Chapter 6: Renewable sources of energy

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Key headlines

The proportion of renewable generation outstripped fossil fuels for the first time in 2020 as a result record renewable generation. **Renewable electricity now represents 43.1 per cent of total generation, up from 36.9 per cent in 2019**

Growth in new renewable capacity continued to slow with just 1.0 GW added in 2020, the lowest since 2007. Covid-19 restrictions are likely to have contributed to the slowdown in growth in 2020 but at just 2.1 per cent, this is the slowest growth rate since 2002.

Renewable generation increased by 15.1 TWh (13 per cent), 11.6 TWh of which can be attributed to wind generation (2.9 TWh onshore, and 8.7 TWh offshore). Despite the modest increase in capacity, favourable weather conditions (notably the exceptionally high wind speeds during storms Ciara and Dennis in the first quarter of 2020) contributed to the increase in wind generation.

Total renewable fuel use increased by 1.6 mtoe (6.8 per cent); as renewable fuel use continues to be dominated by those used for electricity generation (74 per cent), almost two thirds of the increase can be attributed to the increase in wind generation. **Renewable heat increased by 0.3 mtoe (6.3 per cent) and grid injected biogas increased by 9.0 per cent, though from a relatively low base (0.5 mote).**

The renewable energy flow chart overleaf summarises the flows of renewables from fuel inputs through to consumption for 2019 and includes energy lost in conversion. The data are sourced from the commodity balance Table 6.1 and Table 6.4 for electricity outputs.

It also shows net imports for those renewable fuels which are transportable; utilising natural resources such as wind, solar and hydro are localised in nature resulting in a high proportion of domestically produced renewable sources which in 2020, represented approximately 80 per cent of renewable demand. Excluding primary generation and biogases, net imports represent around half of the demand, the majority of which is wood pellets used in electricity generation.

Renewable energy flow chart (Tables 6.1 and 6.4)

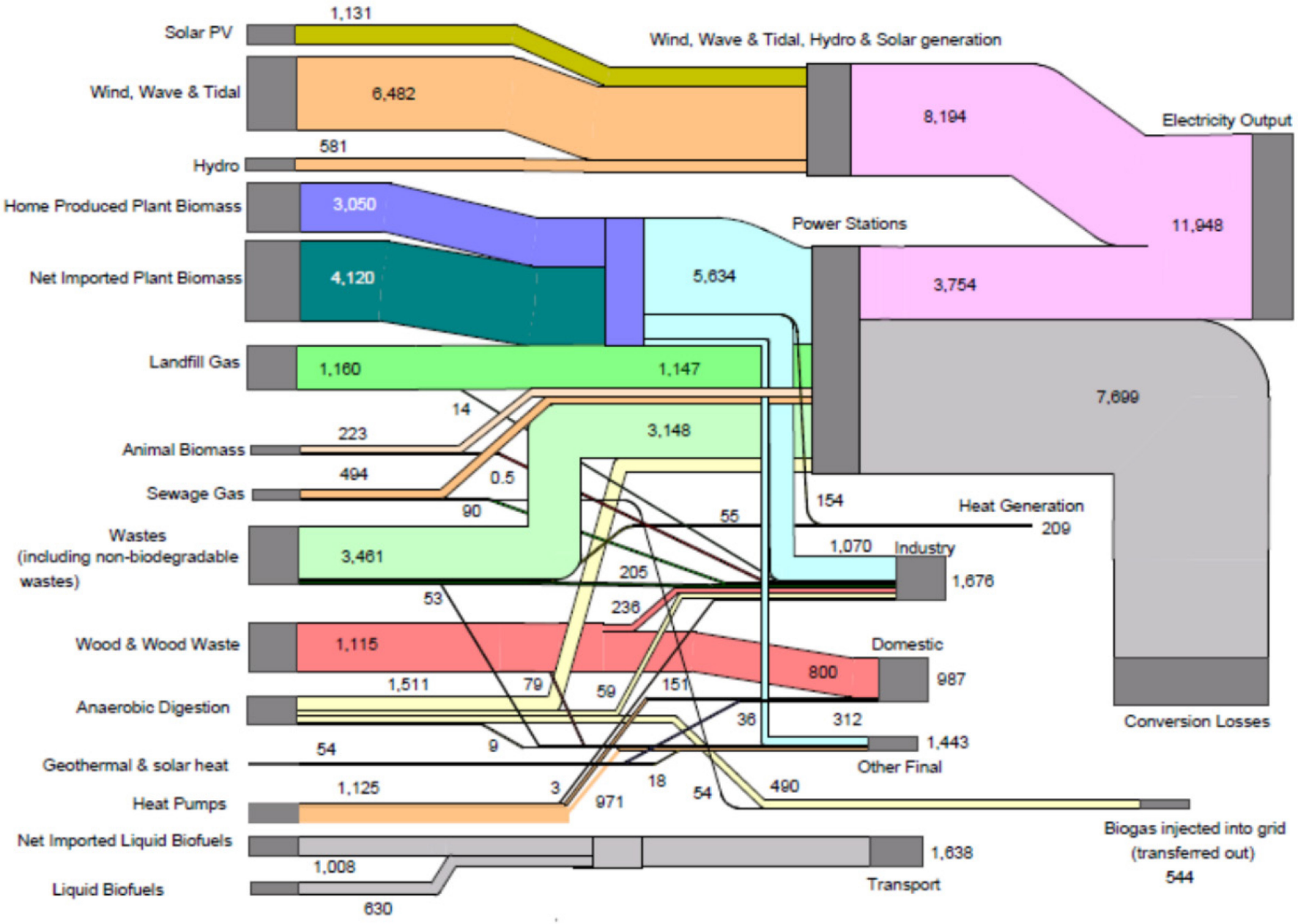
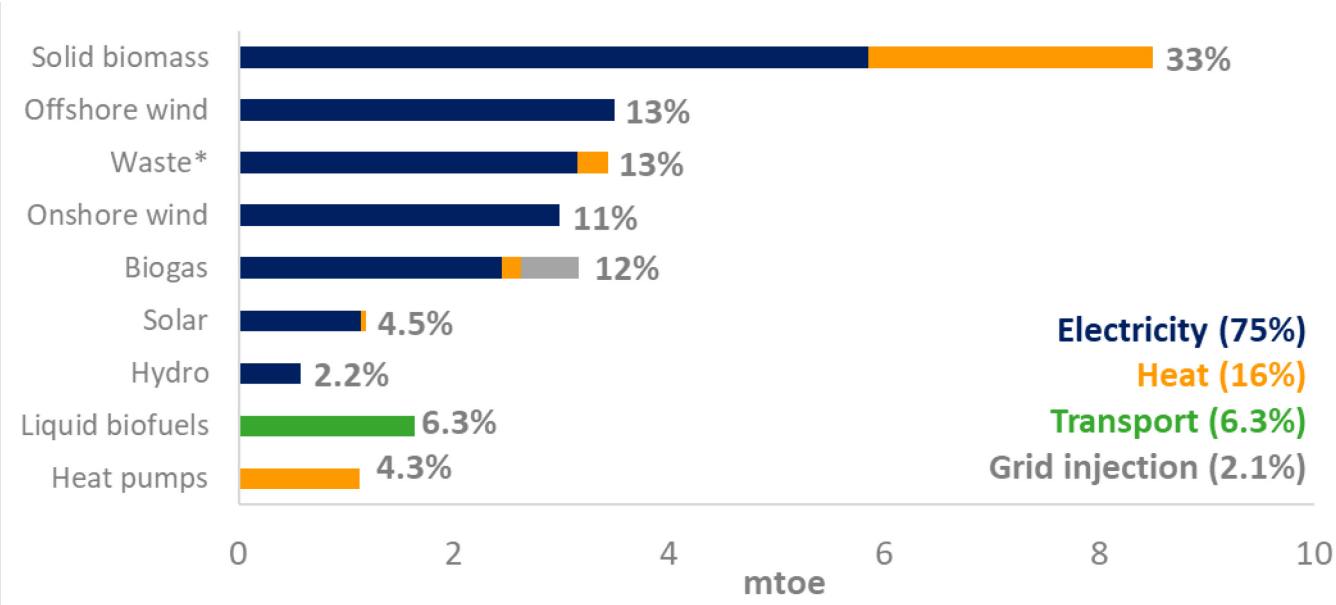


Chart 6.1 shows each of the renewable fuels and the end use of these fuels be that for electricity, heat, transport, or injection of biogas into the national grid.

Chart 6.1 Use of renewable fuels, 2020 (Table 6.6)

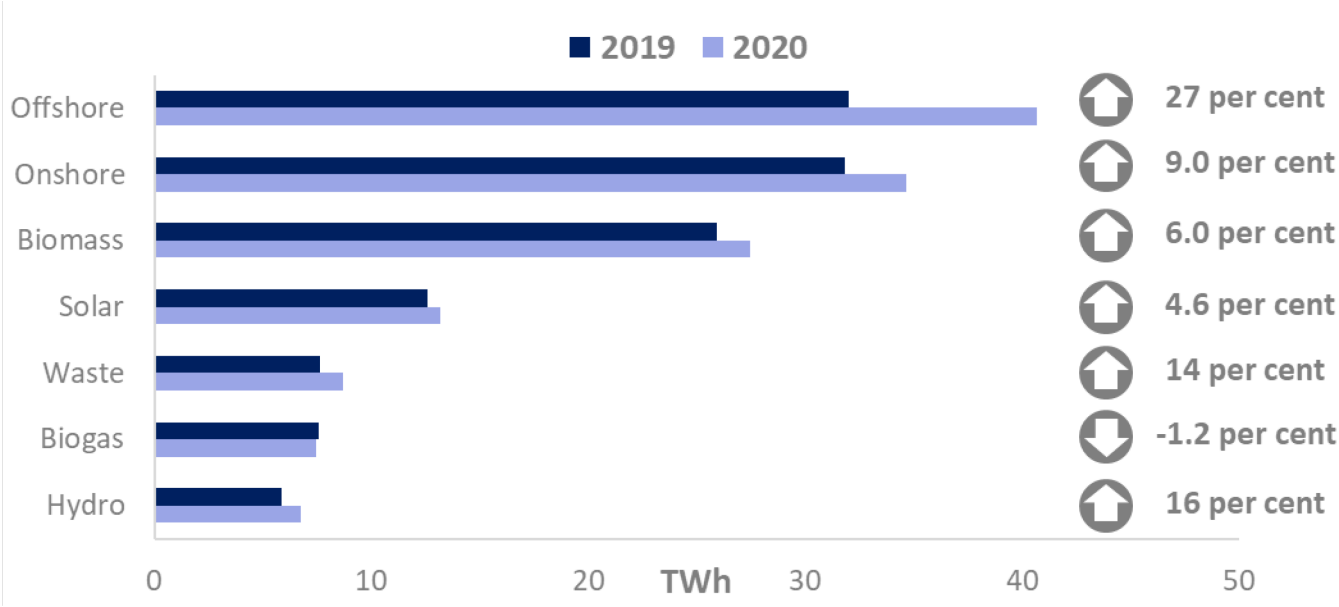


**Including non biodegradable waste*

Solid biomass, including wood, waste wood, animal and plant biomass, represented 33 per cent of total renewable demand in 2020 with approximately two thirds being used in electricity generation and the remaining third to produce heat. Biogas (landfill and sewage gas, and anaerobic digestion) has historically been used in generation and heat but has more recently been injected into the gas grid. Over three quarters, however, is still being used for electricity generation with 17 per cent being injected into the grid (up from 11 per cent in 2016, the first year data became available).

Although solid biomass accounts for the largest share of renewable fuel, on an output basis (i.e. generation after conversion losses in thermal generation), offshore and onshore wind show a higher share at 29 per cent and 25 per cent respectively in 2020. Chart 6.2 shows the change in generation between 2019 and 2020. With low-capacity growth in 2020 generally, some weather dependent renewable sources showed higher growth rates compared to thermal generation due to favourable wind speeds and rainfall.

Chart 6.2 Growth in generation by fuel 2019 – 2020 (Table 6.4)



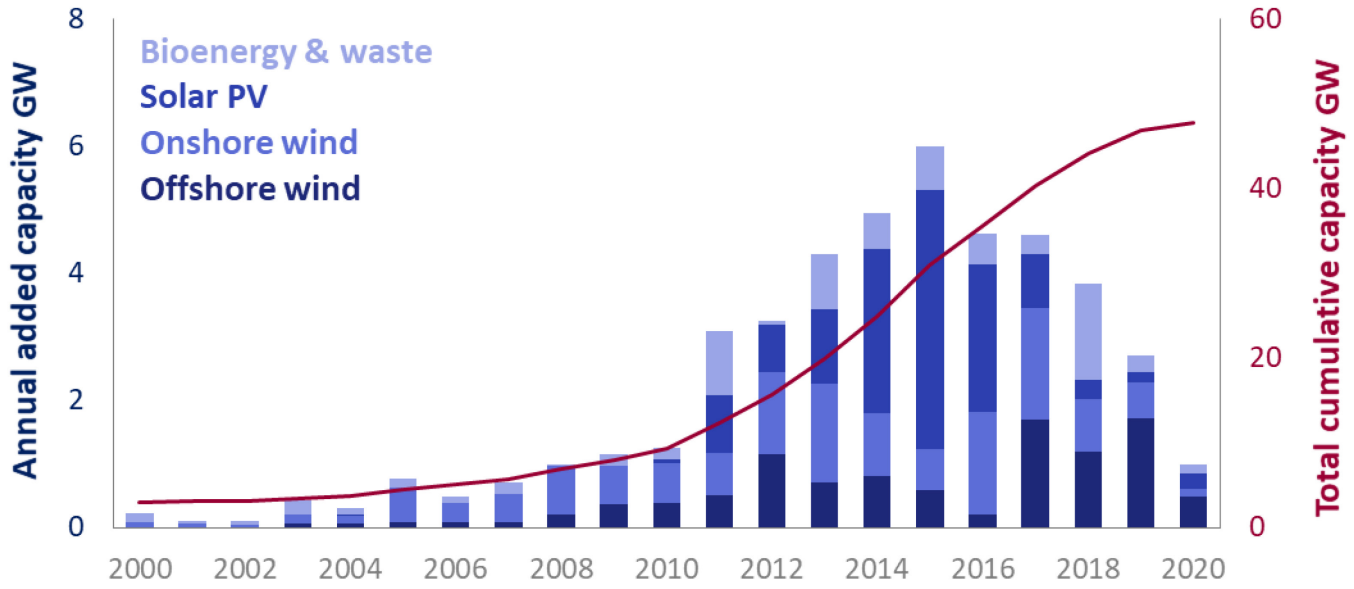
Offshore wind generation showed the highest increase in both absolute and percentage growth terms (by 8.7 TWh or 27 percent), with onshore also growing strongly (by 2.9 TWh, or 9.0 per cent). Although offshore wind did see some added capacity during 2020 (0.5 GW, or 5.0 per cent), the dominant effect on wind generation was the exceptionally high windspeeds particularly during the first quarter when Storms Ciara and Dennis hit the UK.

Generation from hydro also increased in 2020, by 0.9 TWh to 6.8 TWh, a 16 per cent rise. Installed capacity for hydro is stable and the additional growth was due to higher levels of rainfall compared to 2019. Energy from waste plants increased their capacity in 2020 which provided an additional 0.5 TWh in generation (1.1 TWh including non-biodegradable waste).

Only biogas saw a reduction in generation due to falling extraction rates at landfill gas sites, generation reached a peak in 2011 and has fallen by 34 per cent since then to 3.5 TWh.

Chart 6.3 shows the growth in new capacity over time. **New capacity reached a peak in 2015** when a total of 6.0 GW was installed, 4.1 GW of which was in solar PV. In 2020, just 1.0 GW was installed though some projects may have been deferred due to Covid-19 restrictions. Chart 6.3 shows new capacity in the year of installation by technology compared to the cumulative total capacity.

Chart 6.3 Annual added capacity 2000 to 2020 (Table 6.4)



Prior to 2011, solar PV capacity formed a very small part of the renewable energy mix representing just 1.0 per cent of total capacity. However, since then and up until 2017, it increased significantly with capacity added during those years accounting for 87 per cent of the current installed capacity. Although growth has slowed since 2017, solar PV's share of the renewable mix stands at 28 per cent in 2020. Growth in new wind sites has been more stable particularly onshore wind, though it has slowed markedly over recent years with just 0.1 GW added in 2020, an increase less than one per cent. Offshore wind has seen higher levels of new capacity in recent years with almost half being installed since 2016. Wind now represents over half total installed capacity (see wind map on next page showing location by capacity band).

Despite the slowdown in new capacity, the overall picture of increasing generation since 2000 remains positive with new records regularly being set including total generation in 2020 which at 134.6 TWh was 13 per cent higher than in 2019. Chart 6.4 shows how each technology has contributed to this strong growth.

Map of UK wind capacity 2020

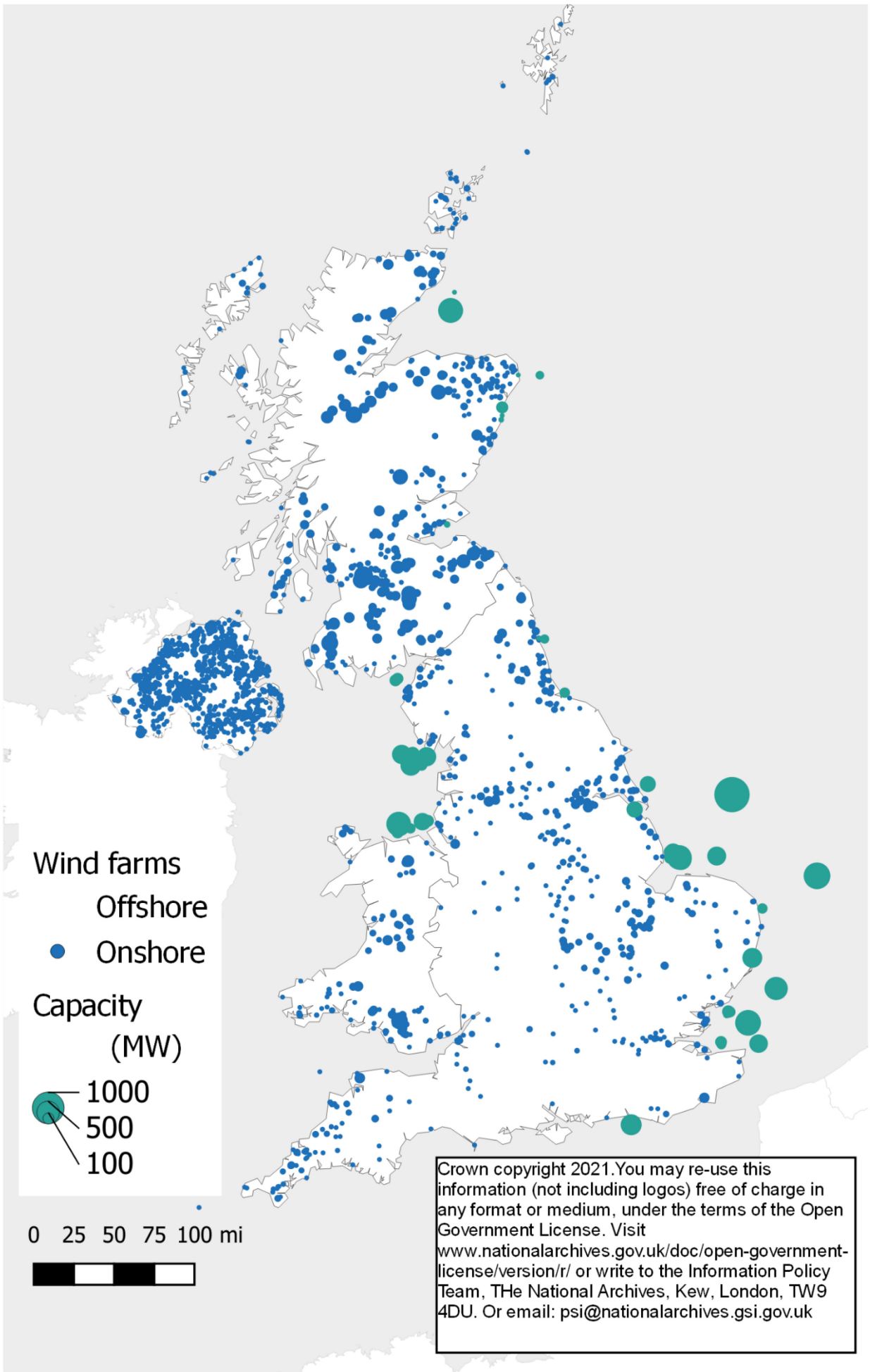
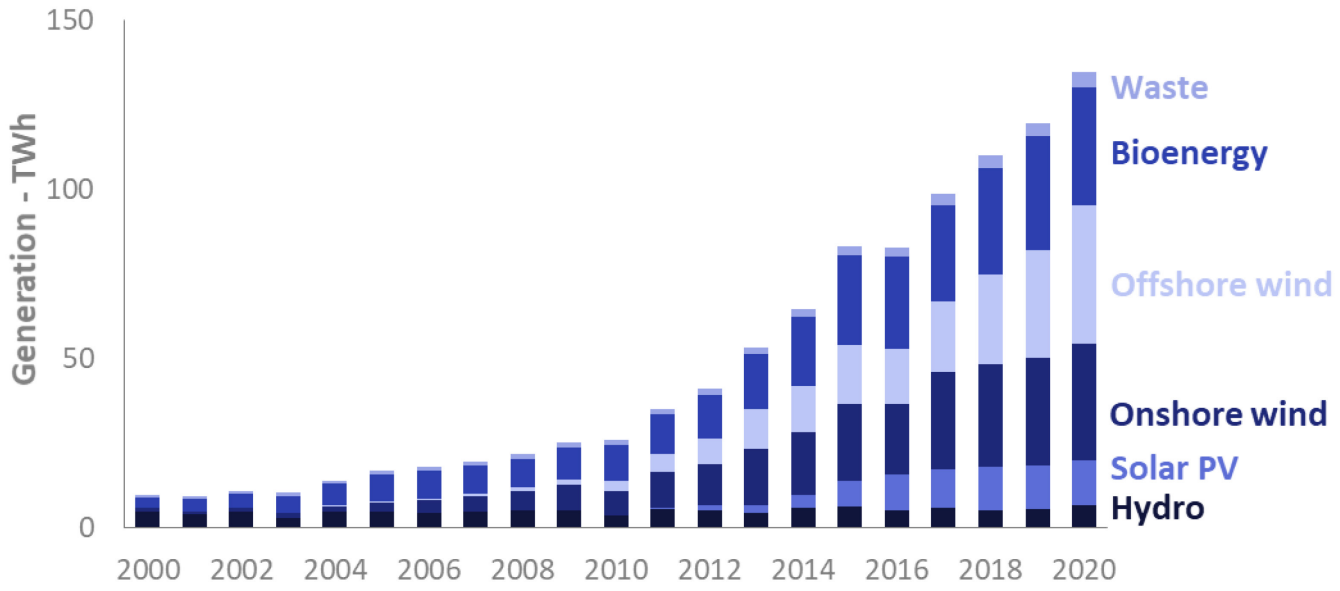


Chart 6.4 Trends in generation by technology 2000 to 2020 (Table 6.4)

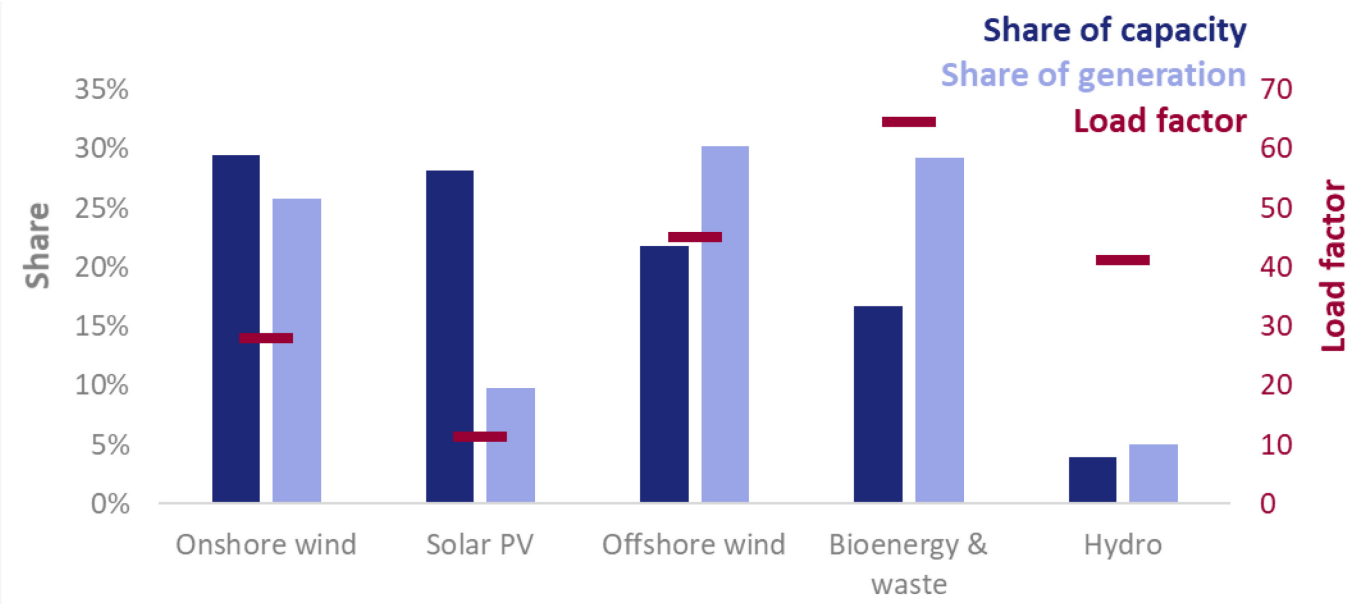


Hydro is a mature technology and generation tends to fluctuate from year to year in line with rainfall. In contrast, solar PV generation only started proliferating from 2012 reflecting the surge in new capacity incentivised via the Feed in Tariff (FiT) support scheme, increasing its share of renewable generation from 3.3 per cent in 2012 to 9.8 per cent in 2020.

Bioenergy saw rapid growth in the years from 2012 as several large power stations converted from coal to plant biomass. Generation from biogas had been fairly stable initially with some generation from landfill and sewage gas plants but as extraction rates have declined at landfill sites, increasing amounts of anaerobic digestion have offset this decrease.

Technologies with a high share of capacity do not necessarily have the highest share of generation because generation is dependent on the load factor. Load factors are the ratio of how much electricity was generated as a proportion of the total generating capacity**.** Within renewables, load factors can be heavily influenced by weather conditions, wind speeds on wind load factors, sun hours for the load factor for solar PV and, to a lesser extent, rainfall on load factor for hydro. Chart 6.5 compares the key technologies' share of capacity and generation alongside the load factor for 2020.

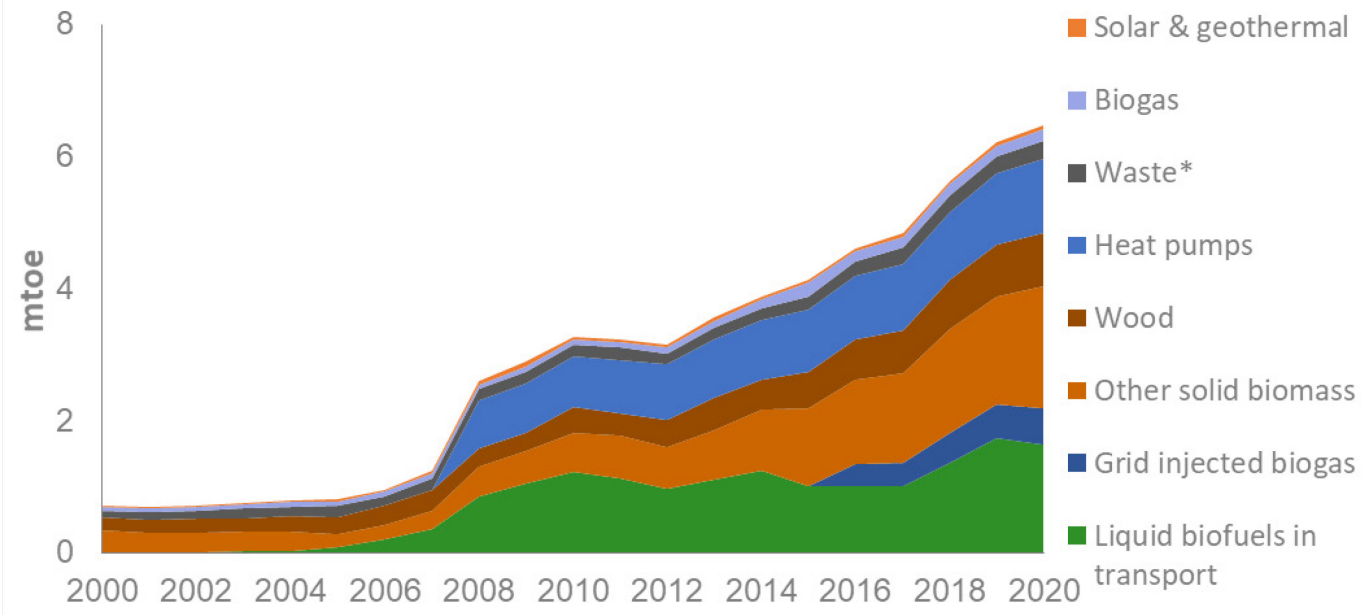
Chart 6.5 Relative share of capacity and generation and load factors 2000 (Table 6.5)



Thermal generation such as bioenergy and waste tend to have high load factors as indicated by the relatively high share of generation compared to capacity. Conversely, solar PV has a very low load factor due to limited hours of sunlight.

In 2020, the load factor for overall renewables was the highest ever reported. On an unchanged configuration basis, where only sites operating for the full year are included, the load factor was 41.6 per cent, the highest since 2008. Favourable weather conditions such as strong wind speeds and high rainfall contributed to the increase, and potentially increasing efficiencies in thermal generation.

Chart 6.6 Other renewable fuel uses; heat, transport, and grid injected biogas (Table 6.6)



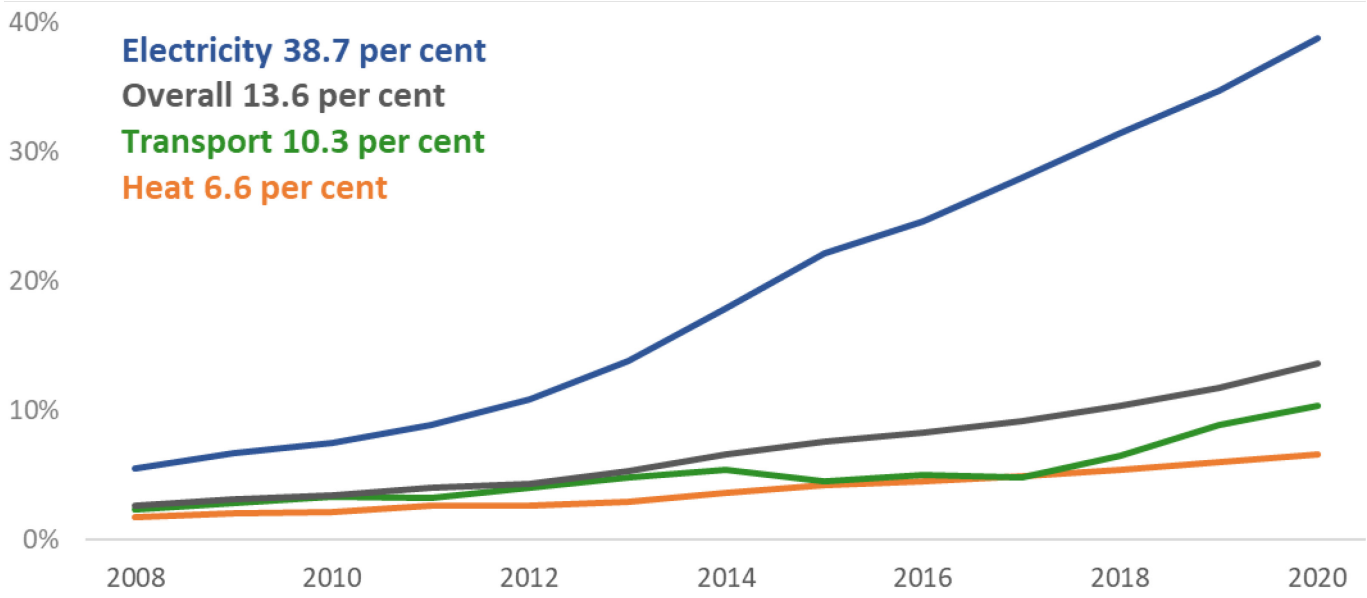
**Including non biodegradable waste*

Whilst electricity generation represents three quarters of renewable fuel demand, heat also accounts for a sizable proportion (16 per cent) with liquid biofuels (6.3 per cent) and of increasing importance, biogas injected into the grid (2.1 per cent). Between 2019 and 2020, renewable heat increased by 7.6 per cent with most of the increase in plant biomass though heat pumps also increased by 4.1 per cent with new installations.

Liquid biofuel in transport fell in 2020 by 5.6 per cent. Liquid biofuels are blended with diesel and motor spirit and the drop in demand is due to markedly lower demand for transport fuels due restrictions arising from the Covid-19 pandemic.

Until 2016, only minimal amounts of biogas from anaerobic digestion sites were injecting into the grid; with support from the Renewable Heat Incentive, it is of increasing importance in the renewable energy mix increasing by 9.0 per cent in 2020. It also now includes some sewage gas being injected (still just representing 10 per cent but increasing at a higher rate than anaerobic digestion sites).

Chart 6.7 Renewable energy as a proportion of total final consumption (Table 6.7)



Progress in the growth of renewable energy as a proportion of final consumption was separately monitored as part of a European Union Directive, the Renewable Energy Directive (RED). The RED set the UK a target to derive 15 per cent of total energy consumption by 2020 from renewable sources. The overall target covered electricity[1], heat[2], and transport, there was a separate target for transport to derive 10 per cent from renewable sources, including liquid biofuels and renewable electricity. The final outturn for the RED was **13.6 per cent against the 15 per cent overall target and 10.3 per cent for transport, an 11 percentage point increase since 2008.**

[1] The proportion of renewable electricity using RED methodology was 38.7 per cent, lower than the 43.1 per cent referenced in the key points section. This is due to the 'normalised' methodology in the RED, whereby wind generation is calculated using an average of the load factors.

[2] Domestic wood consumption has been revised downwards following new estimates arising from a Defra study on domestic consumption. This resulted in a change from 2,241 ktoe to 733 ktoe in the 2018 reference year which has been applied to the time series to 2008. The heat pump series has also been back corrected to 2008, removing a previous step change in 2015. The methodology note (link) provides further detail.

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