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A series of background briefings on the policy issues in the December 2019 UK General Election

Energy and Climate Change

Ralf Martin
Petra Sarapatkova
Dennis Verhoeven

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CENTRE *for* ECONOMIC PERFORMANCE

Energy and Climate Change

CEP ELECTION ANALYSIS

Ralf Martin, Petra Sarapatkova and Dennis Verhoeven

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- UK greenhouse gas (GHG) emissions are declining. The UK has a framework of long-term targets, which aim to reduce net emissions to zero by 2050 in line with what is needed on a global scale to prevent the most severe forms of climate change. There are concerns about the country's ability to reach the targets.

- A key factor causing lower emissions growth over the last ten years has been the drop in output and slow catch-up that occurred in the wake of the global financial crisis.

- While this was helpful for climate change in the short run, the trend will reverse if growth picks up and this will make emissions reduction harder in the long run, unless concerted action is taken to make the transition towards a clean economy.

- The evolution of UK climate change policy is also in danger from Brexit: while slower growth resulting from leaving the EU may help with emissions in the short run, at the same time reduced investment in pro-environment research and development (R&D) and infrastructure is likely to result in emissions being higher in the long run. With much of UK climate policy derived from EU policy there is also the risk of policy dilution post Brexit.

- To meet the long-term targets, further action is needed to commit more resources to renewable energy deployment as well as R&D.

- Residential energy use should also be tackled by providing the right incentives to move to gas-free options while ensuring that the poorest households are not unduly burdened.

Centre for Economic Performance
London School of Economics and Political Science
Houghton Street, London WC2A 2AE, UK
Tel: +44 (0)20 7955 7673
Email: cep.info@lse.ac.uk Web: http://cep.lse.ac.uk

Introduction

UK greenhouse gas (GHG) emissions are declining and have been declining for some time. As of 2018, the UK emitted 449 million tonnes of CO_2 equivalent (tCO_2e).[1] That corresponds to a reduction of 43% relative to 1990 levels, which should make it easy to meet the 2020 target of a reduction of 37%.

Moreover, the UK has a framework of long-run targets developed by the Committee on Climate Change, an independent body of experts advising government. At present, this requires a reduction of 51% by 2025 and 57% by 2030. In addition, shortly before resigning as prime minister, Theresa May introduced a so-called 'net zero' target, requiring a reduction of emissions to (net) zero by 2050.[2]

So far, so good. Despite this, things are far from well when it comes to climate change in the UK. There are concerns about the country's ability to reach the 2050 target.

First, a key factor accounting for lower emissions growth over the last ten years has been the drop in output and slow catch-up in the wake of the global financial crisis. As Figure 1 illustrates, it is most likely that the UK would have missed a 2012 emissions target requiring a reduction by 12.5% of 1990 levels[3] (as part of the UK's Kyoto Protocol obligations) if it were not for the growth slowdown.

Second, even without further recovery and an additional helping hand in the form of slower growth due to Brexit, it is unlikely that the future carbon targets will be met. For example, in Figure 1, consider a growth path that leads to no recovery and a 7% reduction in GDP by 2033. This lies in the mid-range of the government's own forecasts about the impact of Brexit, which suggests a reduction of between 5% and 9%. This would just about bring the UK to a 57% reduction by 2030 (in line with the government's target). By 2050, we would see a reduction of 74%, which is quite a long way from the government's (net) zero target, implying a 100% reduction by that date.

These concerns raise at least two potential questions: What needs to be done and how meaningful are the targets in the first place? Each will be addressed in turn.

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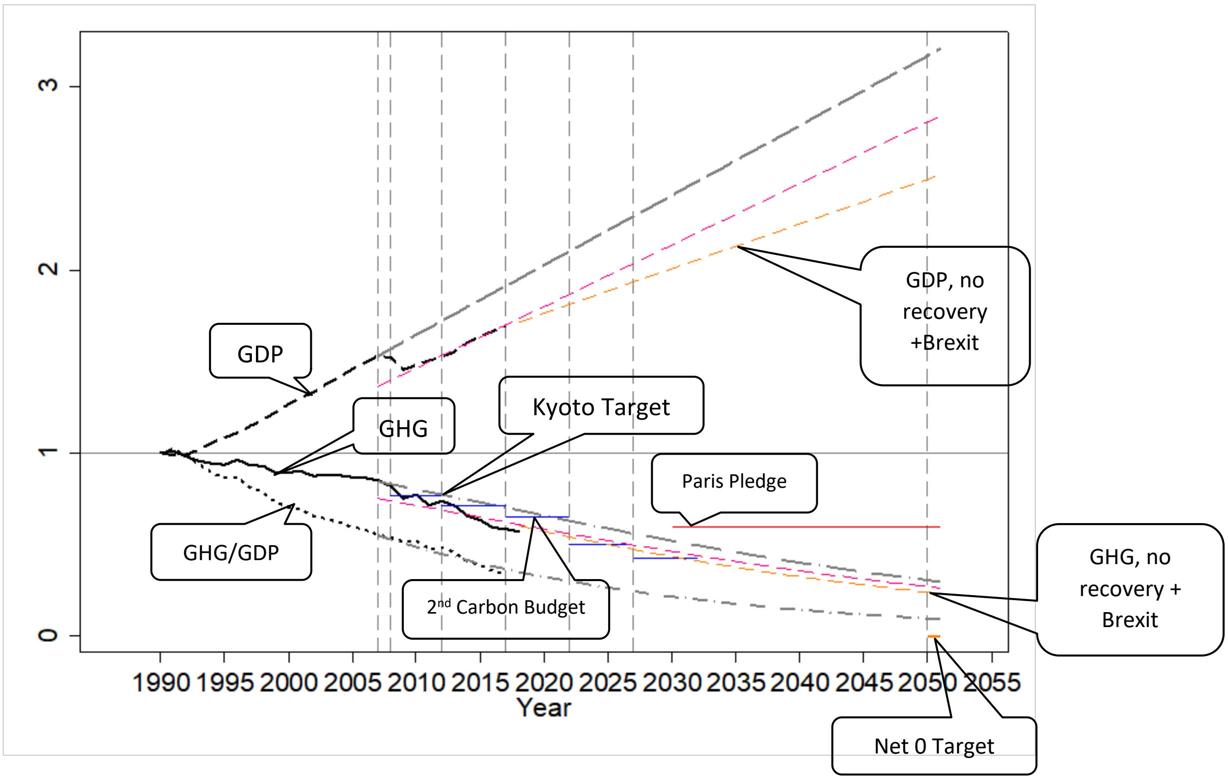
[1] CO_2e is a standard unit for measuring various greenhouse gases combined. The idea is to express the impact of each different greenhouse gas in terms of the amount of CO_2 that would create the same amount of warming.
[2] The 'net' refers to the fact that emissions can be reduced either by reducing actual emissions or by increasing atmospheric CO_2 depletion by planting trees, for example.
3 Because United Nations efforts to curb emissions started in the early 1990s, much of policy and debate on GHGs is formulated relative to a 1990s base year.

Figure 1: UK greenhouse gas (GHG) emissions and projections



Notes: Paris Pledge was the UK government's pledge at the Paris climate summit in 2015.
Source: Authors' calculations based on ONS and BEIS data.

What to do?

To understand what is required, it is useful to look at the main sources of GHG emissions. Figure 2 shows that most (83%) emissions are from CO2, which mostly come from transport, energy supply, residential and business. To reduce emissions dramatically, we need to:

i) Stop generating electricity from gas (coal is no longer relevant in the UK).
ii) Stop heating our homes with gas.
iii) Buy more electric cars, trucks and buses (use more public transport).
iv) Plant trees.

Crucially, ii) and iii) make sense only if i) is achieved. In principle, the UK is in pole position for renewable energy generation, particularly from offshore wind (but also tidal as well as other ocean technologies). According to a new report by the IEA (2019, see also Figure 3) the global potential for offshore wind alone is several times larger than current world electricity demand, and much of that potential is located in UK waters.

But the UK has been slow to adopt renewable electricity generation, particularly compared with European neighbours such as Denmark or Germany. The reason is simply lack of political will. Government support for renewable energy amounts to tens of billions of euros annually in Germany (for example, nearly €20 billion in 2014 alone),[4] whereas in the UK, support amounts to a total of about £6 billon via the government's current 'contract for difference' (CFD) scheme and legacy payments from its predecessor, the 'renewable obligation' scheme.[5]

Notwithstanding this, the UK is now home to the biggest stock of offshore wind power and is rapidly catching up in terms of the share of electricity produced from renewable power (Figure 4a). But considering the long-run target and the rather low levels of support by international comparison, any future government will need to increase the levels of support available via a support scheme such as CFD.

It also might be necessary to change how this scheme is funded. Currently, the funding comes from all electricity customers via the so-called 'supplier obligation'. But this implicitly means that emissions from electricity are priced higher than emissions from (domestic) gas usage, which creates perverse incentives. An improvement would be to impose the supplier obligation on both electricity and gas customers.

Figure 4b shows slow progress in the UK adoption of electric cars.[6] That said, the UK now has a long-run target to phase out all fossil-fuel-based cars by 2032. Increasingly, there are restrictions on 'dirty' cars at the city level. It is therefore plausible that these figures will improve in the near future.

Residential heating is another area where emissions have been persistent for a long time (see Figure 5) despite recent government subsidy schemes for insulation or heating upgrades. But what has consistently been avoided by governments of all colours are strong sticks in addition to carrots; for example, the levying of some form of carbon tax on private households, in particular on residential gas consumption.

The reason for this is clear: governments are worried about the political backlash of such a highly regressive levy (as heating costs amount to a larger fraction of the total income of poorer households). By contrast, residential electricity is implicitly taxed because electricity suppliers are part of the European Union's Emissions Trading System (EU ETS) and because households have to bear the costs of the CFD scheme. Hence, this creates an incentive **not** to invest in electric heating infrastructure, such as heat pumps.

But it is exactly this kind of infrastructure that is needed to meet the long-term net zero targets. Hence, to avoid such perverse incentives, it would be desirable to ensure that the carbon in residential energy is priced as well by a carbon tax or similar. To avoid a negative impact on

[4] https://www.ise.fraunhofer.de/content/dam/ise/de/documents/publications/studies/aktuelle-fakten-zur-photovoltaik-in-deutschland.pdf

[5] For example, payments under the CFD scheme amounted to about £700 million in 2018. Legacy payments under the ROC scheme amounted to £5 billion. The CFD guarantees carbon-free energy producers guaranteed price for their electricity. If the market price is lower than the guaranteed price, the government provides a subsidy that makes up the difference, if it is higher then firms have to pay back the difference. The so-called strike price is determined in a reverse auction; that is, suppliers will offer a certain capacity of renewable power for a certain strike price. The company that offers the lowest price (subject to other criteria) will win the contract. The scheme is funded via the Supplier Obligation; that is, a kind of tax on electricity firms.

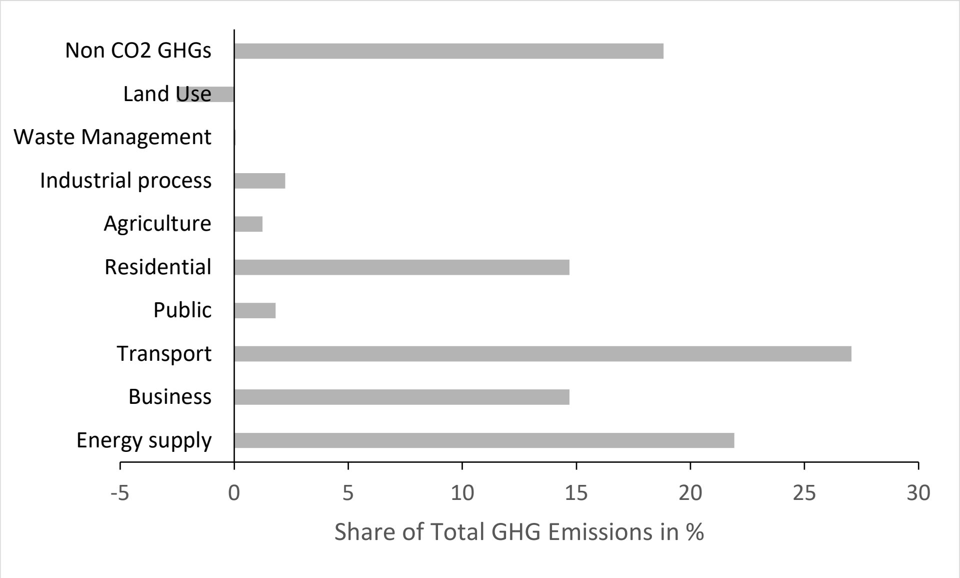
[6] This is in spite of the government's rather generous 'Plug in car grant' support scheme (first started in 2011).

fuel poverty and a public backlash more widely, this could be done by a revenue-neutral rebate scheme – that is, the money raised is paid back to households.

Even if this were to be done on a lump-sum basis (that is, everybody gets the same) this will be a progressive tax because poorer household consume less gas in absolute terms (even though this accounts to a larger fraction of overall spending).[7] If done right, it could, in addition, lead to support for rather than opposition to climate policies.[8]

The Labour Party has been most vocal about funding emission-reducing home improvements[9] as part of its election pledges. Combining this with an incentive scheme as outlined would allow the same benefits to be delivered at lower cost.

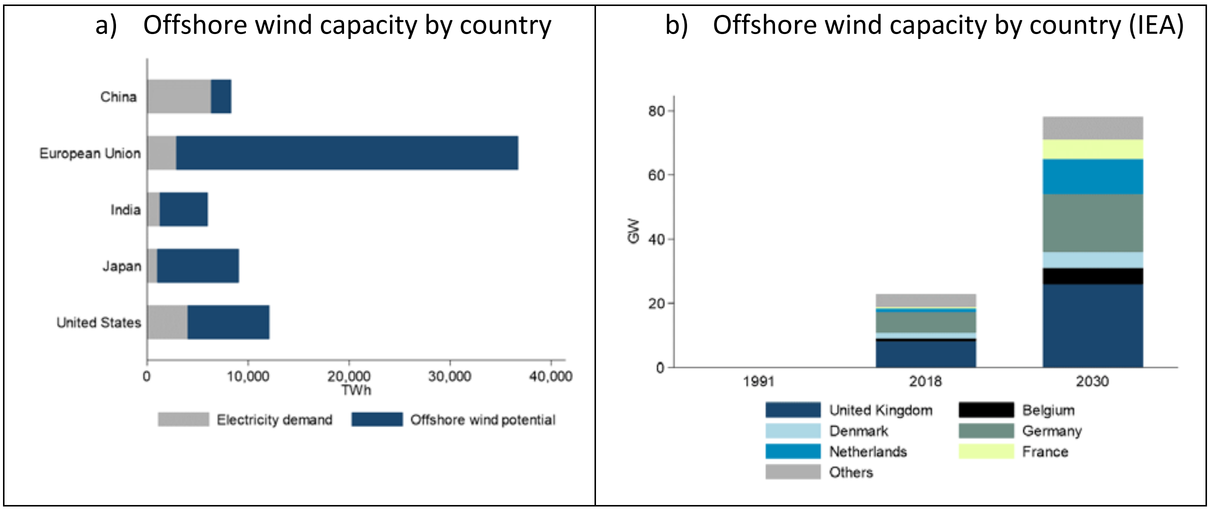
Figure 2: UK greenhouse gas (GHG) emissions and projections



Notes: The figure reports percentage shares in total 2018 emissions by the UK, which were 448 MtCO2e. 'Public' corresponds to public sector emissions (for example heating government buildings). 'Land Use' refers to forests and vegetation that converts CO2 back into its components. Non-CO2 GHGs include methane and nitrous oxide emissions that primarily arise in farming.
Source: Authors' calculations based on BEIS data.

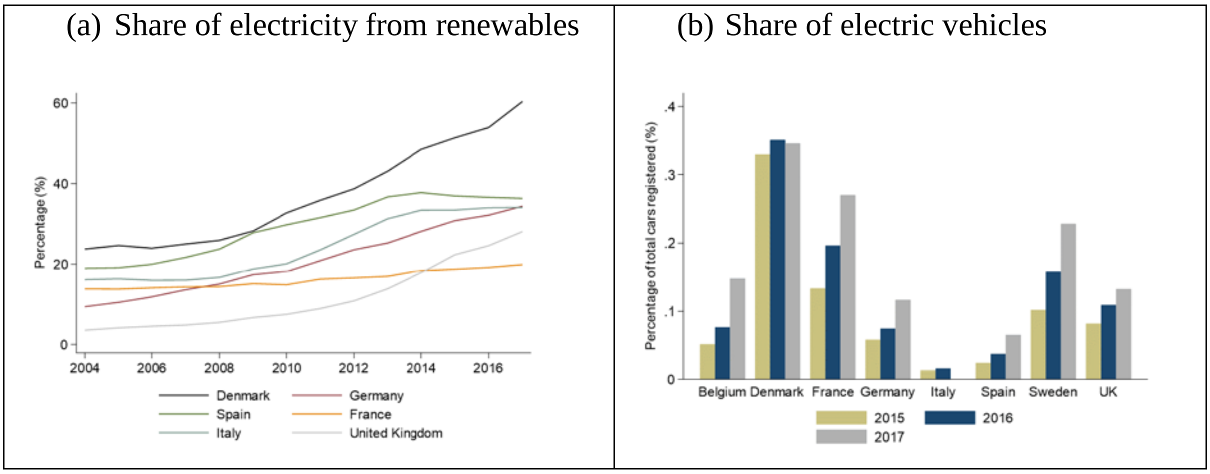
[7] Even without a change in behaviour, a £50 charge per tonne of CO2 would imply about £120 in extra cost for the average household. For the poorest households, this would only be about £90 because of their lower overall consumption – hence, a £30 net gain.
[8] For example, the government should start paying the lump-sum benefits before the tax rates are increased and make the rebate highly visible to recipients. A scheme along those lines has been implemented in British Columbia since 2008 and it has proven to be highly effective as well as popular (see Lacroix and Richards, 2015).
[9] https://labour.org.uk/press/labour-pledges-to-make-all-new-homes-zero-carbon-within-three-years/

Figure 3: The potential of offshore wind



Source: [IEA](IEA).

Figure 4: Adoption of clean technologies



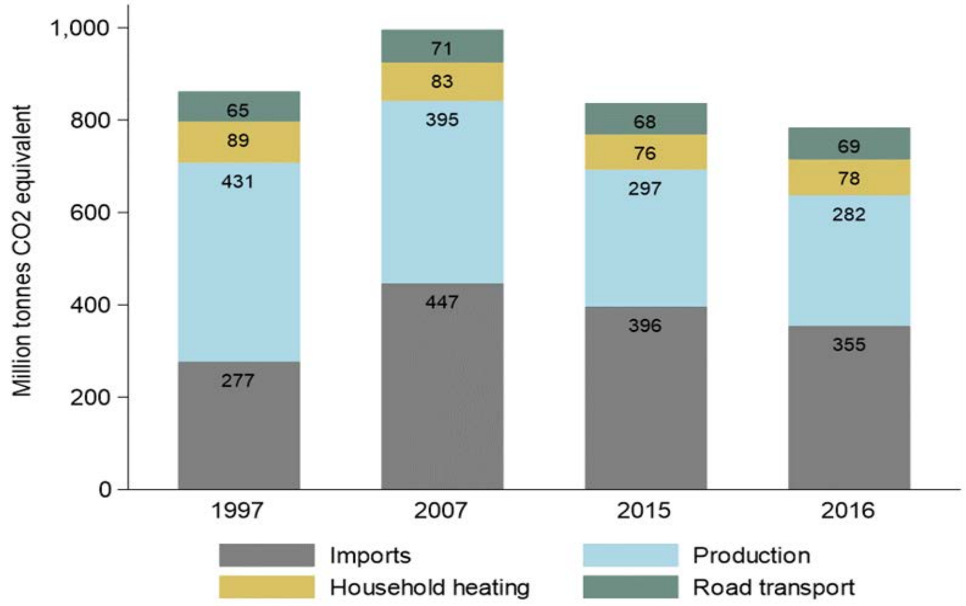
Source: Eurostat

What's the point of 'net zero'?

While the net zero pledge was certainly an attention-grabbing policy move, it is possible to question its rationale without being a climate change denier. Figure 5 illustrates one issue. More than most countries, the UK is good at avoiding emissions at home while pushing up emissions abroad through the goods that we consume.

For example, in 2007, this amounted to 447 MtCO2e, while emissions associated with goods produced and consumed in the UK amounted to only 395 MtCO2e. Things improved a bit in 2016 when emissions embedded in imported goods reduced to 355 MtCO2. But the UK still imports 43% more emissions than in 1997.

Figure 5: Consumption versus production emissions



Source: DEFRA

What's more, even if the UK managed to reduce both consumption and production emissions to zero, this would have very little effect on the actual climate, unless most other countries followed suit. One important channel in which the UK can affect what happens in other countries is by pushing the knowledge frontier on clean technologies and practices.

Figure 6 shows the share of clean, dirty and grey technology in total innovation activity (measured using patent filings) over time globally, as well as for clean innovation by country.[10] There are two important features. First, after a dramatic explosion in clean (and grey) technology from 2000 to 2010, there has been a dramatic collapse across both technologies and countries.

Second, the UK is a laggard when it comes to both clean car and clean energy technology. Moreover, like other countries, the UK follows the dynamic of boom and bust of clean technology innovation.

What is driving this dynamic? This is an area of continuing research. But one potentially relevant factor is government spending on R&D. After sharp increases in spending between 2000 and 2010, government spending on energy, and renewable energy in particular, flatlined or even decreased in many countries after 2010 (see Figure 6).

Overall, government spending on energy R&D in the UK improved somewhat after 2015. But this was primarily due to increases in spending on nuclear technology and energy efficiency. Spending on renewable energy technology remains low in the UK by international standards (see Figure 7). Overall spending on energy technology also remains low by historic standards. The UK (along with most other countries) spent substantially more on energy research during

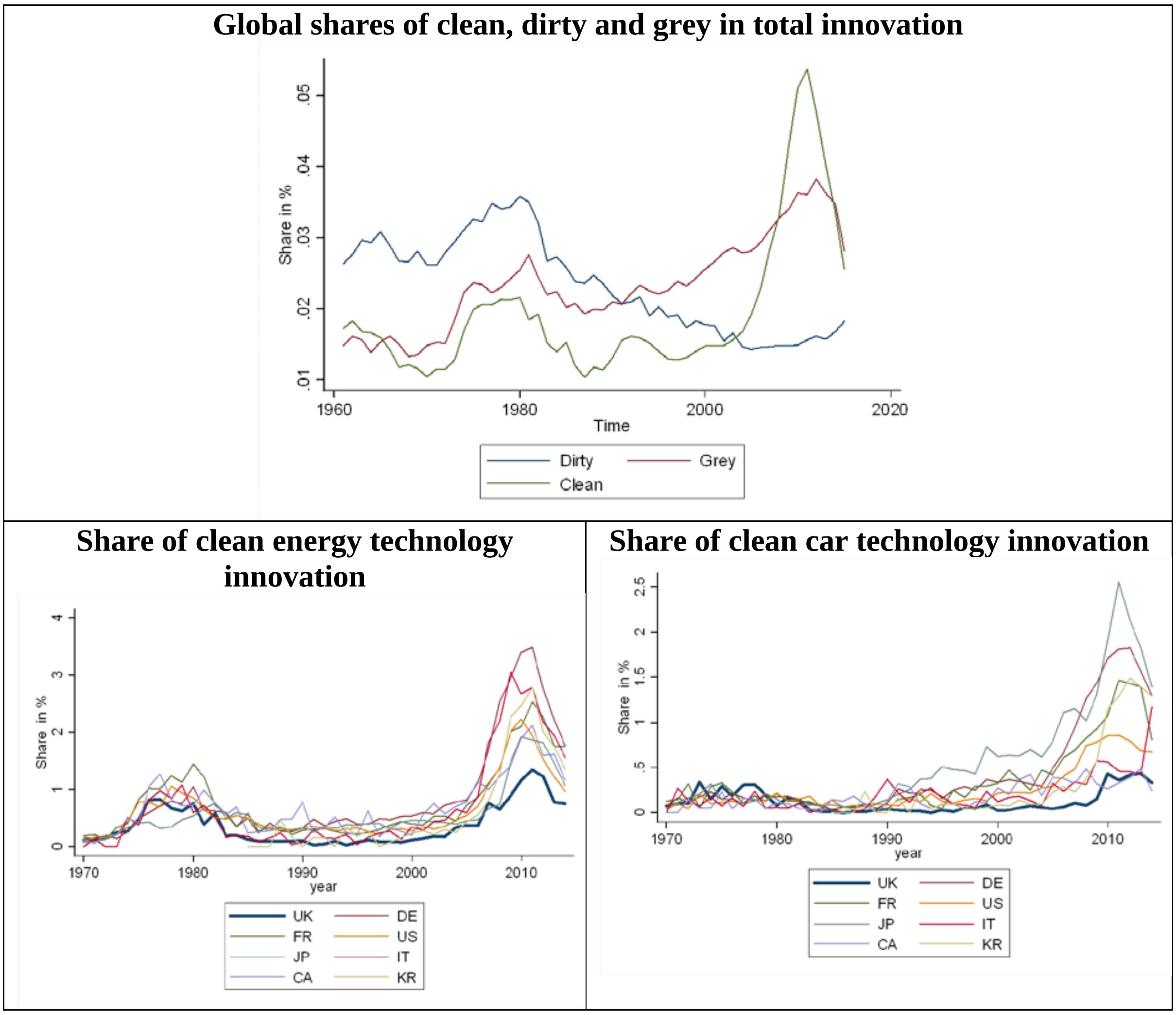
[10] Clean refers to non-fossil fuel-based technologies, dirty to fossil fuel-based tech and grey to technologies that make fossil fuel technologies less polluting.

the oil crisis of the late 1970s and early 1980s; for example, as Figure 7 shows, the share was nearly 0.1% of GDP in 1980 compared with less than 0.05% in 2018.

So what led to the decline in spending after 2010? A plausible factor is the strain on government budgets following the global financial crisis. This could well be a case study for what is going to happen to the UK policy-making in this area if Brexit goes ahead with further slow growth and pressure on government revenues in turn.

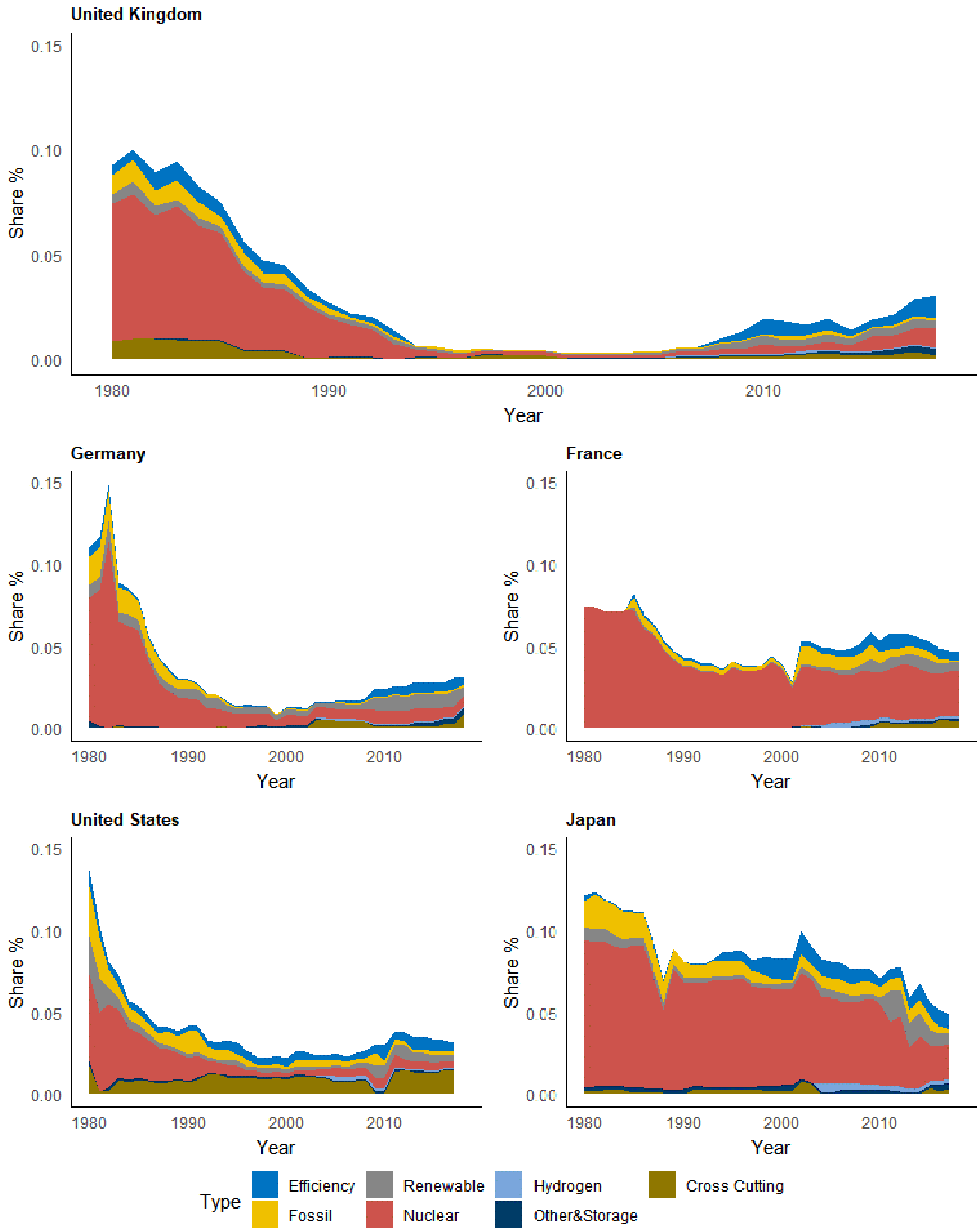
Recent CEP research has also suggested that the drop in clean energy innovation could, in part, be driven by the discovery of shale gas, which redirected energy R&D resources. This would have a similar effect to that of a recession in terms of the impact on emissions: a short-term respite if energy production moves from dirtier fuels such as coal to shale gas, but more emissions or more costly emissions reduction in the future due to the delayed investments in fully clean alternatives due to the strong path dependency of technological progress (Acemoglu et al, 2019; Aghion et al, 2016; Acemoglu et al, 2012). In this context, the suspension of fracking is very welcome and should be made permanent.

Figure 6: Clean versus dirty innovation



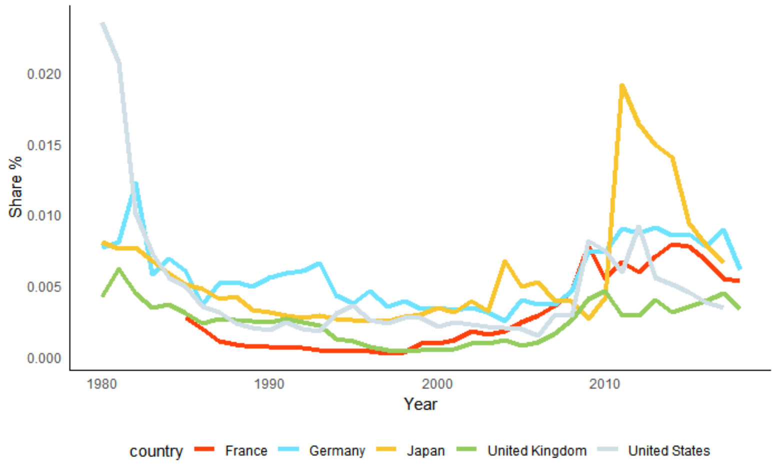
Notes: Clean refers to non-fossil-fuel-based technologies. Dirty are fossil-fuel-based technologies. Grey are technologies aiming to make fossil-fuel technologies less polluting and more efficient.
Source: Authors' calculations based on PATSTAT data.

Figure 7: Government R&D spending on various energy technologies as share of GDP



Source: Authors' calculations based on IEA data.

Figure 8: Government R&D spending on renewables as share of GDP



Source: Authors' calculations based on IEA data.

Climate policy as growth policy

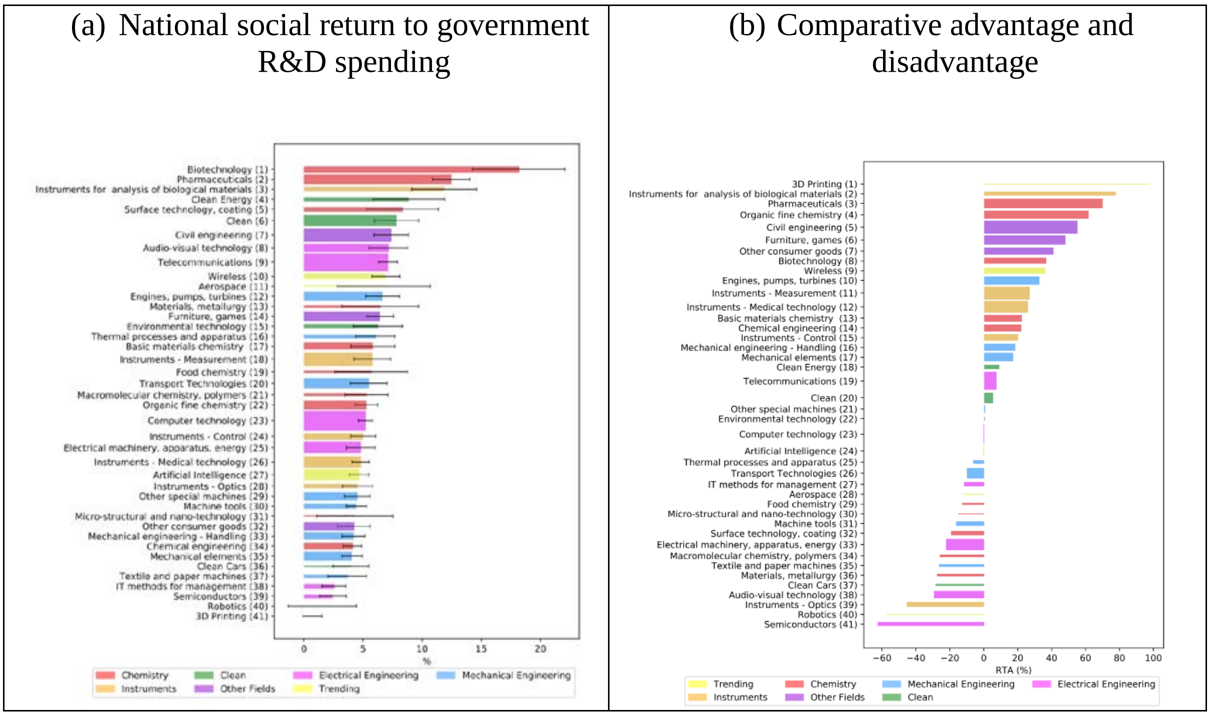
One reason why politicians sometimes get excited about clean technologies is the hope that they will not only help to solve climate change but also contribute to economic growth. But this depends on which green technologies we are talking about as well as on which technologies receive less funding due to an increase in funding to clean technologies.

What matters here are the knowledge spillovers from different technologies, as well as the response of different sectors to public R&D support. In a recent study (Rydge et al, 2018), we examine this taking account of both direct and indirect knowledge spillovers. Figure 9a shows estimates of social returns to government R&D spending that can be achieved in different technology areas. We see that for the UK, clean technologies – in particular, clean energy technologies – are high up the ranking, with returns of more than 7% on average. Only Biotech, Pharma and Instruments achieve higher returns than clean energy technologies.

This would suggest that directing more government resources towards clean energy technologies would be growth-enhancing as well as helping to address climate change. By contrast, clean car technologies are among the technologies with the lowest return (less than 5%).

In Figure 9b, we also report how the UK is specialised in various innovations fields relative to other countries. This reveals that at present UK is not overly specialised in clean energy technologies.

Figure 9: Comparing technology categories for the UK, 2005 to 2014



Notes: Panel (a) shows the average social return from government R&D investments in different technology area. To compute social returns, we take account of private and external (knowledge spillover) values that arise for innovators based in the UK only. Panel (b) shows the share of innovation in a particular technology in the UK relative to the share globally (minus 1); that is, positive value indicate areas of comparative advantage; negative values indicate comparative disadvantage.
Source: Authors' calculations based on PATSTAT data.

Brexit and climate change

There are also risks emerging from Brexit that go beyond reduced investment in clean R&D and infrastructure due to budget pressures. At present, large parts of UK climate policies are underpinned by EU regulation and it is not at all clear what will happen to policy design and stringency after Brexit.

For example, the EU ETS regulates and puts a price on nearly 50% of European as well as UK CO2 emissions from power plants, industry and aviation. The EU ETS has its shortcomings, but there is good evidence that it has reduced emissions and provided incentives for clean innovation.[11]

In principle, the UK could remain part of the EU ETS as do other non-EU countries (for example Norway and Switzerland). But the government has now proposed instead to introduce a carbon tax for firms previously regulated by the EU ETS.[12] It is not clear yet how the tax level is going to be set. In principle it could be lower, higher or exactly equal to the EU ETS price.

[11] See, for example, Dechezlepretre and Calel (2016), Martin et al (2014), Martin et al (2016).
[12] https://www.gov.uk/government/publications/meeting-climate-change-requirements-if-theres-no-brexit-deal/meeting-climate-change-requirements-if-theres-no-brexit-deal#actions-euets

But even a UK government committed to climate policy would find it hard to set a level higher than the EU ETS as it would endanger the competitiveness of firms relative to European firms at a time when they are already struggling due to Brexit. On the other hand, a government not committed to climate policy would find it easy to set a lower level or abolish the measure entirely.

There is also a risk that European climate policy overall becomes weaker after Brexit. The UK has been a driver of climate policy within the EU, particularly as a champion of market-based approaches to regulation such as the EU ETS. Taking this influence away raises concerns about the quality of future policy design and implementation.

Conclusion

Despite little government attention devoted to climate policy in recent years, there has been some progress. Notably, clean energy generation has been increasing on the back of a dramatic expansion of offshore wind power.

The net zero emissions target introduced by Theresa May at the end of her premiership was a symbolic milestone that needs to be backed up with a ramping-up of policies to support renewable deployment and research in clean technologies as well further incentives to reduce emissions (particularly in the domestic gas sector).

In doing so, UK policy-makers need to keep in mind that the policy objective must be to reduce global emissions. The UK can contribute to that most effectively by helping to develop, pilot and improve technology that will make a transition to clean technology the economically rational thing to do, even when not taking account of the potential damage from climate change.

By embedding support for clean technology in a wider industrial strategy and focusing on areas where social returns are highest, such a strategy can also contribute to more economic growth in the short run.

By reducing growth, Brexit may offer moderate respite in the short run when it comes to direct emissions in the UK. But it will make solving climate change harder in the long run if it reduces investment in pro-environment R&D and infrastructure.

There is also the risk that Brexit weakens domestic climate policy directly because much of it is based on EU rules and a UK government facing the economic challenges of Brexit might be easily tempted to compromise in this area. Moreover, the UK has historically been a force helping to advance the climate agenda within the EU and its absence in future could lead to a weakening of EU climate policy.

Further reading

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Ralf Martin is an Associate Professor of Economics at Imperial College Business School and Director of the Growth Programme of the Centre for Economic Performance.

Dennis Verhoeven is an Associate of the CEP Growth Programme and a Postdoctoral Researcher at KU Leuven.

Petra Sarapatkova is a PhD Student at Imperial College Business School.

For further information, contact:
Ralf Martin: r.martin@lse.ac.uk
or Helen Ward: 07970 254872, h.ward1@lse.ac.uk
or Romesh Vaitilingam: romesh@vaitilingam.com

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