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Paying for net-zero – The fiscal framework for the UK's transition to low-carbon energy

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Headlines

- The changes required for the United Kingdom (UK) to reach net zero greenhouse gas emissions in 2050, unlike the reduction in emissions that the UK has achieved so far, will directly affect the way the public uses energy, for instance in transport and heating homes. The cost to the economy of these changes will depend, amongst other things, on the willingness of consumers to adapt.
- The Committee on Climate Change (CCC) have estimated the various costs to society at 1-2% of 2050's GDP (£20–40 billion as a share of 2020's economy). It could cost less if technological and social innovation proceeds faster than expected. There are also a range of potential benefits to society, besides averting some of the effects of climate change.
- The UK government will need to adopt a judicious mix of carbon taxation, regulation, and direct intervention to pay for and achieve its net-zero emissions target.
- Direct technology-specific government intervention has proved the most effective way of bringing in new technologies, and driving down their costs, provided that the government chooses the right technologies.
- Carbon taxes have been effective in influencing how consumers choose between existing competing technologies.
- How the costs are distributed between energy consumers and taxpayers will depend on decisions made by the government.
- The public may be more accepting of taxes and other charges that pay for specified low-carbon infrastructure than they are of those with less specific purposes.
- The public will probably remain highly resistant to measures that appear unfair, for instance bearing disproportionately on low-income families or those (e.g. outside big cities), who are most dependent on their cars.
- A range of options have been proposed for addressing the regressive nature (most affecting the poorest) of high energy prices and taxes.
- A wide ranging public debate is needed to explore the most acceptable options and, hopefully, to win support and participation.

Contents

Grantham Briefings analyse climate change and environmental research linked to work at Imperial, setting it in the context of national and international policy and the future research agenda. This paper and other publications are available from **www.imperial.ac.uk/grantham/resources**

Introduction

The target of a net-zero economy

The Committee on Climate Change (CCC) recommended that the United Kingdom (UK) should transition to an economy that produces net-zero greenhouse gas emissions by 2050[1] and, in 2019, the government legislated accordingly.

The CCC estimates that achieving this target will require total investment in the range of 1-2% of 2050's Gross domestic product (GDP), or about £20-40 billion *per annum* based on the size of the economy in 2020, although there are many uncertainties. It says that if technological and social innovation exceeds expectations, as it has in the recent past, the costs could be lower. There will also be other benefits to society from achieving this 'net-zero economy', such as for health, equality and the environment.

Technological progress, especially in renewable electricity generation and electric batteries, has reduced the cost of low-carbon electricity and electric vehicles, but the costs of cutting emissions are expected to be higher for domestic heating, industry, and 'negative emissions' technologies that remove carbon dioxide from the atmosphere.

In the light of this, the CCC has called on the Treasury to "undertake a review of where the costs of the transition fall and develop a strategy to ensure this is perceived as fair."[2] This discussion paper runs over the background for this review.

Box 1: Distributing the burden of costs

A range of policy measures are available to the government to raise the costs required to achieve its target for a net-zero economy.

Carbon taxes – Ultimately paid by industries and consumers. The maximum cost is defined, but not the reduction of carbon emissions. The actual cost depends on the scope and cost of carbon reduction efforts.

Carbon emissions trading – Ultimately paid by energy industries and consumers. The level of carbon reduction is defined, but not the cost. The actual cost depends on scope and cost of carbon reduction efforts. Trading should enable the most cost-effective reduction options to be taken.

Government spending – Ultimately paid by tax payers or increases in government debt.

Regulation – Ultimately paid by energy industries and consumers. The burden to society will depend on solutions being available that comply with regulations, as well as peoples' willingness to make changes.

Economic principles

In principle, the transition to a net-zero economy could be delivered by carbon taxes or trading schemes; government spending funded from taxation or borrowing; or regulation (see Box 1). In practice, a combination of all three is likely. In some areas, a change in policy may be all that is required for private enterprises to roll out a sufficiently advanced technology. Success will depend on achieving a good balance between pricing, regulation, direct government intervention and other forms of influence.

Some leading economists believe that 'carbon pricing', which involves introducing a cost for emitting greenhouse gases by implementing taxation or carbon emissions trading schemes, is the most efficient measure for reducing emissions[3]. In recent years, major oil and gas companies have consistently lobbied governments in favour of carbon pricing[4].

In the UK, carbon taxes have been shown to be effective in influencing the choice between existing, reasonably-competitive, technology options. They can also influence longer-term investment provided that future tax levels are predictable. However, successive UK governments have not always stuck to longer-term carbon taxation policies.

As discussed below, direct technology-specific government intervention has proved effective in the UK for deploying and reducing the cost of new technologies. Experience suggests that the public are more accepting of taxes or other charges that pay for these low-carbon investments than they are of such charges with less specific purposes.

Regulation has also been highly successful in some sectors, such as vehicle-, and to some extent, building-efficiency. It imposes the costs on the regulated companies and, in all probability, their customers, and it works best where options exist that comply with low-carbon regulations.

As the UK emerges from a period of austerity, followed by the global effect of the Coronavirus pandemic, the scope for new spending on mitigating climate change from general taxation may be limited. It seems reasonable that the polluter (consumers or companies) should have to pay, at least to some extent, in the form of higher energy prices.

However, energy-related taxes, and higher energy prices in general, are unpopular. They tend to be regressive, meaning they fall disproportionately on the poor, and face strong social resistance, although a wide range of options are available to counteract this.

For example, a group of senior figures in the United States (US), including three former Treasury Secretaries, have proposed that the proceeds of carbon taxation should be paid back in equal amounts to all citizens as a "carbon dividend"[5]. Similar proposals have been made in the UK[6] and a recent report by the Grantham

Research Institute on Climate Change and the Environment at the London School of Economic and Political Science (LSE) has evaluated the role of carbon pricing versus complementary policy measures for each economic sector in the UK[7].

The province of British Columbia in Canada has introduced a wide-ranging carbon tax with most of the revenues used to compensate households and industries affected by price rises. The taxation rate has risen steadily to reach C$35 to C$40 per tonne of carbon dioxide in 2019 and governors plan to increase it further to C$50 per tonne in 2021. The package of taxation and compensation has retained public support[8,9].

Democratic politicians in the US have proposed the Green New Deal package of policies, in which measures to reduce greenhouse gas emissions are implemented as part of a wider programme of social reform[10].

Since 2007, the UK government has set a range of 'shadow' prices for carbon emissions that public sector bodies are expected to consider when weighing up the costs and benefits of their actions, but which are never applied. Updated in 2019, the mid-range or 'central' case will rise from £81 per tonne in 2030 to £231 per tonne in 2050[11]. When these shadow prices were introduced, they were judged necessary to reduce emissions by 80% by 2050. However, they neither take account of the newer target of net-zero emissions by 2050, nor the more recent reduced cost of renewable energy technologies and batteries, so may be subject to change in the future. As shown in Figure 1, most carbon taxes in the UK, where they apply, fall well short of these figures. However the tax on petrol and diesel fuel, if it is regarded as a carbon tax, is already in excess of this target tax level.

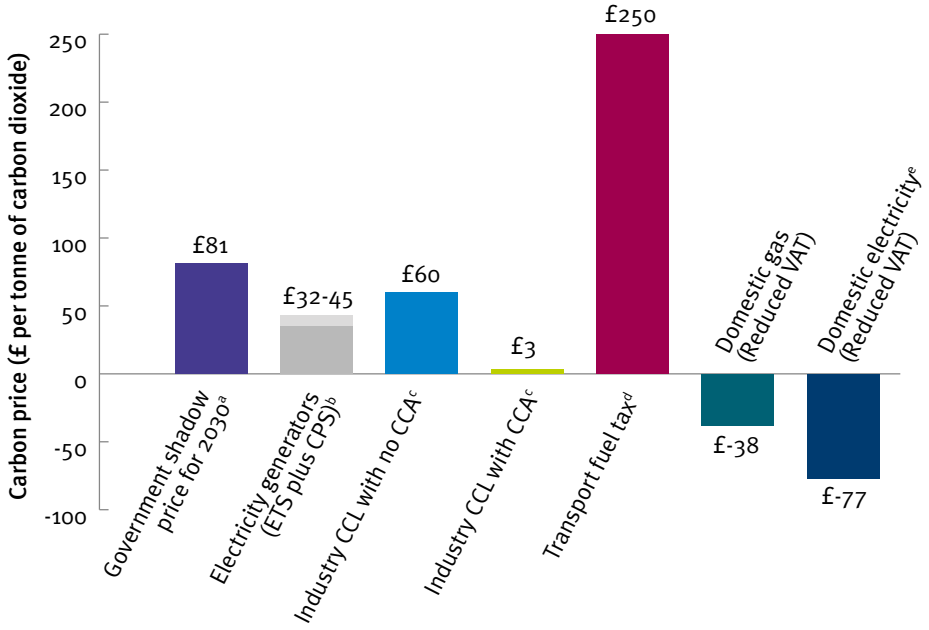
Electricity generation

The energy supply sector accounted for 24% of UK greenhouse gas emissions in 2017. Emissions declined by 60% between 1990 and 2017.

European Union Emissions Trading Scheme

The UK is a member of the European Union's (EU) Emissions Trading Scheme (ETS), a cap-and-trade system applying quotas to limit emissions from electricity generators and large scale industries, which has been running since 2005. The price of a unit of carbon emissions has been volatile, falling from around €15 per tonne of carbon dioxide in 2009 and 2010 to around €5 from 2012 to 2017, before rising to over €20 in 2018, following a set of reforms[12].

The UK may leave the EU ETS when it leaves the EU. In the 2018 budget, the government announced that it would introduce a 'carbon emissions tax' to replicate the ETS if circumstances mean the UK leaves the EU without any trading arrangements in place[13], however, ministers have said that the government's strong preference is to remain "highly aligned" with the ETS[14].



[a] The price that the government judged necessary to meet the previous target of reducing emissions 80% by 2050. It rises to £231 in 2050
[b] ETS: EU Emissions Trading System, CPS: Carbon Price Support
[c] The most energy intensive industries also pay the ETS, trading at around £20 per tonne of carbon dioxide. Industry also contributes to electricity sector carbon charges. CCL: Climate Change Levy, CCA: Climate Change Agreement
[d] High fuel taxes pre-date climate concerns and, in part, pay for roads
[e] Electricity sector carbon charges are, however, passed on to domestic electricity consumers

Figure 1: Simplified picture of carbon taxes in the UK

Carbon Price Floor

In 2013, the government introduced the Carbon Price Support (CPS) as a carbon tax on electricity generation. It was intended to top up prices in the EU ETS, which were considered at the time to be erratic and low, so that the two levies would add up to a more stable Carbon Price Floor (CPF). The original plan was that the CPF would rise steadily to reach £30 per tonne of carbon dioxide in 2030[15]. In 2014, the CPS was frozen at £18 per tonne of carbon dioxide until 2020, and in 2016, the price-freeze was extended to 2021[16]. However, the recent rise in the price of carbon emissions in the ETS to over £20 per tonne has lifted the total effective tax rate in the UK (ETS plus CPS), to between £35 and £45 per tonne of carbon dioxide.

In the 2017 autumn budget, the government said it was confident that the total carbon price created by the combination of the ETS and CPS was set at the right level, and that it would continue to aim for a similar total carbon price until 'unabated' coal (power stations without carbon capture technology) was no longer used for electricity generation. This was intended to deliver a stable carbon price while limiting the cost to energy businesses and energy consumers. The government has recouped about £1 billion *per annum* in receipts from Carbon Price Support in recent years[17].

The EU Large Combustion Plant Directive (2001/80/EC) and the Industrial Emissions Directive (2010/75/EU) have also played a part in the decline of coal in the UK. The government has said that it will regulate to phase out coal power altogether by 2025[18].

Renewables support

The government has undertaken a series of programmes intended to attract further investment in renewable energy, by supporting the price of electricity that has been generated by sources like solar and wind generators. The Renewables Obligation, which imposed quotas on carbon emissions from industry, was followed by a system of Feed-In Tariffs (FIT), which fixed prices, then, most recently, the auctioning of Contracts for Difference (CFD), also a system to fix prices. The Treasury estimates that these will cost consumers £7.9 billion in 2019-20, rising to around £8.5 billion *per annum* by 2025, before declining gradually as older contracts expire (which had been agreed when the cost of energy was higher). The Treasury has said that there will be no new "low-carbon electricity levies" until these costs start to fall, with the exception of up to £557 million for further CFDs that was promised in the government's Clean Growth Strategy[19] in 2017. However, these policies have been successful in driving down the cost of renewables so that, for instance, depending on future gas prices, onshore wind turbines are expected to be the cheapest way to build new capacity for generating electricity. Prices for electricity from offshore wind in the 2019 government auction were less than wholesale electricity prices[20].

Capacity payments

The National Grid undertakes a series of auctions to purchase generating capacity between one and four years ahead of time. The objective is to ensure security of supply as the market-share of renewables increases. So far, energy regulator Ofgem have committed £3.8 billion between 2020 and 2022, with more than 60% intended to support energy generation from fossil fuels, especially in combined cycle gas turbine (CCGT) plants (44%)[21].

Regulated energy sector

The UK electricity and gas transmission and distribution systems are monopolies subject to regulation by Ofgem. The energy network companies have invested over £100 billion in national and local grids since 1990, and this rate of investment is set to increase as part of the transition to a net-zero economy. This regulation, which directly affects the future shape of the electricity system, is passed on to electricity and gas consumers through their bills[21].

Discussion

By far the most successful use of taxation has been the combination of the EU's ETS and the UK's CPF. This has been credited with the rapid decline in electricity generated by burning coal, which has led to the greatest reduction in UK greenhouse gas emissions over the past decade.

These measures have been successful because coal power stations are by far the most polluting and their decline was the 'low-hanging fruit' of climate policy. The UK had already closed its own coal mining industry, which limited the social costs, in terms of jobs lost in the UK. The small difference in cost between coal and both gas and renewable generation allowed energy producers to take up government support for renewables and switch from coal with little cost to the customer. Consequently, it was possible to drastically reduce emissions with limited impact on costs paid by electricity consumers.

Carbon taxes will have less influence over electricity generation after the most polluting fossil fuel, coal, disappears from the equation. The amount of gas power that is required will then largely depend on the availability of wind and nuclear power (which have low operating costs), and tax revenue will eventually decline as gas generation also declines. Most new electricity generation will be procured by the government through auctions of CFDs or capacity payments. However, carbon taxes that raise the price of fossil electricity may incentivise new creative ways to generate further electricity or efficiency gains, such as 're-powering', or extending the life of, wind turbines beyond their contract length. There is a case for increasing the price of fossil fuel electricity through the CPF mechanism, but, at some stage, the additional cost to consumers ceases to outweigh the benefits of reduced greenhouse gas emissions.

By far the largest financial commitment to emissions reduction has been government support for renewable electricity generation, especially wind power. Costs have fallen dramatically and offshore wind is now increasingly competitive with other sources of generation. However, as the market- share of technologies with low operating costs, such as wind and nuclear, increases, electricity prices will become increasingly erratic. The government may need to continue to guarantee the price of electricity to consumers in order to secure investment in new generating capacity.

So far, the cost of support for renewables has ultimately been paid by electricity consumers. In principle, this is socially regressive since fuel costs account for a larger share of the spending of lower-, as compared to higher-, income families. This seems to have been accepted on account of the popularity of renewables and partly because improving efficiency in electrical and gas appliances has reduced households' energy demand, thereby masking any increasing utility bills. According to the CCC, with the sharp decline in the cost of renewables, and as the older and more expensive price contracts run out, there should be some further capacity to finance new low-carbon measures without increasing consumers' bills.

In 2020, the costs of investing in the net-zero energy system are fairly modest, but they are expected to increase as renewable energy makes up a larger percentage of the total energy generation – unless the cost of battery technologies continues to fall rapidly.

According to the CCC, available evidence suggests integrating low-carbon infrastructure into the existing energy system could cost £10-25 per megawatt hour (MWh) for a system consisting of up to 50-65% renewables, but could increase further as the percentage increases.

The CCC estimates that meeting the UK's projected increase in electricity demand with conventional gas generators would cost around £46 billion *per annum* in 2050. Its projected low-carbon system would cost an additional £4 billion *per annum*. This captures the majority of costs associated with mitigating the intermittent nature of renewable electricity from solar and wind generators, such as the costs of building back-up generation, and the costs of building and running reserve and response generators. The CCC assumes that 100% of electricity in this system comes from low-carbon sources, made up of intermittent renewables (57%); nuclear power, or fossil fuel plants that capture and store the greenhouse gases they emit (38%); and low-carbon gas such as hydrogen (5%)[22].

A flat-rate government guarantee on the price of renewable electricity would substantially insulate the renewables industry from the costs of mitigating its own intermittency. It has been suggested that the industry should carry greater responsibility for managing intermittency, perhaps by bearing a greater share of the costs or being required to guarantee electricity supply[23].

The answer hinges, in part, on whether the renewables industry is best placed to manage the intermittency of the whole energy system, but there will eventually be a trade-off between more renewables and more investment in stabilising solutions such as storage, flexible demand, smart grid and international interconnections. Requiring the renewables industry to bear a greater share of the costs of guaranteeing electricity supply could help to find the optimum solution.

As the costs of renewables continue to fall, the electricity sector may be the best placed to finance its own transition. Much depends on future reductions in the cost of investing in seasonal storage and other solutions, such as demand flexibility[24].

Business and industry

The business sector accounted for 17% of UK greenhouse gas emissions in 2017. Emissions declined by 30% between 1990 and 2017.

The EU ETS

In addition to electricity companies, energy intensive industries also pay the EU ETS, however, concessions are granted to some. In the current trading period (2013-2020), for example, 43% of quotas have been issued freely to companies considered most at risk from international competition, though this proportion is expected to fall in the future. Nearly a half of the UK's carbon dioxide emissions are covered by the ETS.

The Climate Change Levy

The Climate Change Levy (CCL) is a tax on all significant business energy users. Since April 2019, the rates have been equivalent to approximately £60 per tonne of carbon dioxide for electricity and £68 per tonne for gas[25]. However, businesses in sectors that enter Climate Change Agreements (CCA) to improve their energy efficiency qualify for reductions of 95% on electricity and 65% on other fuels. According to the Environment Agency, CCAs in 2016 reduced emissions by 15% (equivalent to 7.8 million tonnes of carbon dioxide) compared to the level in 2008[26]. However, assessments of the effectiveness of CCAs in achieving genuinely incremental carbon reductions have varied[27]. A 2009 Grantham Institute Working Paper concluded that, had the CCL been implemented at the full rate for all businesses (i.e. without the concessions available to CCAs), "further cuts of energy use of substantial magnitude could have been achieved without jeopardising economic performances"[28].

The Climate Change Levy raised just under £1 billion in 2017-18[29].

Compensation for energy intensive industries

In the 2014 budget, the government announced a compensation package of support worth £3 billion for the most energy intensive industries that are subject to international competition, intended to protect them from the impact of

government-mandated carbon reduction and renewables support measures. It expected this compensation to cost around £500 million *per annum* from 2016-17.

Discussion

The CCL is a hybrid between regulation and taxation. It seems to have been moderately successful in recent years and there is a good case for its continuation, raising the levy towards the government's shadow price and raising the ambition for CCAs. However, there are some businesses, mainly heavy industries operating at very high temperatures, for which low-carbon alternatives are not readily available. In these cases, technologies such as Carbon Capture, Use and Storage (CCUS), or the use of hydrogen as a low-carbon alternative to natural gas, are possible options. However, more research into such innovative technologies will be needed to crack these problems before effective taxation or regulation can be introduced.

The perceived problem with raising taxes, or indeed imposing costly regulations, on UK businesses and industries is their exposure to international competition. No government wants to see its industries handicapped in international markets and, equally, there is no merit in measures that lead to firms migrating to countries where they are less regulated. The true extent of this problem is, however, disputed. In June 2016, the World Bank concluded: "So far there is little evidence that carbon pricing is reducing economic competitiveness"[30]. Some propose introducing 'carbon border taxes', tariffs that reflect the greenhouse gases emitted in the manufacture and transport of imported goods, in order to protect energy intensive industries in their home markets and potentially also to stimulate emissions reduction abroad. Such taxes are under debate in the EU today[31], but they are highly contentious with nations in the early stages of industrialisation.

Transitioning to net-zero emissions in industry is inevitably, to some degree, an international challenge. Working out an acceptable way to protect industries that are subject to demanding emissions-reductions regimes should be high on the agenda for international climate diplomacy.

Land transport

The transport sector accounted for 27% of UK greenhouse gas emissions in 2017. Emissions fell by 2% between 1990 and 2017.

Fuel taxes

Transport has now overtaken electricity generation to become the highest emitting sector in the UK[32].

Transport is already a major source of government revenue in the UK. Petrol and diesel fuel are heavily taxed, at 57.95p per litre, and VAT at 29% is charged on the full price. In 2016-17, the government received £27.9 billion from fuel duty and £5.9 billion from vehicle licensing (vehicle excise duty). Less than half of this income is spent on roads[33].

Not surprisingly, successive governments have seen fuel tax as a financial opportunity. In 1993, the government instituted a 'fuel escalator' under which fuel tax would be increased by the rate of inflation plus 3%, and in 1996 this was increased to plus 6%.

But, fuel taxes are regressive and unpopular. In 2000, a protest, led by lorry drivers blocked access to the UK's main petrol distribution centres and, faced with a national crisis, the government cancelled the escalator. The fuel tax has remained approximately constant in nominal terms since then and has therefore declined in real terms[34,35]. *The Sun* newspaper continues to run a "freeze the tax" campaign and the *gilets jaunes* (yellow vests) protests, which began in 2018 in France, have also illustrated acute public sensitivity towards fuel taxes. In contrast, it is rarely commented upon that local bus fares have more than doubled, in nominal terms, since 2000[36].

Since UK fuel tax is now *lower* than it was before climate change became a broadly-held political concern, it is hard to categorise it as a carbon tax. Nevertheless, it has created a large economic incentive, equivalent to nearly £250 per tonne of carbon dioxide, for better fuel economy and the adoption of electric or other non fossil-fueled vehicles.

Emissions standards

EU emissions standards are another influential government intervention in the vehicle market. The EU has set a target that car fleets must see their emissions reduce by 37.5% by 2030, from an average of 95 grams of carbon dioxide per kilometer in 2021[37]. This is expected to force significant growth in the use of electric vehicles. The average emissions coming from a new car sold in the UK in 2018 was more 30% less than it was in 2000, mainly as a result of adherence to these standards[38].

The government has said that it intends to ban the sale of new conventional petrol or diesel cars by 2040, aiming to see ultra-low emissions vehicles making up at least 50% of new car sales and up to 40% of new vans, by 2030. However, following advice from the CCC, the government has said that it will consult on bringing the ban forward to 2035 and also ruling out hybrid vehicles that run on both electricity and fossil fuels[39].

Discussion

It will be important for the UK to maintain the momentum of reducing vehicle emissions after leaving the EU.

The government's targets for phasing out conventional vehicles are essential to creating a net-zero economy by 2050. Initially, this needs to be driven by tightening vehicle emissions standards and subsequently by an outright ban on petrol- and diesel-powered vehicles. Today, electric cars are significantly more expensive to buy than petrol cars, but with lower running

costs. The International Energy Agency (IEA) expects that electric cars and light vans will be the same cost to buy and run as conventional vehicles in the UK by 2021, so, provided there is time for the industry to adapt its manufacturing capabilities, and that adequate charging infrastructure is in place, there may not be a significant burden on people who purchase a new vehicle, at or around, this time.

Getting existing petrol and diesel cars off the road by 2050 may be more difficult. The average life of a new car in the UK is 14 years[40], but, as visitors to Cuba know, this can be extended almost indefinitely through enhanced efforts to repair and replace components. 33% of households with the lowest 10% of incomes own cars; 47% of the lowest 20% income earners; and 57% of the lowest 30% earners. Two thirds of commuting trips are made by car[41]. It is also reasonable to assume that many relatively poor people own older second-hand vehicles. Therefore, the impact of removing older conventional vehicles from the road, if done compulsorily by regulation, would be regressive and politically unfavourable[42].

The CCC has urged the government to bring forward the date when the sale of new conventional cars are banned to 2035, or even 2030. The government has now agreed to bring the date forward to 2035, subject to consultation. This move allows more time to retire existing petrol and diesel cars by 2050 and to develop a market in lower-cost second-hand electric cars. It should also reduce the need for an scrappage scheme to get conventional cars off the roads, which would be socially fair but costly to the government[43].

On the funding side, the government's revenues from the taxation of petrol and diesel fuel are of the same order of magnitude as the total investment needed to meet the net-zero emissions target, so the handling of these will be crucial for the fiscal balance.

As the proportion of electric vehicles grows, the government will need to find other sources of revenue to compensate for the reduced income from fuel tax. Road taxes are the likely mechanism, because they can also be structured to help address the problem of congestion. Ideally, the government would introduce road taxes within the next decade and increase them gradually as fuel tax revenues decline. Fuel tax will become increasingly regressive as wealthier motorists acquire electric vehicles and those with older conventional vehicles remain paying both fuel tax and road tax. Finally, a generous scrappage scheme may be required as a necessary incentive for the last of these older vehicle owners.

According to the Institute of Fiscal Studies (IFS), income from fuel duties has fallen by 17% as a result of inflation since 2010–11 (at a cost to the exchequer of £5.5 billion in 2019–20), and by an additional 12% relative to the plans that were inherited by the coalition government in that year (at a cost of £6.7 billion)[44]. Raising fuel duties at least in line with inflation would further incentivise energy efficiency in vehicles and at home, and the take-up of electric vehicles. Furthermore, the income could fund a major scrappage scheme as well as investment in vehicle charging infrastructure.

However, motoring taxes are deeply unpopular across the world and, in the absence of a wider cultural shift, governments will be reluctant to increase them or, indeed, to innovate at all[45]. Taxes and other charges specifically related to cutting urban congestion and pollution seem to be more palatable, as well as higher charges on larger and more polluting vehicles. Notably, however, the highly visible Congestion Charge in London has not raised a great deal of money (£250 million in 2016-17) and has been quite costly to run (about £80 million *per annum*)[46].

Domestic heat

Direct emissions from the residential sector (mainly from natural gas, domestic heating and cooking) accounted for 15% of UK greenhouse gas emissions in 2017. Emissions declined by 16% between 1990 and 2017.

Taxation

VAT is charged at 5% on domestic electricity and gas, compared to the standard rate of 20%. The cost to the exchequer of lowering this rate is approximately £2.3 billion *per annum* for electricity and £2.1 billion *per annum* for gas. The value of the reduced rate to the consumer is £38 per tonne of carbon dioxide for gas and £77 per tonne for electricity[47].

Regulation

The government intends to ban gas central heating for new homes from 2025[48]. For existing homes, it is not yet clear whether the most promising alternative involves electric heating with heat pumps or converting the gas network to deliver hydrogen (or other low-carbon gas). Either way, the cost of home heating is expected to rise. The CCC have estimated the total cost of bringing buildings into line with the UK's net-zero emissions future, of which substituting for domestic gas is the largest part, at £15 billion *per annum* by 2050.

Energy efficiency

The relative inefficiency of the UK's housing stock is a major problem. Only about 30% of UK homes meet the government's basic target, achieving a 'C' graded Energy Performance Certificate (EPC)[49]. Efforts to upgrade the stock have stalled, with the number of homes in England adopting significant energy-efficiency measures declining from more than 600,000 in 2013 to less than 200,000 in 2017-18.

In 2007, the government announced a policy of requiring all new homes to be zero-carbon by 2016. But in July 2015 the policy was dropped to promote house building[50].

Discussion

Domestic heating probably represents the most difficult challenge for the UK to meet its ambition for a net-zero economy in 2050.

The UK is building new houses at an annual rate of less than 1% of the existing stock, so the bulk of the problem is in converting, or 'retrofitting', the heating systems of existing houses. This will be costly and, so far, there is no agreed technical solution or strategy. The CCC identify heat pumps, hybrid heat pumps, and district heating in conjunction with hydrogen gas networks as likely options.

The CCC's plan is to concentrate on enhancing energy efficiency over the next few years – which will be needed anyway to improve the poor public health suffered by people in substandard housing. They call on the government to publish a low-carbon heat strategy within the next year and phase out fossil fuels from buildings that are not connected to the centralised gas network before 2030. This would lead to regulations being in place by 2035 that require "almost all replacement heating systems for existing homes must be low-carbon or ready for hydrogen, such that the share of low-carbon heating increases from 4.5% today to 90% in 2050."

The CCC recommends this final, and most difficult, stage of decarbonising heat in buildings takes place late in the programme. It expresses the hope that investment will become available since the costs of technologies in other parts of the programme will have dropped by then. However, the particular problems of paying for the transition to net-zero emissions domestic heating is one of the reasons why the CCC has requested a Treasury review into how best to fund the transition to a net-zero economy.

The absence of any carbon tax or other charge, and the lower than standard rate of VAT, mean the UK is effectively subsidising the gas industry and incentives are running in the wrong direction. Without a change in public opinion, it would be difficult to win popular acceptance for tax increases. The CCC may be right when it says that the most realistic medium-term option is for the government to rebuild a programme that promotes energy efficiency in homes. But, even this will require generous incentives, such as offering low-interest loans to fund the retrofitting of low-carbon heating technologies in existing homes.

Fossil fuel subsidies

Oil and gas taxation

UK oil and gas producers pay 30% Corporation Tax on their profits, which is higher than the rate of 20% that applies to other industries. They also pay a Supplementary Charge, an additional tax on profits, set in 2019 at 10%. In recent years, the government has varied the level of the Supplementary Charge to reflect shifts in the price of oil[51,52].

However, these companies are allowed to deduct the costs of decommissioning old offshore oil and gas platforms, such as those in the North Sea, from previously taxed profits, leading to substantial repayments of taxes already paid. These repayments have been returning about £1 billion *per annum* in recent years. The companies are also allowed to bring forward the deduction of current investment costs from taxable profits ('accelerated depreciation') and, in the case of onshore fields (including 'fracking' for shale gas), and less profitable offshore fields, to deduct more than 100% of the investment cost ('enhanced depreciation')[53]. Such concessions are becoming more common as the UK's remaining oil and gas fields tend to become smaller and less profitable.

The government's total tax revenues from oil and gas production reached a peak of £12.4 billion in 2008-09. Since then, they have been highly variable, turning negative in 2015 and 2017 (when the decommissioning refunds were issued), before rising to £1.2 billion in 2017-18[54].

Support for exports of fossil fuel technology

The UK's export credit agency, UK Export Finance (UKEF) is estimated to have provided £551 million of support for fossil fuel related projects per year between 2014 and 2016, which was by far the largest share of its energy portfolio.

Export credits for fossil energy were the subject of a 2019 inquiry by the Parliamentary Environmental Audit Committee. The Committee described this practice as the "elephant in the room", undermining the UK's international climate and development targets. They recommended that UKEF should end support for new fossil fuel projects by 2021, and should align its work with the national effort to achieve a net-zero economy by 2050[55]. The practice has also been criticised by the former Secretary-General to the United Nations, Ban Ki-moon. "These figures and policies are hard to reconcile with the UK's commitments under the Paris Agreements", he said[56].

Does the UK 'subsidise' fossil fuels?

In 2009, the G20 group of major economies agreed to phase out what it calls "inefficient fossil fuel subsidies"[57] and, in the same year, the G8 group of highly industrialized nations including Russia called for progressive reduction. In 2016, the G7 (formerly the G8, renamed after Russia was disinvited in 2014) set a deadline to achieve this by 2025.

However, there is no agreed definition of what counts as an inefficient fossil fuel subsidy for this purpose, and various international organisations and NGOs look at this in different ways.

The IEA's definition focuses on policies that lead to fossil fuel energy being sold at less than the international market price. On this basis, they estimated fossil fuel subsidies world-wide to be worth $548 billion in 2013[58]. By far the largest subsidies are in major oil and gas producing countries where oil, gas and electricity are commonly sold at below international prices. It is on the basis of this definition that the UK government has said that it does not subsidise fossil fuels.

The Organisation for Economic Co-operation and Development (OECD), on the other hand, in its definition of fossil fuel "support", includes all government measures that either help fossil fuel producing industries or lower the cost of their products to consumers. They estimated total UK support in 2014 to be over £3.5 billion[59]. By far the largest components were the reduced rate of VAT on domestic gas and exemptions from petrol duty of oil not used for transport.

In 2019, the European Commission published a report[60] with a figure showing UK support for fossil fuels as €11.6 billion in 2016. The study[61] that this is based on took a broader approach than the OECD[62].

A paper published by the International Monetary Fund (IMF) in 2015 adopted a radically different approach to the concept of energy subsidies[63]. Here, subsidies are the difference between the actual price paid by consumers and a rational price that includes local and global environmental costs. On this basis, global energy subsidies are far higher than those estimated using the IEA or OECD method, at $4.9 trillion, or 6.5% of global GDP in 2013.

Discussion

Whether the UK 'subsidises' fossil fuels, or not, depends on the definition that you adopt. The UK does not sell fossil fuels below international market price and, generally, the UK taxes oil and gas production more heavily than other sectors of the economy. However, the government does have a policy of "maximising the potential economic value of remaining oil and gas reserves"[64], and provides tax incentives for new developments to achieve this. The government provides support for fossil fuel-related technology exports. And the government does not have an overall tax regime that systematically reflects the environmental costs of fossil fuels.

Today, the UK uses more fossil fuel energy than it produces, so a reduction in its oil or gas production would lead to an increase in net imports. But, as the UK approaches net-zero emissions, the government will have to align its policies for oil and gas investment with its overall climate policies.

Conclusions

Facing up to the costs of achieving the net-zero economy and net-zero emissions target for energy is not something that can be left to the Treasury. There is a limit to the contribution that can be expected from general public funds, especially as the UK economy emerges from a period of austerity and the global Coronavirus pandemic. Public funding can be a very inefficient way of financing the changes that are needed. The financial cost cannot be predicted, but is closely linked to the pace of technological development, as well as the willingness of the public, and of business, to adapt; specifically to switch to electric vehicles and public transport, to accept the higher energy taxes needed to upgrade the energy efficiency of our homes, offices and factories, and eventually to adopt new heating technologies.

Extensive public debate is needed around these issues. Some increase in fuel costs seems inevitable, at least during a transition period, and there must be a mechanism for protecting poorer families. The government and the CCC can help to clarify the options, but civil society needs to take a leading role in promoting debate and finding acceptable solutions to the fiscal challenges of creating the net-zero economy.

Eventually, technological solutions may go part of the way to creating a net-zero future for energy-intensive industries that face international competition. But a degree of international cooperation will also be required. Unless some way can be found to level the playing field with countries that regulate greenhouse gas emissions less, the UK government will have to pay most of the cost from public funds. This needs to be high on the agenda for climate diplomacy.

The government will need to bring its policies for promoting trade promotion and, eventually, the domestic oil and gas industries, into line with its vision for a net-zero emissions economy. That will place a burden on public finances, especially as the government continues to fund the de-commissioning of North Sea installations through clawing back of taxes paid in the past.

Finally, as carbon intensive sectors of the economy decline, government industrial strategy will need to promote industries of the future that can take their place.

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