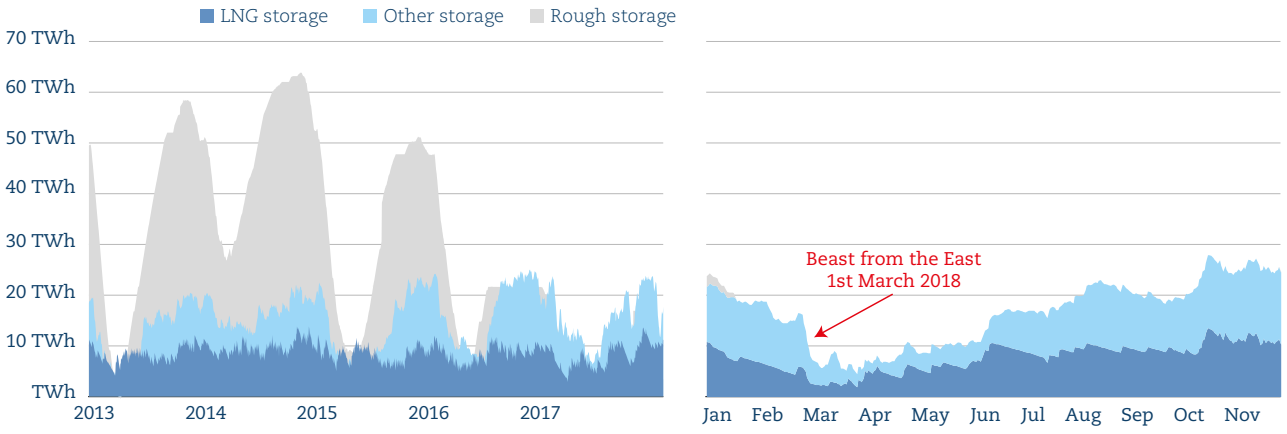
Government asserts that the UK benefits from diverse gas supplies, but voices concerns about growing import dependence. Presently, the UK imports about half its gas – the bulk coming by pipeline from Norway and the majority of the balance as Liquefied Natural Gas (LNG) from Qatar. Depending on demand, by the 2030s import dependency could be 70% or more. For this reason, the government supports the development of shale gas; but, this is unlikely to achieve the scale and pace to contribute to energy security in the early 2020s. Brexit further complicates matters as the UK will likely find itself outside the EU's internal energy market, left to fend for itself in increasingly competitive global and European gas markets[3]. The government's own analysis shows gas will continue to flow, but potentially at a higher price to the consumer[4].

The 'Beast from the East' raises concerns about midstream capacity and flexibility

The cold weather in late February-early March 2018, the so-called 'Beast from the East', tested the resilience of the UK's market structures to provide additional gas when required. The gas price spiked and additional gas flowed, but had the cold weather lasted longer, the outcome could have been very different. The graph below shows the amount of gas in storage and LNG terminals since 2013, making clear the impact of the closure of the Rough seasonal storage facility. At the time of the cold snap, gas stores were roughly 57% full, by the end of the week they were 27% full, with major increases in demand coming from the local gas networks[5].

Government's view is that the market should determine if more storage is necessary and that state intervention could distort the market with unforeseen consequences[6]. This may be true, but it underestimates the risk that a serious supply shock would soon become a significant political issue. During the week of the Beast from the East natural gas provided approximately 80% of the energy required to power and heat the UK. With the closure of the Rough storage site in 2018, the UK has effectively offshored its seasonal storage further up its supply chains using pipeline imports or LNG deliveries.

In assessing future UK gas security, the current reliance on the N-1 assessment is far from adequate. We recommend a broader approach that considers the security and resilience of the entire gas supply chain in a whole system context[7]. As Government acknowledges, the market's key sources of flexible supply in times of high demand are the two continental interconnectors and the three LNG terminals. The status of the interconnectors is complicated by Brexit; but perhaps more should be made of the role of LNG as a source of interseasonal storage, together with demand side flexibility.



Source UKERC, based on data from National Grid

3 Bradshaw, M J (2018) Future UK Gas Security: A Position Paper.
4 CEPA (2017) A Review of Gas Security of Supply within Great Britain's gas market – from the present to 2035.
5 Wilson, I.A.G., Taylor, R., Rowley, P (2018). Heat decarbonisation challenges: local gas vs electricity supply.
6 BEIS Select Committee (2018) Gas Storage Inquiry.
7 Bradshaw, M J and Solman, N. (2018) *A New Approach to Assessing UK Gas Security.*

Heat: action in the face of uncertainty

Jan Webb and Richard Lowes

The Clean Growth Strategy recognises the centrality of heat decarbonisation to energy policy goals. Making heat decarbonisation feasible means using less energy in buildings, and integrating fabric efficiency upgrades with incentives for low carbon heat. As the Committee on Climate Change continues to argue, policy action is not yet sufficient to achieve these changes[8].

Financial support for domestic energy efficiency, notably via the Energy Company Obligation, has been significantly reduced since 2012. The Energy Systems Catapult has funding from UK Government to develop business models for heat as a service, but there is limited evidence about market feasibility. For new housing, the English zero carbon homes policy for 2020 was withdrawn in 2015. Home insulation rates declined again in 2017, with only 123,000 lofts or walls insulated (5% of 2012 peak delivery). Policies on energy use and carbon emissions for public and commercial buildings have not changed since 2008. The exception is Scotland, where public investment, particularly for low-income households, has increased slightly. In 2015 Scottish government made energy efficiency a national infrastructure priority with commitment to invest around £0.5 billion to 2021 and plans to incentivise upgrade of all buildings by 2040[9].

The Industrial Strategy includes a new 'mission' to halve energy use in new buildings by 2030. This could provide a basis for momentum to be regained – but only if it is extended to include existing buildings, complemented by incentives for households, businesses and landlords to invest, and backed up by measures to improve skills, inspection and enforcement.

Low carbon heat deployment

Deployment of low carbon heat remains limited and new gas connections continue to be installed. Low carbon options such as heat pumps, district heating using low carbon sources, and hydrogen are not yet deployed at scale. The Renewable Heat Incentive (RHI) has primarily supported bio-energy and there is a lack of policy beyond 2021. Action is also lacking for off-grid areas and new buildings which remain easy wins for heat policy.

UKERC research into heat sector 'incumbency' highlighted the efforts of the gas industry to promote technological options which maintain the gas system[10]. Using hydrogen to decarbonise the grid could reduce emissions and consumer impacts. However, as an untested technology it is subject to major technical, economic and social uncertainties.

Major investment in hydrogen network infrastructure and CCS technologies would also be necessary – this should be a priority for both government and industry if this option is to be taken seriously. In the meantime, the potential of hydrogen should not delay installation of district heating and heat pumps.

District heating networks

The £320 million Heat Networks Investment Project is positioned as key to a competitive market, but investment needs to increase substantially year on year to meet the envisaged £16 billion development by 2050. The pilot used only £24m of the available £39m budget. The Competition and Markets Authority recommended sector regulation via Ofgem[11] and UK Government now plans to proceed in order to secure affordable finance and consumer protection[12]. The necessity for the latter is demonstrated by BEIS research showing the current variability of price and service standards[13]. Consultation is planned in 2019. In Scotland, area-based heat and energy efficiency planning, regulation and licensing of district heating are proceeding to legislation[14]. Low carbon sources for district heating include heat recovered from industry or environment, but this is undeveloped in the UK. The Clean Growth Strategy makes only a small (£18m) commitment to an industrial heat recovery programme, alongside funding for improving low carbon heating technologies.

Joining up policy

Meeting near zero carbon targets for buildings requires policies which combine building and technology regulation, taxation and incentives, and should apply to every building. The Industrial Strategy 'mission' on new buildings is welcome, but will not affect most of the building stock. Whole building solutions, government backed finance and local delivery could support deployment. A future RHI must also consider whole building approaches, and support those households without access to up-front capital. We therefore repeat our call for a Heat and Energy Efficiency White Paper to set out comprehensive actions on clean, affordable heat and retrofit of buildings.

8 Committee on Climate Change. (2018) 2018 Progress Report to Parliament.
9 Energy Efficient Scotland Route Map 2018
10 Lowes, R., Woodman, B., Clark, M. (2018) Incumbency in the UK heat sector and implications for the transformation towards low-carbon heating.
11 CMA (2018) Heat Networks Market Study.
12 UK Government BEIS (2018) Heat Networks: Ensuring Sustained Investment and Protecting Consumers
13 UK Government BEIS (2017) Heat Networks Consumer Survey; UK Government BEIS (2018) Heat Networks: the Experiences of Consumers and Operators
14 Scottish Government (2018) Heat & Energy Efficiency Strategies: Second Consultation Analysis; Energy Efficient Scotland Ministerial Statement:

Electricity: keeping up momentum

Keith Bell

According to a report produced on behalf of Drax, the UK saw the greatest fall in carbon intensity of electricity production of any country in the world between 2008 and 2017, falling by around 250 g/kWh, a reduction of more than 50%[15]. Once again, the most recent capacity market auction, designed to give confidence that there will be sufficient generation to meet demand, has seen prices significantly lower than expected. However, there are new uncertainties about this mechanism due to a successful legal challenge to the State Aid approval process.

Offshore wind made spectacular gains in the most recent contracts for difference auction, achieving prices of £57.50/MWh, close to the estimated cost of gas fired plant. Such a price suggests that wind energy can now be considered 'subsidy free'. However, developers may find it difficult to secure power purchase agreements outside the risk reduction facility provided by the CfD arrangement.

The recent speech by Greg Clark MP suggested that changes to the Electricity Market Reform framework would be considered soon by government. The likely rejection of the more revolutionary changes recommended by the Helm Review such as an auction based on 'Equivalent Firm Capacity' will avoid unnecessary disruption to the sector.

System operation and resilience

Much large schedulable generation has closed in recent years. This has led to concerns about options available to the ESO not simply to meet total demand but to manage power flows across the system and facilitate timely restoration were it to suffer a complete shutdown. The latter has a very low probability and has never happened in Britain but would have a massive societal impact if it did.

Increasing challenges are being caused by reduced system inertia and high system voltages under conditions of low power flows on the transmission system[16]. The last few years have seen increases in the cost of capability to 'black start' the system[17]. Existing regulatory and commercial arrangements were largely established for a very different system in 1990. They are now in urgent need of review to ensure that, as a package, they adequately address locational issues, the growth of distributed resources, the potential for storage and flexible demand, and changes to the technologies connected to the grid, in particular the use of power electronics.

The culture and capability of distribution network operators (DNOs) and coordination between the electricity system operator (ESO) and the DNOs[18] need to be fit for the future system. The transition from DNOs to distribution system operators (DSOs) is being addressed slowly – mainly through the Open Networks project. The 5 year review of the Capacity Market offers a chance to better align it with the range of system operation needs. At a time when Brexit has cast doubt on new interconnector developments[19] and the effects on trade across the existing ones, the Capacity Market review will also consider the extent to which imports via interconnectors can be relied on.

Network investment and uncertainty

Against a background of criticism for excessive profits, the transmission network owners and Ofgem are preparing for the next transmission price control for the period 2021-2026. This faces a significant level of uncertainty around changes in generation and demand for electricity and the associated need for network capacity[20].

Demand uncertainty arises from the possibility that a large part of Britain's car fleet will become electric and that at least some of the nation's heating demand will be electrified. These developments will have a major impact on distribution network investment[21]. However, the size of the impact will depend on the extent to which consumers are willing and able to be flexible, for example in the timing of electric vehicle charging. At present, the benefits of consumers minimising their impact on the network are not passed through to them. Reform of the way fees are determined for access to the network has the potential to correct that and reward flexibility. A significant code review to address this is expected from Ofgem soon.

15 I. Staffell, M. Jansen, A. Chase, E. Cotton and C. Lewis, (2018). Energy Revolution: Global Outlook. Drax: Selby.
16 https://www.nationalgrideso.com/insights/system-operability-framework-sof.
17 https://www.nationalgrideso.com/balancing-data/system-balancing-reports.
18 Bell and Gill (2018).Delivering a highly distributed electricity system: technical, regulatory and policy challenges.
19 See http://www.fablink.net/faq/#q7.
20 http://www.ukerc.ac.uk/news/ofgem-riio-2-framework-consultation.html.
21 The next distribution network price control period will run from 2023.

A fair and equitable energy transition

Christina Demski, Carolyn Snell, Mark Bevan and Catherine Waddams

Energy policy discussions often focus on the technological and lifestyle implications of a low-carbon energy transition. However, it is equally important to ensure the processes and outcomes of that transition are fair and just, both in distributional and procedural terms.

Recent policy developments have attempted to improve fairness within the energy system. The energy price cap aims to provide some assurance that domestic consumers who do not switch tariffs are not disadvantaged in the retail energy market, which rewards frequent switching. However, there are many aspects of fairness and justice yet to be addressed. Fuel poverty and energy affordability for vulnerable groups are particular policy areas that require attention.

The challenge of fuel poverty

Improvements in energy efficiency and corresponding reductions in energy use decreased the average household energy bill between 2008 and 2016, counteracting the effect of rising prices[22]. However, there has also been a substantial increase in the share of household expenditure spent on energy since 2003, particularly for low income households[23].

Difficulties in paying energy bills arise from a combination of circumstances, such as sporadic income and unexpected shocks to household budgets. Therefore it is advisable to combine support for households with other types of support (e.g. debt support). UKERC research has shown that schemes aimed at alleviating fuel poverty for low-income families and disabled people are often insufficient, failing to target the complex circumstances faced by these groups. More tailored policies are needed that do not only focus on cost effectiveness[24].

> Schemes that use trusted intermediaries to identify and support vulnerable households may improve access, but organisations working in this remit have seen their funding cut substantially in recent years.

Public acceptance and trust

There is an increasing focus on how the low-carbon energy transition is being funded, including the equitable sharing of costs and benefits. Most emission reduction schemes are funded through levies on domestic energy bills. Whilst such policy costs are not as high in the UK as they are in some countries[25], they disproportionately affect those most vulnerable to rising prices. The poorest homes are also, in effect, self-funding schemes designed to help those most in need. To ensure existing inequalities are not exacerbated as the energy transition unfolds, more progressive policies may be required such as funding low-carbon schemes through general taxation[26]. There is a particularly strong case for energy efficiency for low income households to be supported via this route.

While an equitable transition is an important principle to strive for, it also plays a vital role shaping public acceptance and engagement, especially with regards to how costs are distributed[27]. Whilst the UK public supports a low-carbon transition, and perceives some personal responsibility to contribute financially, this is conditional upon other actors committing to do the same. Distrust of the energy industry in this regard relates to the belief that profit is the primary driver for decision-making, something perceived to be at odds with commitments around low-carbon energy and affordability. Trust in government is higher, but politicians are perceived to be too closely connected to the energy industry, leading to inadequate and ineffective regulation of energy companies. The UK public requires much greater transparency and accountability, including around energy costs and wider decision-making, especially in terms of how money is spent. Increasing the financial burden through levies on energy bills without addressing these issues could lead to further distrust, and perhaps even undermine public support for the energy transition.

22 Committee on Climate Change. (2017) Energy Prices and Bills – impact of meeting carbon budgets.
23 Deller, D. &d Waddams Price, C. (2018) Fairness in Retail Energy Markets? Evidence from the UK.
24 Snell, C. et al. (2018) Policy Pathways to Justice in Energy Efficiency.
25 Gross, R. and Hanna, R. (2018) What's in a bill? How UK household electricity prices compare to other countries.
26 Barrett, J., Owen, A. & Taylor P. (2018) Funding a low carbon energy system: A fairer approach?
27 Evensen, D., Demski, C., Becker, S. & Pidgeon, N. (2018) The relationship between justice and acceptance of energy transition costs in the UK.

Transport: achieving the road to zero

Jillian Anable and Christian Brand

UK energy use from transport has increased 16.1% since 1990, against an economy-wide decrease of 4.1% and net carbon emissions are unchanged[8,28]. A lack of progress with heavy goods vehicles and aviation persists, but the unexpected change is the increase in new car CO_2. Switching from diesel accounts for a small proportion of this increase; the main culprit is a continued swing towards larger passenger cars. Electric vehicles only account for 3% of sales, with three out of four sold being plug-in hybrid electric vehicles.

'Road to Zero' or 'Road to Nowhere'?

Several countries have committed to phasing out conventional vehicles between 2030 and 2040, with manufacturers also announcing targets. A long awaited report by the UK Department for Transport (the 'Road to Zero' strategy), expected to address decarbonisation of the transport sector as a whole, turned out to focus on roads only, with the major emphasis on passenger cars.
The ambition for ultra-low emission car sales (ULEVs) increased from 30-70% to 50-70% by 2030, and 40% for vans, ahead of a ban on sales of diesel and petrol cars and vans by 2040. Criticism was immediate and widespread. Firstly, there is ambiguity over the definition of an ULEV, leaving the door open for hybrid vehicle sales after 2040. These apparently more ambitious targets appear no greater, and possibly less stringent, than those proposed in the 2011 Carbon Plan.

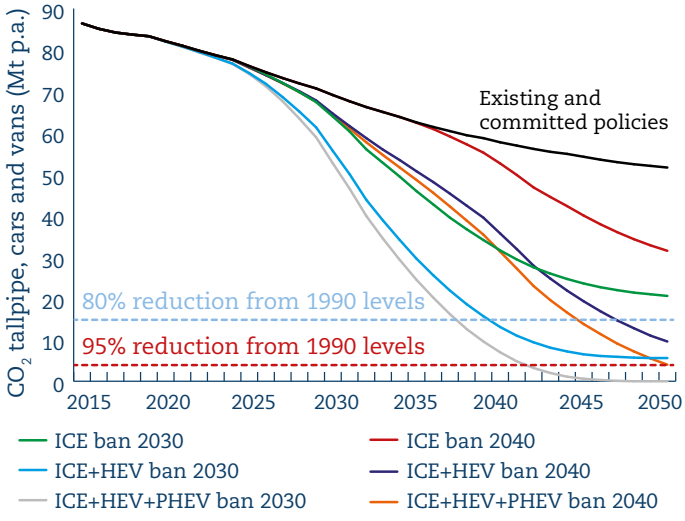
Secondly, the 2040 target is weak by international standards, with many calling for this to be introduced a decade earlier. The BEIS Committee called for the target to be brought forward to 2032 (in line with Scotland), with ongoing UKERC modelling suggesting that it needs to be much earlier and include ULEVs with internal combustion engines to be in line with the Paris Agreement. The graph shows CO_2 emissions from UK cars and vans for seven scenarios compared to the current (80%) and potential Paris target (95%) for 2050. This clearly shows the 'Road to Zero' ('ICE ban 2040') may neither hit the target nor make the early gains needed for a 1.5°C trajectory. Thirdly, the policies identified to achieve this are deemed by many to be inadequate. These include improvements to charging infrastructure, maintenance of grants for some ULEV purchases and potential reforms to vehicle tax.

Policy holes, not pot holes

The European regulation on new car emissions accounts for two-thirds of expected annual carbon mitigation from the sector. However, the performance gap between the tailpipe emissions measured during controlled tests, and those achieved 'on the road' has increased year on year. Data from one million vehicles indicates that the divergence increased from 9% in 2001 to 42% in 2016[29]. This gap has effectively negated any savings from car energy efficiency improvements over the past decade.

Budget 2018 confirmed continuation of the 'fuel duty freeze' saving motorists £1,000 to 2020, but this does not square with our climate change commitments – shifting to more sustainable modes of transport, or promoting EVs. Whilst the duty differential was maintained for alternative fuels and funding announced for the Industrial Strategy Future of Mobility Challenge, Government announced nearly £30billion over five years for road improvements – the largest CAPEX item across the UK economy by the early 2020s.

The transport sector has 10 years to achieve 40 years-worth of carbon reductions if the latest warnings from the IPPC on the need for 'rapid and far reaching actions' are to be taken seriously. This will require much more than is currently on the table[30].



28 BEIS (2018) Digest of UK Energy Statistics (DUKES): energy.
29 Tietge, U; Mock, P, German, J, Bandivadekar, A and Ligterink, N (2017) From laboratory to road. A 2017 update.
30 Brand, C., Anable, J., Morton, C. (2018) Lifestyle, efficiency and limits: modelling transport energy and emissions using a socio-technical approach.

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