Getting to Net Zero Part 2: The Land Use question

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In Part 1 I covered the drive to renewable energy and the technical progress that has been made to achieve reliable renewable energy at affordable prices.

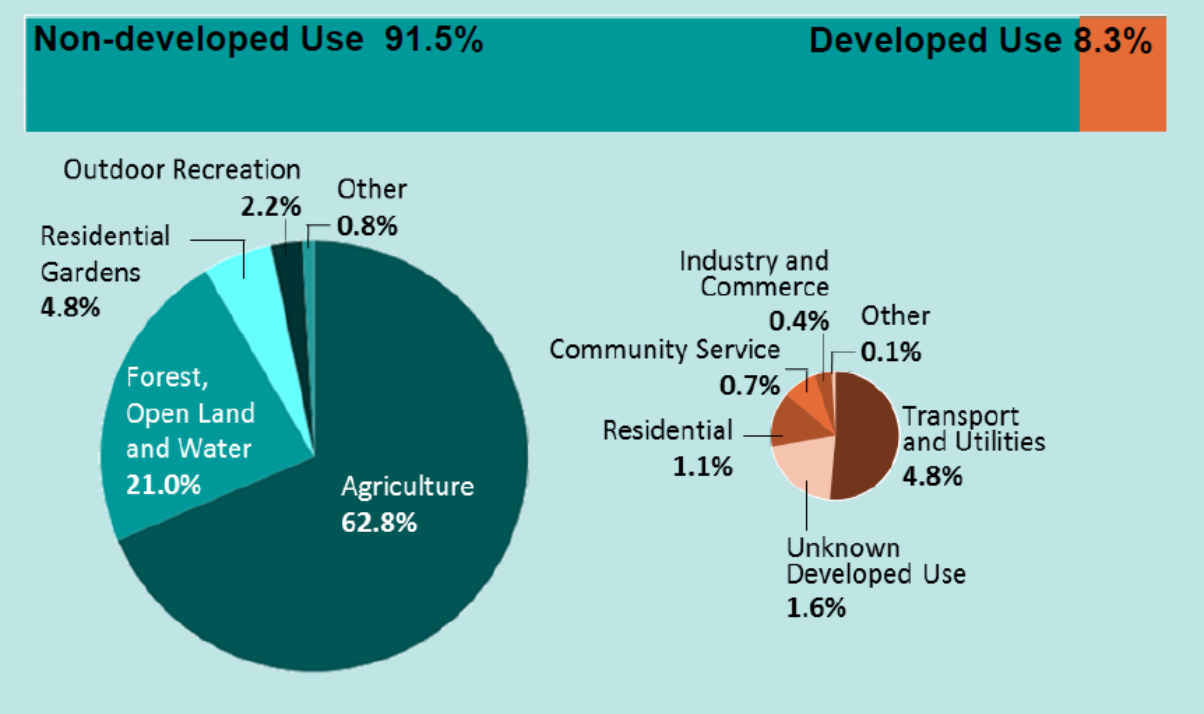
In particular I emphasised the efficiency of solar and its flexibility to be placed closer to consumers thereby reducing the cost of energy transmission; due to both reduced transmission distance and thereby reduced losses and through a lower need for transmission capacity and therefore investment.

There are however, many concerns that people have in the UK regarding the space that is required for solar and so in this article I will explore some of the issues around land use in the UK.

For the purposes of this article I will refer to land use in England rather than the whole of the UK. This is because England has the highest density of population and because a much higher percentage of land in England is good quality agricultural land than if we take the UK as a whole.

Land Use

The land use statistic for England make surprising reading as only 8.3% of land is deemed as developed. Over half of this is used by Transport and Utilities (4.8%) but surprisingly residential (classified as the footprint of homes – not gardens) makes up only 1.1%.



Source: Land Use in England 2018, Ministry of Housing, Communities and Local Government

Of the 91.5% of land that is non developed 62.8% is agriculture and 21% is forest, open land or water. Residential gardens makes up 4.8% of land so the combined footprint of dwellings and gardens is only 5.9%.

As you might expect London has a much higher proportion of developed land but even in such a large metropolis this is still less than 40%. Most of the other major regions of England are similar to the national picture with the South East highest with around 10% of its land developed.

Land use history

Land use has changed over time but in many respects has remained remarkably similar. For example Doomsday book recorded that 15% of England was wooded – a figure remarkable close to today's, and that 35% was Arable and 30% pasture – i.e. 65% agriculture – also very close to today's figure of 62.8%. (Ref: The History of the Countryside, Oliver Rackman)

There is almost no true wilderness in England (although Scotland has some in the far north). Every corner of England has been shaped by mankind and our management practices. Woods have been managed to yield timber for building and wood for energy for thousands of years, whilst the best land has always been used for arable crops or kept for animal pasture much as it is today.

Nevertheless there have been major changes, such as the Land Enclosures of the eighteenth century, that ended the medieval system of strip cultivation, or the need to grow more food during WW2 which resulted in the loss of much of the downland and lowland heath of southern England to arable farming. Contrary to popular opinion the industrial revolution was not responsible for significant (ancient) woodland loss as most woodland loss since 1800 is to agriculture in the short lived boom in the middle of the nineteenth century and again since WW2. Woodland coverage has since recovered through the creation of new (secondary woodland) on abandoned poorer farmland. (Ref Rackman).

Farming practice since WW2 has continued to become more intensive with diversity within regions reducing – for example, there is now little dairy farming in the east of England where arable has become predominant.

Food production

Since the industrial revolution Britain has never been self sufficient in food, indeed the ability to buy cheap food from abroad whilst Britain focussed on industry and commerce was a major political argument in the mid C19 with the Corn Law debates.

By economic value Britain still produces just over 75% of the food it can produce (indigenous) and about 65% of all food. As Britain also exports food the amount of UK produced food that is consumed in the UK is lower at 55%. The equivalent import ratio figures in the late C19 show a much greater reliance on imports in the past, as free-trading Britain imported food from every corner of the world.

In many respects British agriculture has enjoyed a sustained boom since WW2 and the EU Common Agricultural Policy (CAP) has continued the incentives to produce. The CAP has unfortunately encouraged intensive production and has led to heavy use of fertilizers, pesticides and herbicides to achieve high yields. Whilst this policy has certainly led to a European wide self-sufficiency in food it has come at a huge and on-going loss of biodiversity, as well as widespread soil fertility loss, something that is now widely seen as a crisis.

Post Brexit

With Brexit the opportunity to reform the subsidy of farmers is being taken with the government announcing a phasing out of the previous CAP regime by 2028 and its replacement with Environmental Land Management Schemes (ELMS) that include sustainable farming incentives, local nature recovery and landscape recovery schemes.

This is likely to result in major changes in land use, hopefully to the benefit of biodiversity but also to humans with improved areas for recreation. For farmers who have built business models on the old CAP subsidies this will mean significant change and with an the average age of farmers increasing it could lead to changes in the structure of farms not seen for many generations.

Solar Farms

Solar farms proposals have increased significantly in the last couple of years (following a lull after the removal of subsidies in 2018) and this is now leading to a more prominent debate about the location and size of such developments. Many people are objecting to the solar farm proposals in their area whilst at the same time supporting Solar PV in general. So in this section I will present a few facts on the economics of both farming and solar farms which will help frame the debate.

An acre of land in the east of England can produce 3.4 Tonnes of wheat per annum. At a 2021 price of £170 per tonne for wheat that makes a gross income of £561/ac. However seed, fertilizer and pest control costs cost ~£200/ac and labour and machinery another £150/ac and after adding in drying, storage and other costs means the cost of production is nearly £500/ac resulting in a net income of only around £65/ac.

To buy that acre of land would cost nearly £7000, which if used for wheat production is a return on investment of less than 1% per annum. And this is with wheat prices as high as they are this year – in previous years they have been as low as £107 on the world market.

The cost of production in the UK means that many UK farmers will look favourably at the near £1000 per acre rental income per annum that a solar farm will pay them. The reason that solar farms can pay such a high rent is simply that the gross income from an acre of solar panels is huge at over £16,000 per acre. The fact is that solar panels are very cost effective and can turn sunlight into high grade electricity at remarkably low costs.

Another way of looking at this yield is to consider how much Natural Gas we would need to import to generate the same amount of electricity. At today cost of gas this would be £20,000. Using that same acre to grow wheat would yield a import saving of only £561. I.e. economically an acre of solar yields 35 times more income than wheat farming!

In terms of the balance of energy security vs. food security the argument for solar as a sensible use of land is clear.

How much solar do we need and how much land will it take?

The proposed target of 40GW (for the UK as a whole) of solar by 2030 represents an increase of 25GW compared with today. The increase of output targeted will require 135,000 acres of land to be allocated. If this all this land (for solar) was in England alone (total area of 32.5 million acres) this would represent less than 0.5% of total land area and less than 1% of the area currently used for agriculture.

Where should we put them?

Many argue that we should put more solar panels on buildings and other parts of the built environment and indeed there are strong arguments for doing that with many counties now mandating the fitment of solar on new buildings. Nevertheless the economics of such installations are not as strong as for the large scale solar farms, however for new buildings new building standards will mandate solar and other efficiency measure.

The key factor for solar farms will therefore become size and location and these will be matters to be dealt with by the local or national planning authorities. One can only hope that there is some strategic thought given to their location and indeed governments and councils are belatedly putting in place enhanced guidelines.

Will solar farms ever go back to agriculture?

When a solar farm is built on farmland it is because this is deemed an appropriate use of Agricultural land (particularly lower grade land). There is no 'change of use' to from 'agricultural' to 'developed' land involved so the construction of a solar farm does not presume it will be re-developed into housing at a later point.

Solar Farm biodiversity impact

There are many who argue that Solar farms are impacting biodiversity adversely. However much depends on what the starting point for the land was and how the site is managed. If an ancient wood is felled to make way for a Solar Farm then this is clearly a disaster. However if a lower grade arable field is used where it has been intensively farmed for many years the natural soil structure is likely to be damaged and a period of lying fallow will lead to a natural replenishment. In the meantime a rich flower meadow can be planted and this will result in increase biodiversity. A recent report supports the positive impact on biodiversity that a solar farm can achieve if managed correctly.

Community Energy

The size and concentration of Solar Farms is increasingly a concern for many with those living near new developments clearly impacted disproportionately, however this does not diminish the case for solar which is strong and justified both on economic and national security measures. The amount of land that is required cannot be considered to be significant, at under 1% this hardly seems like a radical land redistribution.

At Sustainable Danbury we are promoting the use of smaller scale locally owned solar PV through a Community Benefit Society where profits are used for the benefit of local people and causes. We are encouraging householders and business and organisations to deploy Solar PV for their own benefit but are also providing a mechanism for community investment in Solar PV.

Solar project through a local community owned society will give the opportunity for local people to have a greater influence over decisions such as the size and location of solar projects as well as influence over how the benefits are shared.