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INTELLIGENCE UNIT

Energy Insecurity

A year on from the 'Powering Up Britain' strategy, Government policy is pushing the UK backwards on energy security.

March 2024

EXECUTIVE SUMMARY

In March 2023, the Government published its *Powering-Up Britain* strategy, with "plans setting out how the government will enhance our country's energy security".

At the time, experts raised concerns about the focus on UK production of fossil fuels that could have only a negligible effect on our energy import dependence, and the limited drive for renewables and energy efficiency that would boost our energy security.

In the year since, the Government seems to have doubled down on this approach.

The Prime Minister made a public speech in September 2023 in which he announced a series of policy changes that will prolong the UK's dependence on oil and gas.

He announced the scrapping of regulations to improve the energy efficiency of private rental homes, that would have led to 2.4milllion households using less imported gas for heating. He announced the scrapping of plans to replace oil boilers, that would have led to 1million households using no imported oil for heating. And he announced a change in the ICE phase-out that contributed to a projected fall in sales of 2.8million EVs that would have allowed more drivers to avoid imported oil and fuels.

The Government disbanded the energy efficiency taskforce that was advising on cutting energy demand by 15%. It also recently delayed the Clean Heat Market Mechanism (CHMM) that would have accelerated heat pump sales and so reduce gas imports. And administrative misjudgements have slowed the deployment of offshore wind farms, which displace gas power generation and cut gas imports.

The Government also introduced a Bill to require annual licencing that might lead to more oil and gas production, and recently prioritised gas power plants in the Capacity Market at the expense of technologies that would reduce gas imports.

Analysis shows that the reduction in UK-based electricity generation due to delayed offshore wind farms could be 22x larger than the electricity that could be generated as a result of new licences for gas exploration. The UK could suffer a cumulative net loss of about 150TWh of electricity production based on UK offshore wind by 2030, a shortfall that would have to made up partly (and maybe mostly) by generation using imported fuels. Replacing this lost wind generation with gas power would drive up gas imports by 300TWh over six years.

Similarly, by delaying the ICE phase-out, meaning fewer EVs on the roads (running largely off UK-generated electricity), UK drivers could use a cumulative total of 55TWh more energy by 2030, and 65TWh more imported energy.

Energy Import Dependency

The UK's energy imports have been growing for a number of years. This has happened largely due to North Sea oil and gas production making their predicted decline. The issue of energy import dependence gained greater prominence during the gas crisis that highlighted risks to our energy imports.

Current Status

Oil and gas are by far the biggest factors determining this energy balance of trade. Together these fossil fuels make up almost 80% of the UK's primary energy demand, almost 100% of energy exports, over 90% of energy imports, and over 80% of net energy imports. (DUKES 1.1.3 (DESNZ, 2023), including Sankey diagrams)

UK gas production has averaged about 420TWh/yr over the past few years, albeit on a downwards trend. Of this, about 10% was used by the oil and gas industry, and an average of 90TWh (20%) was exported each year (omitting 2022 when imports and exports were exceptionally large with the UK acting as a conduit for LNG to the Continent to offset reduced imports from Russia). So about 70% of UK gas production is available for UK customers such as households and power plants. The UK imported over 510TWh a year on average, giving net imports of 425TWh/yr, to meet our annual demand of 850TWh.

Gas exports occur largely during the summer when UK demand is low, and gas imports occur in the winter when our demand is high. But these flows are separate, made up of myriad commercial transactions, such that summer exports do no guarantee reciprocal flows in winter. So, whilst net imports are around 50% of gas demand, actual imports of around 60% paint a slightly worse picture of our security of supply.

On the face of it, UK oil production in the past few years has equated to about 70-80% of UK demand for oil-based fuels (with the exception of 2020 when demand was suppressed by the pandemic).

However, the complex web of exports and imports of oil means that only 10-15% of the oil used in UK refineries over the past few years came from UK sources. And the similarly complex web of exports and imports of refined fuels means that around 90% of the energy that we use in the form of fuels has been imported at some point in the supply chain, whether as oil for refining or as a fuel for use.

Some other energy sources also use imported fuel. All nuclear fuel is ultimately imported; whilst the UK does manufacture some nuclear fuel, it does not have any commercially viable uranium deposits to source the raw materials. And about 30% of biomass is imported e.g. for Drax.

And these statistics will become even starker as UK oil and gas production continues to decline, which will happen irrespective of new licenses.

PLOTTING A PATH TO ENERGY INDEPENDENCE

By contrast, renewables like wind, hydro, tidal and solar use no fuels and so serve to cut our import dependence by reducing the amount of generation that we need to source from fuels.

What's more, renewable electricity can displace not only gas power generation, but also gas for heating (via electric heat pumps) and fuels for transport (via electric vehicles). So, the strategy of electrification that began primarily in order to help reduce greenhouse gas emissions is effectively reducing the UK's energy import dependence across the board.

And in reducing energy imports, the UK reduces its exposure to fossil fuel prices that are set internationally and that can spike in response to factors beyond the UK's control. In contrast, the UK's current high dependency on gas meant that during the worst of the gas crisis we had the highest overall bill for energy out of all the countries in Western Europe.

Finally, electrification is fundamentally more energy efficient than using fossil fuels. For example, limits of combustion thermodynamics mean that a petrol car can be only 20-30% efficient, and a diesel car up to 40%. By contrast, electric vehicles use entirely different technology that exceeds 90% efficiency. Similarly, thermodynamic laws dictate that a gas boiler cannot exceed 92% efficiency, and the typical level is 85%, meaning that 85% of the heat of combustion can be used in the home. By contrast, a heat pump uses a different approach (the same process, but in reverse, as drives a fridge) such that each unit of energy can provide around three times as much heating i.e. an efficiency of 300%.

By replacing fossil fuels in heating and transport, the higher efficiency electrical alternatives will reduce the UK's primary energy demand and hence its energy imports. The combined effect of renewable generation avoiding entirely any imports of primary energy, and energy efficiency reducing the amount of generation needed from other technologies, is a clear route to improving the UK's energy security.

THE GOVERNMENT'S STRATEGY

Government decisions over the past year, including the *Powering Up Britain (PUB)* strategy of March and the Prime Minister's *new approach to net zero* of September, have raised questions.

FOSSIL FUEL PRODUCTION

The Government claims that more UK oil and gas production will assist with UK energy security. It is progressing the *Offshore Petroleum Licensing* (OPL) Bill, that would require the North Sea Transition Authority (NSTA) to hold annual licensing rounds for offshore oil and gas exploration, a move the NSTA itself has described as 'unnecessary'.

However, new licences do not necessarily mean new production. A licence simply allows a company to conduct further research into an area under the sea: mainly undertaking desk-based analysis of existing data, sometimes commissioning a new survey, and occasionally drilling an exploratory well. Only a small percentage of licences result in new production: most licences are passed onto another party, or allowed to lapse and then re-auctioned by the NSTA.

Any new production that did occur would not arrest the unavoidable decline in production. Figure 1 illustrates production projections from the NSTA. These NSTA projections suggest that extra production that might come about through new licences would peak in the mid-2030s.

- By the time that any extra oil production peaked in the mid-2030s (at just 15% of the level seen in 2022), the underlying production from existing fields would have fallen to around 35% of the 2022 level, such that maximum production would be only a half of its 2022 level.
- By the time that any extra gas production peaked in the mid-2030s (at just 8% of the level seen in 2022), the underlying production from existing fields would have fallen to around 25% of the 2022 level, such that maximum production would be only a third of its 2022 level.
- In addition, some gas is used by the fossil fuel industry, amounting to around 10% of production in 2022. This is projected to reach 20% by 2035 (albeit a smaller volume than in 2022) such that actual useful gas output would be even lower, even with extra production.

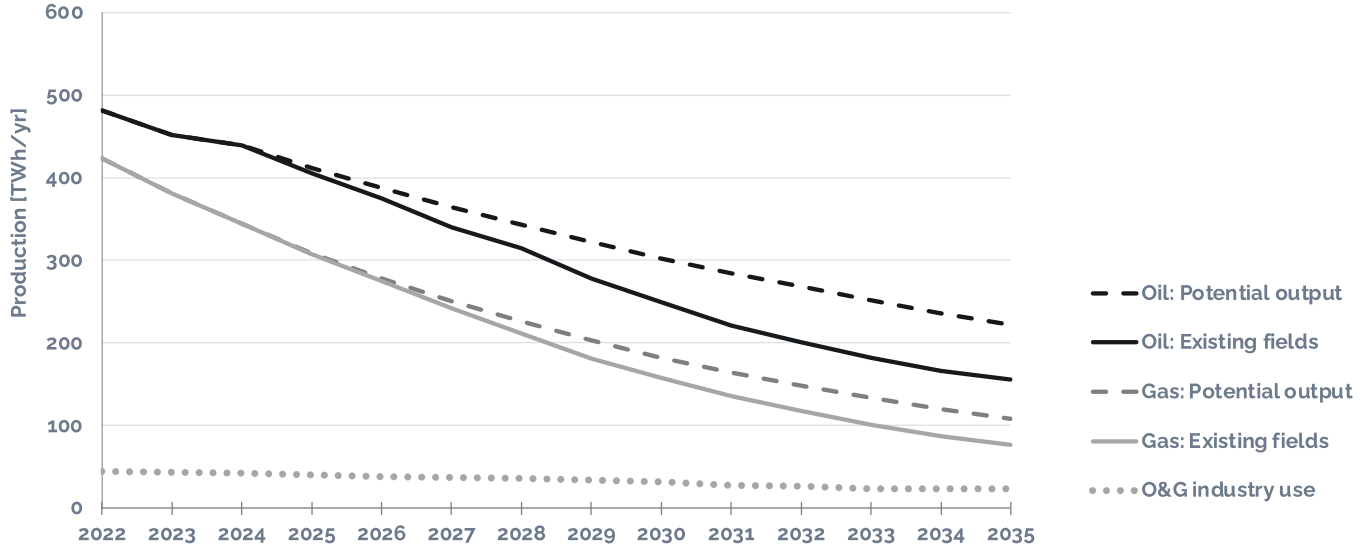

Figure 1: Production projections for UK oil and gas (NSTA, 2024)

These figures have to be viewed in light of the points made earlier. Not all UK gas production is available for UK customers, once we take account of exports (c.20%) and use by the oil and gas industry (10% now, rising to 20% by 2035). And 80% of UK oil production is exported.

In this context of declining UK production of oil and gas, it follows automatically that net imports will rise, unless demand falls sufficiently, and that imports (as well as net imports) will also rise, unless demand falls sufficiently and/or exports fall sufficiently.

GAS IMPORT DEPENDENCE

Previous analysis (ECIU, 2023) found that ambitious demand reduction policies for gas would allow the UK to reduce net gas imports by 55% by 2035 compared to 2022. However, that analysis also showed that the Government's targets are less ambitious, cutting net gas imports by only 5% by 2035 compared to 2022. It also showed that current policies are not even sufficient to meet the Government's targets, such that net imports of gas could be 60% higher by 2035 than in 2022.

Since that analysis was conducted in spring 2023, Government policies have become even less ambitious and/or have proven to be less effective than expected. These include:

- The taskforce tasked with advising the Government how to reach its goal of cutting overall UK energy demand by 15% by 2030 has been disbanded. By way of context, cutting electricity demand by 15% would amount to about 45TWh/yr, which is about as much as would be used by 10million BEVs and 10million heat pumps combined.

- Regulations requiring private landlords to upgrade the energy efficiency of homes have been scrapped.

- The Great British Insulation Scheme (GBIS) has had a slow start, and no improvements to the policy have been made to help insulate homes to cut gas demand from heating.

- The Clean Heat Market Mechanism (CHMM) has been postponed until 2025, removing incentives for manufacturers to sell heat pumps and so putting at risk the Government's stated aim of reaching 600,000 installations per year by 2028.

- The only Contracts for Difference (CfD) allocation round since the publication of Powering Up Britain. Allocation Round 5 (AR5) had a strike price that was too low to allow for supply chain inflation and interest rate rises, such that no offshore wind capacity was secured. And AR6 has a small 'pot', such that less capacity will be secured than is available to proceed. These issues make it less likely that the UK can meet the Government's target of installing 50GW of offshore wind by 2030.

- The Government is now prioritising gas power generation in the Capacity Market for back-up generation. This will be at the expense of low-carbon technologies that use no fuels, including energy storage. It also poses the risk that the excess gas generation will operate not just as occasional back-up but will also seek to generate at other times too, contributing further to our gas import dependence.

- The Government has continued to push ahead with plans for more nuclear generation capacity. Whilst most experts agree that nuclear can play a role, its high costs and long lead-times mean that it will not have a meaningful impact until sometime in the 2030s. And, as noted earlier, the fuel will all be based on imported materials.

The net result of these policy changes and delivery issues is that gas demand is likely to fall more slowly than under even the least ambitious scenario in the 2023 analysis, such that net imports and imports will likely rise more rapidly and will be more than 60% higher in 2035 compared to 2022.

By way of illustration, Figure 2 compares policies affecting annual electricity generation from offshore wind and gas power plants using gas produced in the UK (see methodology for details).

Firstly, it shows the likely future trajectories before the *Powering Up Britain* strategy, the 'pre-PUB' scenario (shown as full lines on the chart). For example, in 2030:

- Being on track to hit the Government's target of installing 50GW of offshore wind by 2030 meant that the growing fleet would have generated 225TWh in 2030, and 955TWh cumulatively in 2025 to 2030.

- UK gas production from existing fields is expected to be 157TWh in 2030, of which c.17% would be used by the oil and gas industry and c.20% would be exported, leaving c.112TWh. If, as at present, power accounts for about 30% of UK gas demand, then that would amount to c.35TWh for power plants, generating c.15TWh of electricity, and 135TWh cumulatively in 2025 to 2030.

- If the 955TWh of electricity generated by offshore wind over six years was instead produced by gas power plants, the UK power sector would have to use over 1,900TWh of gas, which is 7x as much gas as it would be getting from existing UK gas production over the six years, and which would have to come from increased gas imports.

Further electricity will be provided by a mixture of sources. This will include gas power plants using imported gas. This will be on a declining trajectory but the exact amount each year will depend upon a number of factors, but will likely be several tens of TWh of power each year, and the imported gas would be double that number of TWh. Sources such as biomass would be using some imported fuel. The amount of imported fuels would be lower if the UK makes quicker progress on deploying other technologies, including renewables like onshore wind and solar that use no fuel and energy storage that can be charged at times of surplus renewable production.

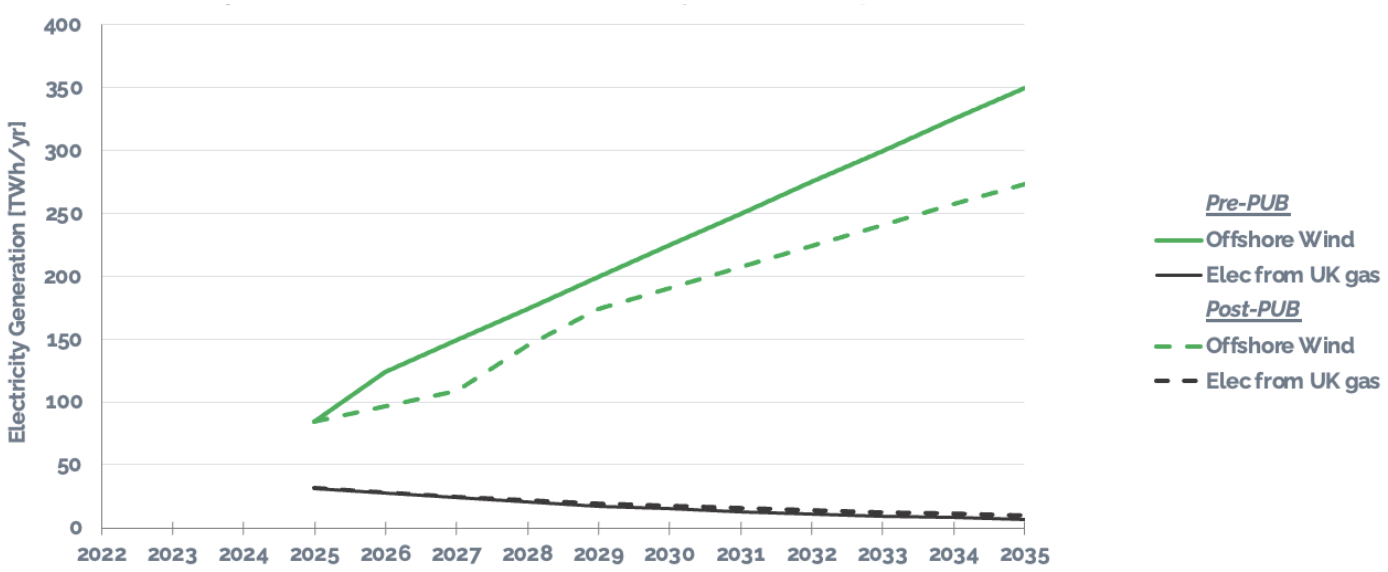

Figure 2: Scenarios of electricity generation from offshore wind and gas under policies prior to, and in the year after, the publication of the Government's Powering Up Britain strategy.

Secondly, based on policy developments over the past year, the 'post-PUB' scenario has been produced (dashed lines on chart).

- The issues with AR5 mean that offshore wind installation will be slower over the next few years, and the limitations on AR6 mean that it might add only 3-5GW in 2027/28 to 2028/29. If the parameters remain similar for AR7 and beyond, the UK might adde just 3GW a year from 2027 onwards. Then the fleet's output in 2030 would be 190TWh, which is 35TWh (15%) lower than if we had been on course to meet the target, and 800TWh cumulatively for 2025 to 2030, which is 155TWh (just over 15%) lower.

- Extra UK gas production in 2030 could be up to 25TWh, but accounting for use by the oil and gas sector, exports and demand from other sectors, it could give just 2.4TWh of extra electricity in 2030, taking the total from UK gas to 17TWh. Cumulatively over six years, the extra gas production would equate to 7TWh, taking the total from UK gas to 142TWh.

- If the 800TWh of electricity generated by offshore wind over six years was instead produced by gas power plants, that would require 1,600TWh of gas, over 5x as much gas as the power sector would be getting from UK production over the six years, even including any extra gas production, and which would have to come from increased gas imports.

The difference between the lost wind power and the little extra gas power would be made up by a range of sources. Again, exactly how much would come from imported gas would depend on a number of factors, but would be several TWh per year, requiring double the number of TWh of imported gas. The use of imported gas and other fuels would be lower if the UK makes quicker progress on deploying renewables and energy storage. Interconnector imports might rise, albeit that the UK can gain more from trading electricity with neighbouring countries than it risks by being involved in international gas markets.

Comparing the two future trajectories, the following comparisons can be made:

- Before the policy changes, offshore wind was set to generate 15x as much electricity in 2030 as would have been generated by gas from existing UK gas fields. The cumulative figure over six years from 2025 to 2030 would have been 7x.

- After the policy changes, offshore wind is set to generate 11x as much electricity in 2030 as would be generated from higher UK gas production. The cumulative figure over six years from 2025 to 2030 will be over 5x.

- The policy changes will likely cut offshore wind output by almost 35TWh in 2030, whilst increasing power output from UK gas production by only 2.4TWh, i.e. the loss of offshore wind generation output would be 14x larger than any gain from extra UK gas production.

- Cumulatively by 2030, the policy changes will likely cut offshore wind output by over 155TWh, whilst increasing power output from UK gas production by 7TWh, i.e. the loss of wind would be 22x larger than any gain from extra UK gas production.

- This is a cumulative net loss of about 150TWh of electricity production based on UK sources over just 6 years. Replacing this lost wind generation with gas power would drive up gas imports by 300TWh over six years.

This analysis illustrates how recent decisions that have promoted gas production and hindered offshore wind will have the effect of reducing the amount of UK-derived electricity generation and increasing the amount of gas that will be imported in any given year.

OIL IMPORT DEPENDENCE

Policies for reducing oil dependence have also been made less ambitious over the past year:

- The cancellation of regulations for the phase-out of oil boilers in off-gas grid homes means that c.1million households will have little incentive to replace oil boilers with alternatives such as heat pumps, and so will retain their very high energy import dependence.

- The phase-out date for the sale of new internal combustion engine (ICE) cars that use only petrol or diesel was pushed back from 2030 to 2035. Whilst this could affect only sales of plug-in electric hybrids (PHEVs) in 2030-2034, the move has impacted wider sentiment, and sales projections for battery electric vehicles (BEVs) have fallen since the announcement.

The policy change on cars has been examined to illustrate the issues; similar points could be made regarding the oil boiler policy. Scenarios for car fuel have been discussed briefly in previous analysis (ECIU 2024, and ECIU 2024). That analysis found that new oil production would account for just 1% of a UK tank of petrol in 2030, and that a similar effect on energy security would be seen BEVs sold up that time cutting demand for petrol.

Each BEV that is bought instead of a petrol car uses 75% less energy and uses at least 90% less imported energy. Analysis was conducted into the impacts of policy changes on energy imports for cars, illustrated in Figure 3.

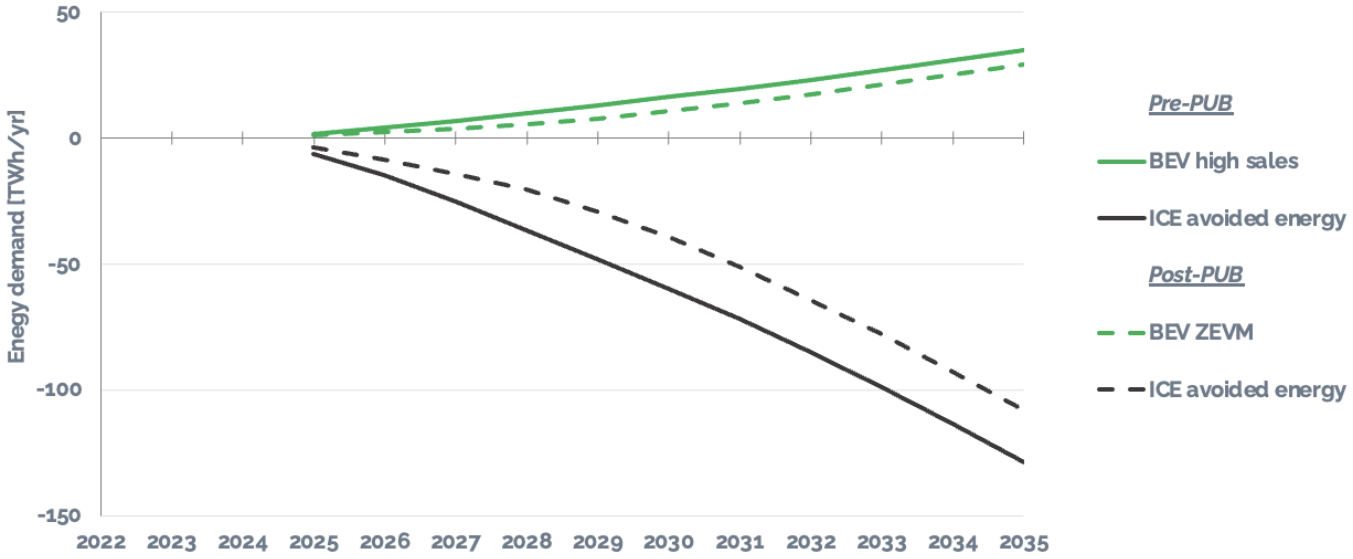

Figure 3: Energy used by BEVs sold from 2024 onwards and energy demand avoided due to commensurate avoided sales of ICEs, under policies prior to, and in the year after, the PUB.

Prior to the policy changes, projected sales of BEVs were up to 80% higher than the proposed ZEV Mandate targets for 2024-2029 (see Chart C, Fiscal Outlook (OBR, 2023).

- 8.1million BEVs sold from 2024 to 2029 would have used 16TWh of electricity in 2030, and a cumulative 52TWh over the six years from 2025 to 2030 (full green line). Of this, the amount generated from imported gas is likely to fall to about 20% by 2030 even under a pessimistic scenario (although it would most likely be less than this due to night-time charging when renewables are more often displacing gas generation). That means that we would be importing about 6TWh of oil in 2030, and 22TWh cumulatively from 2025 to 2030.

- 8.1million petrol cars that would have been sold had there been no new BEVs would have used 60TWh of fuel in 2030, and 190TWh cumulatively over six years (full black line). With imports of oil and/or fuel set to be around 95% by that time, these cars would have been using about 57TWh of imported energy in 2030, and 180TWh cumulatively.

- So, in 2030, the 8.1million BEVs in place of petrol cars would have given an energy saving of 44TWh in 2030 and a reduction in energy imports of 51TWh, and cumulatively over six years an energy saving of 140TWh and avoided imports of almost 160TWh.

Since the policy changes in September 2023, sales projections have fallen, and could follow the targets in the ZEV Mandate. This would result in 2.8million fewer BEVs on the road by 2030.

- There would still be 5.3million BEVs sold since 2024, using 10.6TWh of electricity (dotted green line). This is 5.6Wh lower than under the previous projections in 2030, reducing oil gas imports by about 1.8TWh. Cumulatively from 2025 to 2030, that amounts to almost 21TWh less electricity and 8TWh of avoided gas imports.

- There would still be up to 5.3million fewer petrol cars on the road in 2030, avoiding energy demand of 39TWh and energy imports of 37TWh.

- But there would likely be 2.8million more petrol cars on the road in 2030 than under the previous projections, using about 21TWh of petrol and hence eroding the 'avoided energy' (dotted black line), of which about 20TWh would be imported. Cumulatively from 2025 to 2030, those extra 2.8million petrol cars would use over 75TWh of fuel, of which about 73TWh would have been import at some point (as oil or petrol), even if extra UK oil production is factored in.

- The overall effect of the change in sales projections would be a reduction in energy savings i.e. energy demand that is higher than it could have been, by 15TWh in 2030. This translates into energy imports being higher than they could have been, by 18TWh in 2030. Cumulatively from 2025 to 2030, the impacts of the change mean that car drivers will be using 55TWh more energy and importing almost 65TWh more.

This analysis illustrates how recent decisions that have unsettled the automotive industry will have the effect of reducing the number of cars that are powered by UK-based electricity generation using increasing quantities of UK renewables, whilst increasing the amount of oil and petrol that will be imported in any given year. The role of any increased oil production is essentially irrelevant, given that the vast majority is likely to be exported.

METHODOLOGY

Data for oil and gas production, imports, exports and demand was sourced from DUKES Chapters 1, 3, 4. Data for electricity generation and demand was sourced from DUKES Chapter 5. Projections for UK oil and gas production (with and without new production), and use by the oil and gas industry, was sourced from the NTSA.

Scenarios of future demand for gas and electricity, and future grid mix, were based on ECIU's scenario *Current Policies* from the report *Getting off Gas* (ECIU, 2023). Gas used in power generation was then split into UK production and imports.

The gas power generation analysis starts with the NTSA production forecasts, and then uses the facts that the oil and gas industry uses gas to the tune of c.10% now rising to c.20% by 2035, and 20% is exported. The remaining 60-70% is split between sectors, with the power sector using 30% of the UK retained gas production, equating to around 20% of the original UK gas production.

The wind power generation analysis uses data (capacity and load factor) for offshore windfarms that are already in operation, under construction and/or have been awarded a CfD contract. Projects up to the end of AR4 total 27.3GW and would be expected to generate 40TWh/yr (based on load factors of 40% for earlier projects, rising to 63% for AR4). It then looks forward, using a load factor of 63% and an additional annual build rate from 2027 onwards of 4.5GW under the pre-PUB scenario and 3GW under the post-PUB scenario. Each GW of new offshore wind would generate 5.5TWh/yr.

Calculations for energy used by cars are on the basis of 8,000 annual mileage, for which a petrol car would require c.900 litres of fuel containing a total of 8MWh of energy, which is 4x as much energy as the 2MWh used by a BEV each year. The scenarios assume that half of petrol cars sold would be ICE and half PHEVs (which use 15% less energy than an ICE based on typical driver behaviour).

Every BEV that replaced an ICE reduced UK energy demand by 6MWh/yr. The reduction in energy imports by replacing an ICE with a BEV moves along a trend year-on-year. The percentage of petrol imports rises each year, but they're always around 90-95%, so an ICE uses c.7.5MWh/yr of imported energy each year. And the percentage of imported gas for power generation falls, but in 2030, for example, it would be c.0.8MWh of imported gas, so the import saving would be c.6.7MWh/yr per car.