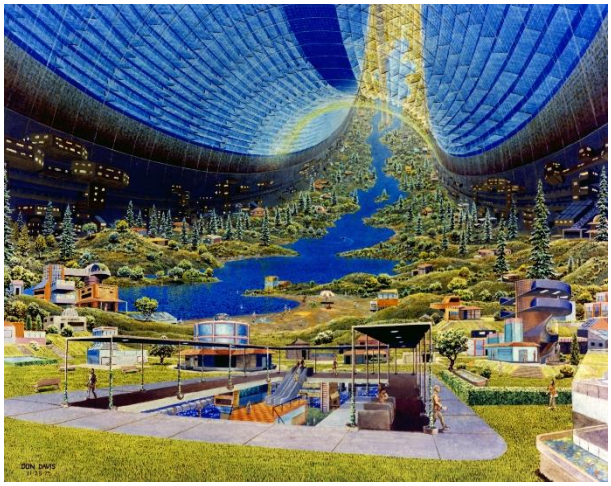


# The UK in 2050

**Even though 2050 lies far in the future, government and business project what scenarios they might face by then. Futurologists aim to spot trends and challenges ahead of time, so that we can prepare for them. Malthus could be called a futurologist. In this briefing, trends extrapolated from his food production variable will be looked at. It will be argued that while economic changes, urbanisation, technological advancement and environmental degradation all influence consumption and resource-availability, population growth determines the severity of the influence of each factor.**

**A look at the different population projection variants shows that both quality of life and the cost of living are best safeguarded when the UK experiences low population growth. Consequently, it is clear that population stabilization at a sustainable level must be included in future government policies. Not only should the UK profess this domestically, it should also do so globally in order to reduce consumption-based conflicts that would force millions to migrate.**

## The history of futurology

Futurology is the discipline of projecting the future. It uses science to assess potential future events, but also relies heavily on art and imagination.[1] Futurology is mostly related to science fiction, but many authors have accurately predicted real developments in their works. H.G. Wells predicted the emergence of nuclear weapons in 1914, years before they came into existence.[2] Arthur C. Clarke wrote about a network of satellites in orbit in 1945, even though the first satellite was not launched until 1957.[3]

Naturally, many predictions miss the mark. Due to the complexity of human society, it is important to consider human, technological, economic and political factors systematically when projecting futures.[4] In spite of the problems futurology encounters, the discipline has been used by governments since the end of World War II. The U.S. military started using technological forecasting then, which is essentially a type of futurology.[5]

### Value of predictions

Today, futurologists predict futures using systematic brainstorm sessions, scenario-building, historical analyses, the gathering of opinions, following trends and envisaging desirable futures.[6] Even though predictions tend to fall short in reality — due to the difficulty of anticipating social developments, economic changes and political realities — futurology certainly has value. Predictions point out potential problem areas, allowing us to respond to these in time.

Allowing sufficient time to prepare for changes is important, because reversing established trends is more difficult than preventing them altogether. It may be necessary to develop specific technologies to prevent or achieve something. Production lead

times are usually significant and, for that reason, it is valuable to know far in advance what ought to be developed. At the same time, it may take a while before an innovation has sufficient impact. Hence, impact lead times should be considered too.

### Malthus' prediction

Population Matters draws from the thought of Thomas Malthus. He can be called a futurologist.[7] Malthus predicted in 1798 that food production would not be able to keep up with exponential population growth. While his prediction was not accurate, he drew attention to a significant issue: unsustainable population growth and the challenges this creates.[8]

Though Malthus underestimated technological development, his predictions are still valuable. It is possible to extrapolate his ideas. He chose to focus on food production, and in line with that it makes sense to extend the argument to consumption in general. This can, in turn, be connected to further developments, such as environmental preservation and societal functioning.

## Global current and future trends

Currently, there are significant global inequalities in consumption patterns. Citizens of affluent states consume more per head than their counterparts in developing nations.[9] Population growth, economic development and urbanisation, however, cause consumption patterns to shift. While this has so far allowed millions of individuals a way out of poverty, increased consumption also has adverse implications such as environmental degradation and resource depletion.

### Population

Population growth is a consistent feature in future projections. While the United Nations projects that the global population will increase to around 9.6 billion by 2050, it is also expected that demographics will change significantly. It is thought that longevity will continue to increase — e.g. one in six people will be over 65 by 2050, which will give rise to serious healthcare problems.[10,11]

### Total consumption

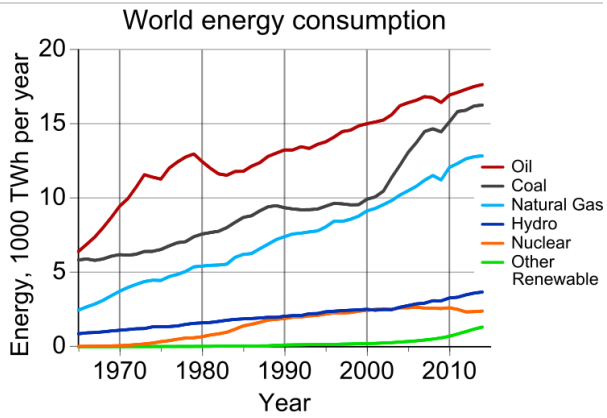
While there are many forms of consumption, energy and agricultural consumption are two components that prove particularly challenging globally in relation to population growth.[12]

#### *Energy consumption*

Energy is a key input into the production of consumer goods. Meeting the growing global demand for energy is a challenge, because the world faces depleted fossil fuel reserves.

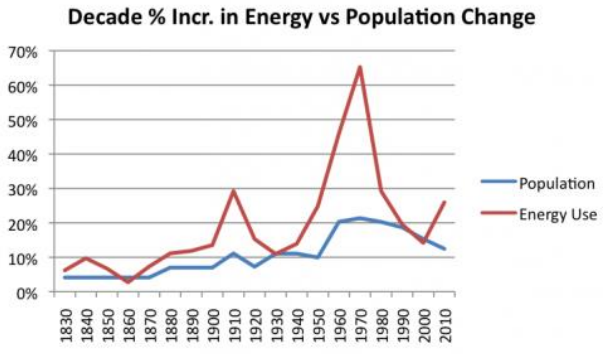
While the world needed a total of 6,100 Mtoe (Million Tonnes of Oil Equivalent) in 1973, it

required 13,541 Mtoe in 2013. Fossil fuels are the main source used to fulfil those energy needs.[13] Most energy is consumed by developed nations, but developing nations are using increasingly more energy as their economies grow.




*Graph: BP Global*

Currently, the industrial sector consumes 52 per cent of all global energy. Increasingly, many countries will industrialise in the future, and therefore the demand for energy will grow.[14] Similarly, it is expected that global electricity demand will rise by more than two-thirds between 2011 and 2035. In 2012, 42 per cent of all energy sources was already used to generate electricity.[15] Increasing electricity demand would thus put a great strain on primary energy sources.

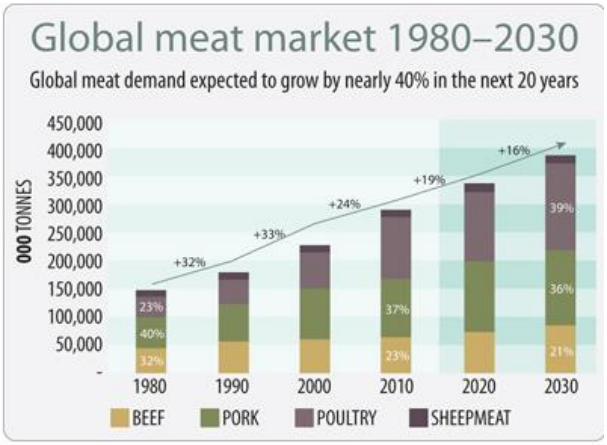



*Graph: Financial Sense*

While there is promising growth in renewable and alternative energy technologies, most areas of the world with rapid population growth are excluded from their widespread usage due to global disparities in wealth.[16] For this reason, there is increasing concern that some of the regions of the world with the largest need for clean energy sources may not be able to follow the same energy trajectories that developed regions are following without significant environmental consequences, or before our energy reserves are depleted.[17]

## *Agricultural Consumption*

In line with population growth and increasing global affluence, global meat production rose to 308.5 million tons in 2013. This was an increase of 1.4 per cent since 2012, and FAO estimates that this trend will continue.[18,19]




*Graph: Rabobank*

Industrialised farming and livestock practices have significant implications, including high greenhouse emissions, land degradation, inefficient use of nutrients and high water consumption.[20] Food insecurity will become increasingly prevalent in the future. Some evidence of that is already visible. In 2000, 16 per cent of the world's population needed international trade to meet food needs and, globally, grain imports increased more than fivefold between 1960 and 2013, as

more nations turned to international markets to help meet domestic food demand.[21]

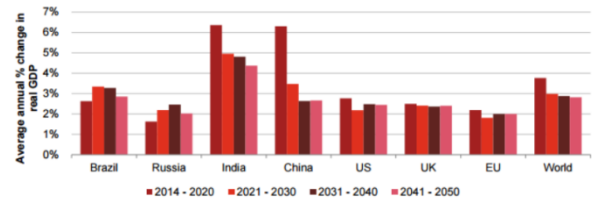
Though improved technology has the potential to increase productivity and agricultural efficiency, climate change gives rise to more natural disasters, and the degradation of the environment also affects productivity adversely.[22] Water scarcity is another factor closely related to agriculture. Not only is water scarcity, as such, seen as one of the most problematic challenges of the future, but also, greater agricultural demands will exacerbate this further.[23]

## Per capita consumption

Not only does population growth drive increased total consumption, but also per capita consumption is on the rise. This is caused partially by economic development and urbanisation.

### *Economic development*

Figure 2: Projected growth profiles for major economies – Regression to the mean

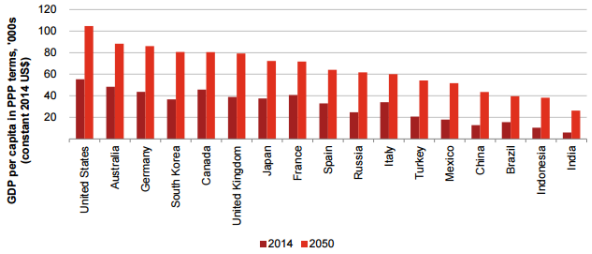



*Graph: PWC*

It is expected that the gap between the three largest economies and the rest of the world will widen, and that upcoming countries will overtake some of the currently-largest economies. The UK will likely no longer be among the top ten economies by 2050.[24] Emerging economies will overtake the Group of Seven (G7) economies in terms of Gross Domestic Product (GDP).[25] Yet, as emerging economies mature, it is probable that their growth rates will gradually slow down.

Even though emerging economies are projected to overtake developed countries in terms of GDP, it is expected that the GDP per capita will remain much higher in the developed world. For that reason, the developed world will continue to have comparatively high consumption.[26] In spite of this, per capita consumption will grow, and the consumer market will become more diverse and more demanding.[27]

Figure 13: GDP per capita in PPP terms for the G7 and E7 economies




*Graph: PWC*

### *Urbanisation*

Globally, the number of urban residents is growing rapidly. In 1900, 13 per cent of the world's population lived in cities. By 2000, 2.9 billion people — close to 50 per cent of the total global population — lived in cities. It is expected that by 2025, there will be 40 cities with more than 10 million residents.[28,29]

Urbanisation creates great challenges. It puts the infrastructure and public services of cities under pressure. As a result, great investments are needed to satisfy the demand for urban facilities and to maintain or improve their quality. It is estimated that over $8 trillion will be needed to upgrade the infrastructure of New York, Beijing, Shanghai and London over the next decade.[30] Urban dwellers use more resources and generate more waste — four times more — than people in rural areas.[31] Many cities will likely struggle to deal with such increases, as their sewage systems are not built to support them. This means there is a danger that the quality of life will increasingly be difficult to maintain in urban areas.

## Resources

Growing consumption means a growing demand for energy, and this in turn means that the world faces depleted fossil fuel reserves.

### *Coal*

Total coal consumption increased by approximately 167 per cent between 1973 and 2013. While coal consumption grew by 0.4 per cent on average in 2014, production levels fell by 0.7 per cent.[32] Current predictions are that there are sufficient coal reserves for 110 more years of consumption.[33] It has been projected that coal consumption will peak worldwide in 2025, before declining by 10 per cent by 2040.[34]

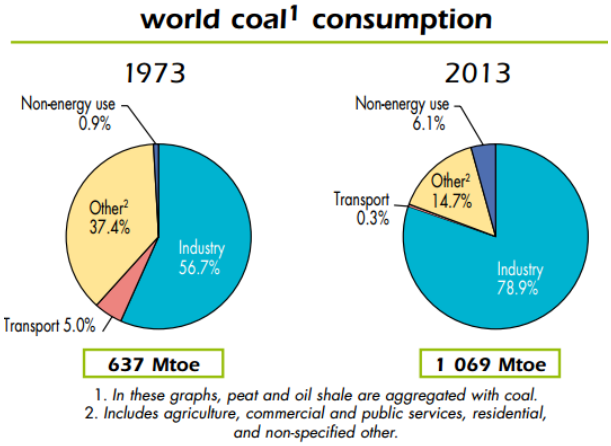



*Chart: International Energy Agency*

### *Oil*

Global oil consumption increased by approximately 165 per cent in 30 years. In 2014, 840,000 more barrels of oil per day were consumed than in 2013. This increase is related to rapidly growing emerging economies.[35] By the end of 2014, 1700.1 billion barrels of oil remained, meaning that there is sufficient oil available for another 52.5 years.[36] It is projected that the demand for oil will grow strongly in the future.[37]

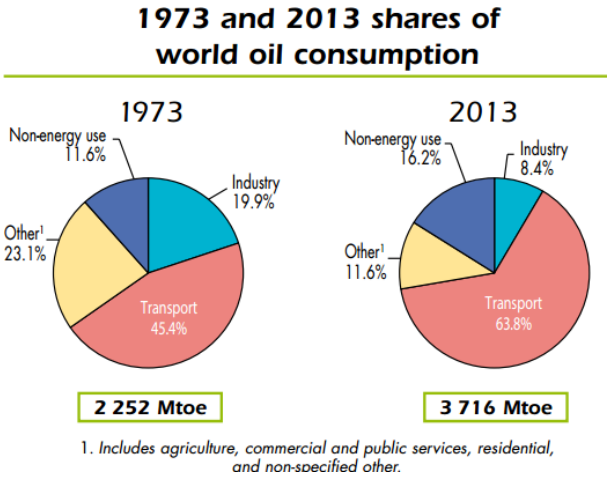



*Chart: International Energy Agency*

### *Natural Gas*

The global consumption of natural gas more than doubled between 1973 and 2013. In 2014, it grew by 0.4 per cent, which was well below the average 2.4 per cent annual growth rate of the previous decade.[38] It is expected that there are enough natural gas reserves for another 54.1 years.[39] Yet, it is projected that the global demand for gas will almost double by 2040.[40]

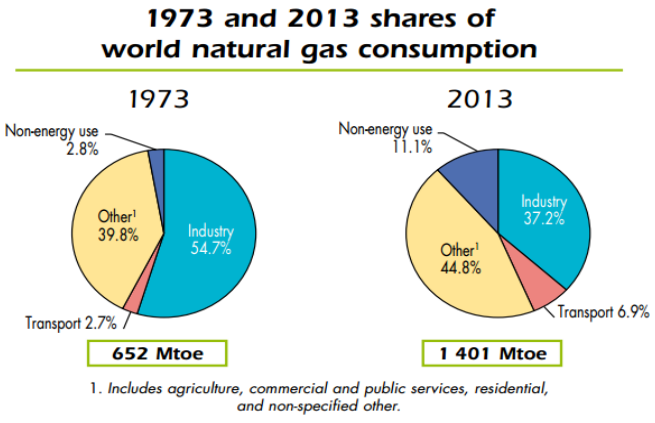



*Chart: International Energy Agency*

### *Alternatives*

Scarcity of certain fossil fuels may drive people to turn to others that are more costly to extract. These increased extraction costs could be very

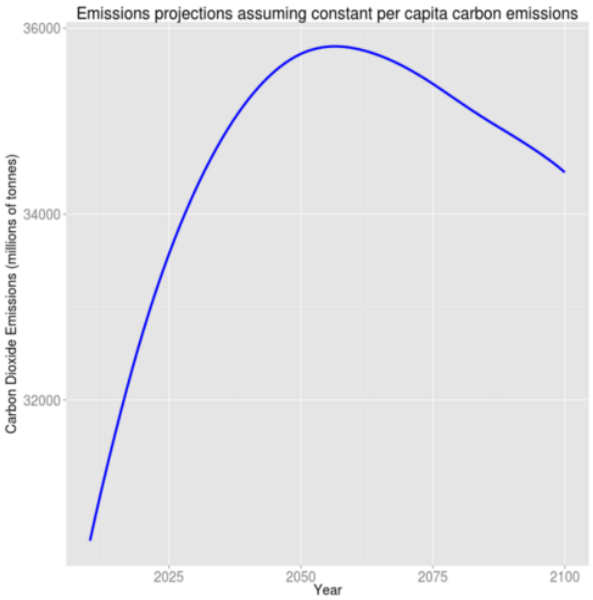
harmful to businesses, even making some no longer financially viable. New technology may allow humans to extract fossil fuels for a longer time, but ultimately this is only a temporary solution. Certain extraction methods, such as fracking, are also extremely damaging for our environment. They pollute the atmosphere, and they could cause earthquakes and spoil clean water.[41,42]

Alternatively, a focus can be placed on the development of renewable energy sources. All energy that is derived from natural processes that do not consume finite resources is considered renewable. This includes biofuel production and geothermal, wind and solar energy.[43] In 2014, renewable power sources provided six per cent of the world's electricity. This means that renewable energy production almost doubled in five years. Most renewable power — 68 per cent — is generated in the OECD countries.[44]

The major challenge that renewable energy faces is that it is currently impossible to produce as much energy as fossil fuel generators using renewable energy sources. The development of generators and the improvement of technology are also costly. Moreover, solar panels and windfarms require a lot of land and, at the moment, energy supply is not yet reliable, as it depends heavily on the weather and generators are not yet widespread enough to overcome this problem.[45] Consequently, it is probable that countries that need energy in the short term will choose cheaper, but more damaging, methods of energy generation.

## Environment

It is projected that global $CO_2$ emissions will increase rapidly. While the world produced approximately 33 gigatonnes of $CO_2$ in 2010, this amount is expected to rise to 55.87 gigatonnes by 2050.[46] Due to expected consumption and population growth, it is assumed that total $C0_2$ emissions will increase until at least the 2050s, before falling slightly.[47]



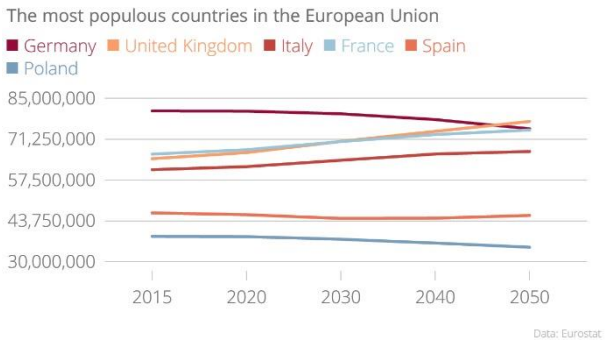

*Graph: the energy collective*

Once the world runs out of fossil fuels, countries that rely predominantly on finite resources will run into trouble. Therefore it is expected that sustainability will rapidly become a business imperative. The impact of business decisions on the environment and society will become increasingly important for consumers as well.[48] Such a change would likely bring down emissions.

# UK current and future trends

## Population

The UK's population size has risen from 52.3 million in 1960, to 64.4 million in 2014.[49] It is currently considered probable that it will pass 70 million by 2027.[50] Eurostat projects that the UK will have more people than France by 2030, and that it will have the largest European Union population by 2047.[51,52] With only Luxembourg, Belgium and Sweden projected to grow faster, the UK's population will grow faster than the EU average.




*Graph: CityAM*

### *Variants*

Predicting population growth accurately is difficult because there are several variables — fertility, mortality and migration — that must be considered. Thus, there are in fact many projection variations. ONS has released several of these predictions that show what the UK's population size might be like by 2039. The following assumptions underlay these scenarios:

- The principal projection is based on the assumptions that are considered most probable.[53]
- Single component variants look at the effect of varying one assumption at a time from the principle projection.[54]
- Combination variants assume different rates for two or more assumptions.[55]
- The zero migration variant assumes that net migration will be zero at all times in the future, while the low and high migration variants hold that the net migration value will change over time.[56]

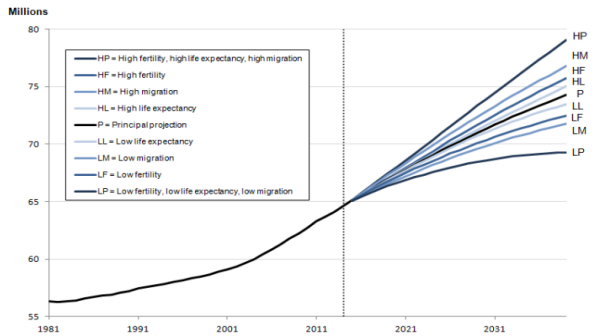
**Variant projections**

| | Fertility | Life expectancy | Net migration | Total population (000s) |
|---|---|---|---|---|
| Principal projection | Principal | Principal | Principal | 74,284 |
| Standard "single component" variants | | | | |
| High fertility | High | Principal | Principal | 75,765 |
| Low fertility | Low | Principal | Principal | 72,504 |
| High life expectancy | Principal | High | Principal | 75,051 |
| Low life expectancy | Principal | Low | Principal | 73,488 |
| High migration | Principal | Principal | High | 76,786 |
| Low migration | Principal | Principal | Low | 71,783 |
| Standard "combination" variants | | | | |
| High population | High | High | High | 79,090 |
| Low population | Low | Low | Low | 69,273 |
| Special case scenario | | | | |
| Zero net migration (natural change only) | Principal | Principal | Zero | 67,658 |

*Table adapted from: ONS and ONS*

The different projections illustrate clearly that, while changes to one component of population growth can make a big difference, ultimately all must be tackled to stabilize growth. ONS only considers the development of population until 2039. It is, however, possible to imagine how each trend would develop beyond that year when all factors remain the same. Only the LP scenario would likely imply population stabilization from 2039 onwards.

**Figure 2.4: Estimated and projected total population, UK, year ending mid-1981 to year ending mid-2039**



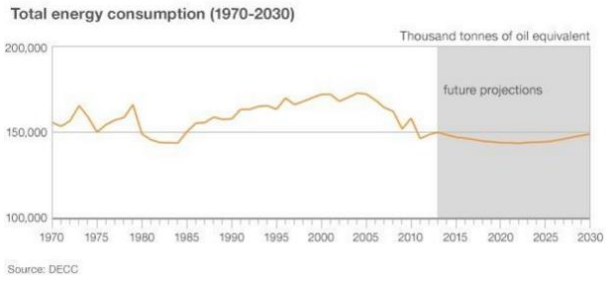

*Graph: ONS*

### *Ageing*

It is projected that the UK population will continue ageing, with the average median age rising from 40.0 years in mid-2014 to 40.9 years in mid-2024, and to 42.9 by mid-2039.[57] Naturally, the more longevity improves and the more fertility rates fall, the more society will age. While ageing per se is not a problem, it does present society with challenges.

## Total consumption

The UK consumes less energy today than it did in 1970, in spite of its population growing by more than nine million people.[58] The Department of Energy and Climate Change (DECC) predicts that, while the UK's population could increase to over 70 million by 2030, the country as a whole will consume the same amount of energy by then.[59]

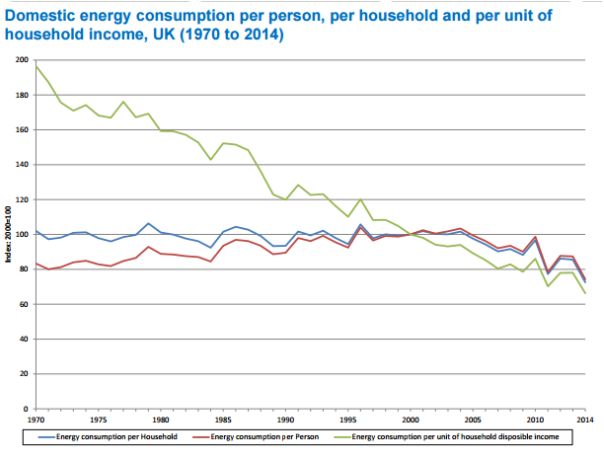



*Graph: BBC*

- The industrial sector has consumed 44 per cent less energy since 1980, due to a shift towards less intensive industries and increased energy efficiency.[60]
- Services used eight per cent less energy in 2011 than they did in 1980, even though the sector has doubled in size.[61]
- The transport sector has consumed 55 per cent more energy since 1980, mostly due to increased road and air travel.[62]
- In the domestic sector, energy consumption fell by three per cent between 1980 and 2011, while the number of households in the UK has increased by 30 per cent. The decrease in consumption is mostly ascribed to energy efficiency improvements and improved insulation.[63,64]

## Per capita consumption

The average person in the UK consumes significantly more than people in the developing world. Government figures show that energy consumption per person has reduced slightly since 2000, but this drop is ascribed to improved efficiency.[65]




*Graph: GOV*

Water consumption in the UK has grown by an average of one per cent per year since 1930.[66] Currently, people use 150 litres of water, on average, per day.[67] If all the water used in the production process of other goods we consume daily is taken into consideration, the average person consumes 3,400 litres a day.[68] While there are plans to reduce per capita water consumption, water scarcity is considered a serious future problem in the UK, especially in London, the South East and East of England. Rainfall and available water are relatively low in this region, while

population size is high compared to other areas in the UK.[69]

## Resources

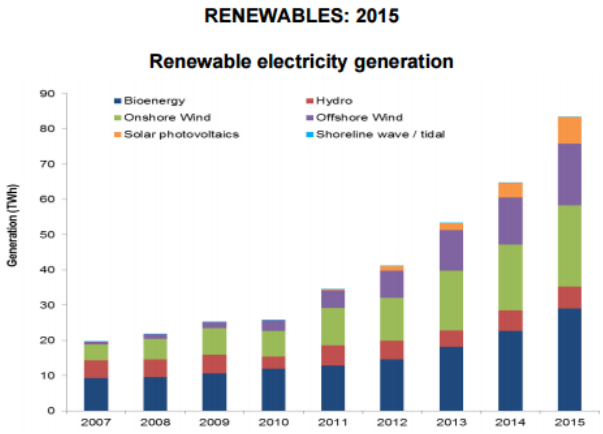
Even though it has been forecast that the UK will consume less energy in 2030 than it did in 1970, UK society will still face severe energy-related challenges. The graph displayed earlier, in fact, shows a curved future projection line after 2022. This implies that, while the UK is currently successfully reducing its total energy consumption, it is expected that it will fail to do so in the future.

### *Fossil fuels and nuclear*

Historically, the UK has relied predominantly on fossil fuels and nuclear energy:

- Until the late 1960s, the UK mainly produced coal as a source of energy: 228 million tonnes were mined in 1952 from surface and deep mines.[70] Before the 1970s, a lot of coal was used for the fuelling of trains, for cooking and for the heating of homes. Currently, around 80 per cent of all coal is used to generate electricity.[71] While around 80 per cent of the UK's energy came from coal in 1960, this amount fell to 30 per cent by 2009.[72] The UK also has to import more coal every year: of the 48.5 million tonnes that were consumed in 2014, 41.8 million were imported, mostly from Russia.[73,74]
- Between 1970 and 2013, the amount of oil that the UK consumed annually fell from 13 million to 780,000 tonnes.[75] This sharp decrease was largely caused by the availability of cheap North Sea gas from the 1990s onwards.[76]
- Gas-powered generators produce 30 per cent of the electricity used in the UK.[77] The total gas demand has been in decline. Between 2013 and 2014, consumption declined by 8.9 per cent.[78] Since 2004, the UK has imported around 45 per cent of its gas supply, mostly from Norway, Belgium and the Netherlands.[79]
- Nuclear reactors generate 19 per cent of the UK's electricity.[80] All but one of these reactors are, however, due to be closed by 2023. Building new reactors is considered expensive, and the problem of radioactive waste storage has so far not been overcome. Insurance and the costs of potential hazards make further use of nuclear power unattractive for the UK.[81]

### *Renewable energy*



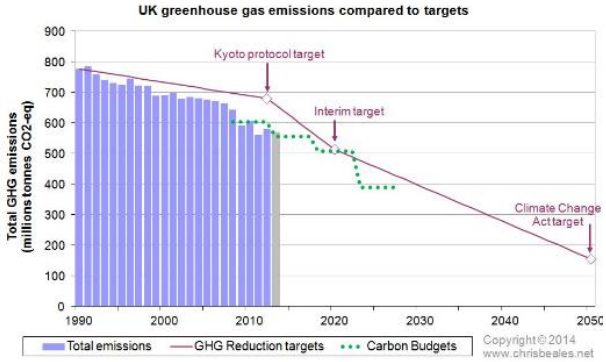

*Graph: GOV*

The UK is focusing increasingly on renewable energy. Between 2014 and 2015, renewable electricity generation increased by 29 per cent.[82] It is to be expected that this will keep growing.

## Environment

Human activity has an adverse effect on the environment. Pollution is not only harmful for the health of humans and wildlife, but it is also seen as a trigger for climate change. Climate change, in turn, exposes the UK to extreme weather patterns, including flooding and droughts. The average temperature in the UK has risen by 1˚C in

the past 100 years, and average summer temperatures are projected to rise by 2˚C by the 2040s. Not only will this affect ecosystems, but it will also impact food production.[83]




*Graph: Chris Beales*

The UK is dedicated to reducing its carbon emissions. It is projected that the UK will manage to achieve the carbon reduction targets between 2013 and 2022, yet it is feared that it will not successfully meet its targets between 2023 and 2027 if no further action is taken. This is blamed largely on an increase in the number of households and growing transport demand.[84]

# Implications for the UK

While all trends will influence the UK, the extent to which that happens will depend largely on the level of population growth. The reason for this is simple: more people means less space and fewer resources per person. For that reason, it is interesting to analyse the likely implications for the UK in the two most extreme population projection scenarios.

## High population projection

According to the high population projection variant, the UK will have over 79 million inhabitants by 2039, which means that it will have grown far beyond 80 million people by 2050.[85] To achieve this, fertility rates and longevity must increase and the UK must attract a lot of migrants. Because fertility levels would rise, the UK population in this scenario will not age as much as it would in other scenarios.

### *Social impact*

Rapid population growth causes great challenges, and the faster the growth, the less time society has available to anticipate and adapt. Technology, in the form of robotics, already replaces humans in some jobs. This creates greater efficiency, but it also means that there are fewer jobs. The UK is already facing significant unemployment levels, and it can be assumed that this will only be worse in a future where even more people enter the job market, and robotics are more advanced than before.

Society must be adapted to meet the needs of an ever-growing population. Scarcity of land and resources will drive up the prices of housing and utilities, and the expansion of existing infrastructure will put a great strain on the Treasury. While it is often assumed that additional people pay for themselves by contributing to the economy, it is also accepted that a population increase of one per cent requires an additional one per cent of all assets to maintain a constant quality of life.[86] Hence, population growth will evidently cause living costs to rise, and the stronger the growth rate, the higher those costs will be, not least because the lifespan of assets will be drastically reduced.[87]

### *Environmental impact*

Human existence affects the environment adversely. Yet, humanity relies on the ecosystem and biodiversity for its well-being in many ways.[88] As population size increases, the negative impact of the human species on the environment will grow.

Nature provides humans with many economically valuable services. It directly provides us with natural resources and, while some of those such as coal and gas are finite and damaging to the environment, others such as the sun and wind are sustainable. Indirectly, nature influences our health positively, including its facilitation of leisure activities. Our natural environment also has the capacity to alleviate some of the effects of climate change, and to counterbalance some of our polluting activities.[89]

Environmental degradation would increase living costs, because the free 'services' of nature that would disappear when we degrade the environment further would have to be replaced. Maintaining a good quality of life would thus be increasingly expensive, if not impossible. Societies will try to optimise the use of resources, space and time, but it remains a fact that certain things stay limited. The more people who live in one space, the less space they have to divide between them. We may reduce resource waste per capita, but when the number of heads increases, that will not be sufficient. Consequently, it is inevitable that both the quality of life and the cost of living are affected adversely in a scenario of high population growth.


## Low population projection

According to the low population projection variant, the UK will have over 69 million inhabitants by 2039. Yet, it is projected that this will be the peak of that growth curve, meaning that population size will either be stable between then and 2050, or fall.[90] Because fertility rates are low in this scenario, it is probable that ageing will be a more prevalent challenge than it is in the high population projection.

### *Social impact*

Unemployment will not be as big a problem in this scenario. There will be relatively more numerous older people, sparking a fear of an unbearable dependency ratio. As robotics are expected to play an increasingly bigger part in business, this will not be as problematic as feared. Moreover, involuntary unemployment will be rarer, and medical developments will most likely extend the working life of individuals, allowing them to participate in the labour force for a longer time.

While even a small amount of population growth will likely increase congestion and scarcity of

resources, it will be comparatively easier for societies to deal with this the more population growth slows down. Optimisation and greater efficiency will have a bigger tangible effect in that case, and fewer people will also slow down the speed with which the Earth runs out of resources and space. This gives people more time to develop sustainable and efficient alternatives.

### *Environmental impact*

In 2015, most major cities in the UK — London being a notable exception — pledged to run entirely on green energy by 2050.[91] This move would be good for the environment, as it would cut the UK's carbon footprint by at least 10 per cent.[92] Given that population growth will mostly take place in cities, the likelihood that the pledge will be realised by 2050 appears more certain in the low population projection scenario. Fewer people require less energy than more people, both directly and indirectly.

It will also be easier to prioritise the placement of nature at the heart of urban planning. When cities have to continuously build new facilities to keep up with the seemingly endless stream of people arriving at their doorstep, there is less room for nature in the budget. Initiatives such as green roofs, vertical gardens and inverted parks in tubes and under bridges can, however, improve the quality of urban life dramatically.[93,94]

## Conclusion

The high and low population projections represent two ends of the scale of imagined population developments. While this means that neither is expected to become reality, it can be said that the population growth the UK will actually face between now and 2050 will lie somewhere between the two. The former illustrated that while society will face challenges in every possible future, the nature and severity of these challenges could differ vastly. Though there are more changes that society will face by 2050, it is clear that challenges are more manageable in the lower population scenario than in the high population variant. Consequently, the government should focus on three aspects when aiming for a sustainable future: technological advancement, sustainable lifestyle choices and population stabilization.

While technology and the promotion of sustainability could lead to a reduction of waste and pollution, increased efficiency and productivity, and generally reduce the human footprint per capita, this approach will always face certain limitations. Even if we manage to reduce the environmental impact per person significantly, the total number of people is an equally important variable. The government must, therefore, actively strive for population stabilization and see it as a necessary requirement for a sustainable future.

Because the challenges of the future are not geographically confined to one space, the UK will have to promote population stabilization beyond its borders as well as within. Only when the global

population size stabilizes, is a truly sustainable future possible. If it does not, conflicts caused by scarcity and poverty will drive millions to migrate, making it more difficult for the UK to truly control its population size.

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