Annex 1:
The below has been produced for the REA by Hawkins Wright for the purposes of inclusion in their response to the Government Biomass Strategy Call for Evidence.

It is not meant for public circulation. Further data is available directly from Hawkins Wright.

Hawkins Wright contribution to Question 3: "*What are the current and potential future costs of supplying these different biomass feedstock types* (waste, forestry, agricultural)*?*"

1. A brief explanation of the difference between spot and contract prices

Long-term contracts for wood pellet supply have typically been agreed upon at prices higher than the average spot price, recognising the fact that the purchasing utility must offer a price close to or above a pellet supplier's long-run marginal cost (LRMC) if it is to persuade a developer to build a mill, the supply chain and guarantee delivery for years ahead.

In contrast, the spot price of industrial pellets is often more reflective of the short-run marginal cost (SRMC) of the incremental tonnage that a pellet mill may produce over and above its contracted volume. The reason for spot prices being closer to the SRMC than to the LRMC is best explained by the current structure of the market. Most industrial pellet demand in Europe is satisfied by long term supply contracts. Potential spot supply has typically exceeded spot demand with the result that pellet suppliers have been obliged to accept lower returns on investment than they can command when selling under a long-term contract.

2. Industrial wood pellet prices

The historical spot price of industrial/utility grade wood pellets (used for power/CHP generation) is depicted in the chart below. Over the past seven years, the price in USD has averaged $158/t CIF ARA. Expressed in British pounds, the average price over the same period has been £115/t CIF.

Figure 1: Industrial wood pellet spot prices in GBP & USD, 2014-2021

Note: Market benchmark prices are quoted in USD on a CIF ARA (Amsterdam, Rotterdam, Antwerp) basis. Prices have been converted into GBP at monthly average exchange rates.

Source: Hawkins Wright, Forest Energy Monitor

3. Future trends in pellet prices

With any commodity, supply cost and selling price are closely related. Other things being equal, the price of a commodity will reflect the marginal cost of supplying a given level of demand into a particular geographical or end-use market. The wood pellet market behaves in a similar way in this respect. The outlook for wood pellet prices will also be heavily influenced by the ebb and flow of supply and demand in the market.

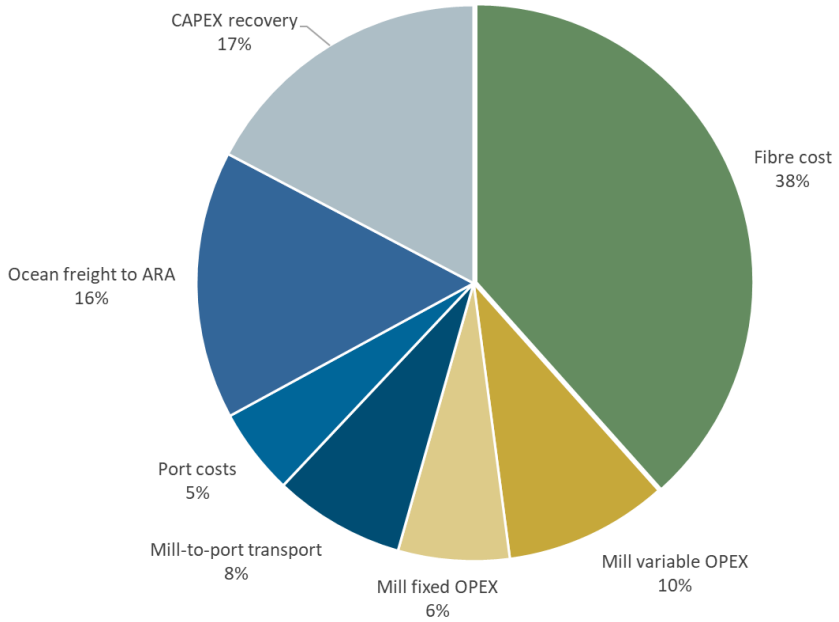
As the global wood pellet market matures and develops, the costs of wood pellet production can be expected to fall. Supply chain efficiencies, economies of scale, and engineering and technology improvements could all help to lower the costs of wood pellet supply. A specific example is the amount of electricity required in the operation of a pellet mill. The first generation of pellet mills - built in the early 2010s - consumed in the region of 200kWh (sometimes more) of electricity for each tonne of pellets they produced. However, with improvements in engineering design and operational experience, the industry norm is now 120-150kWh per tonne of pellets, and companies believe they can reduce this energy consumption even further. Other likely areas of cost improvements include the more widespread use of larger and more efficient ships, which allow the cost of ocean transport to be spread over a larger cargo volume, decreasing the unit cost per tonne of pellets. This trend is already happening in the market, as demonstrated by this recent announcement.

4. Industrial wood pellet cost components

The largest cost component in the supply of wood pellets is almost invariably the cost of the wood fibre raw material. In the first quarter of 2021, the cost of wood fibre comprised 38% of the average cost of supplying wood pellets to CIF ARA. The second largest cost component – amounting to 29% of the total – was logistics (mill-to-port transport, post costs and ocean freight). This was followed by the costs of CAPEX recovery (including a return on investment for the investor).

In comparison, the operating costs (OPEX) of converting wood fibre into wood pellets represents a relatively minor portion of the total, just 16%. OPEX costs, shown in yellow in the chart below, principally comprise electricity, heat (usually from biomass combustion), labour, maintenance and SG&A (overheads).

Figure 2: Global average costs of wood pellet supply to CIF ARA, Q1 2021



Source: Hawkins Wright. The Outlook for Wood Pellets, Q1 2021

5. Imported heating pellets

Heating pellets are used as a source of renewable heat in many thousands of rural homes across the UK, often as a substitute for fuel oil. They are also used to provide heat in commercial settings (e.g., sport centres, schools and hotels) and in agriculture and food manufacture (e.g., poultry rearing and dairy farming/processing).

The size of the UK heating pellet market is estimated to be 550,000-600,000t/y, of which about two thirds is imported, mostly from the Baltic States, Scandinavia and from Russia.

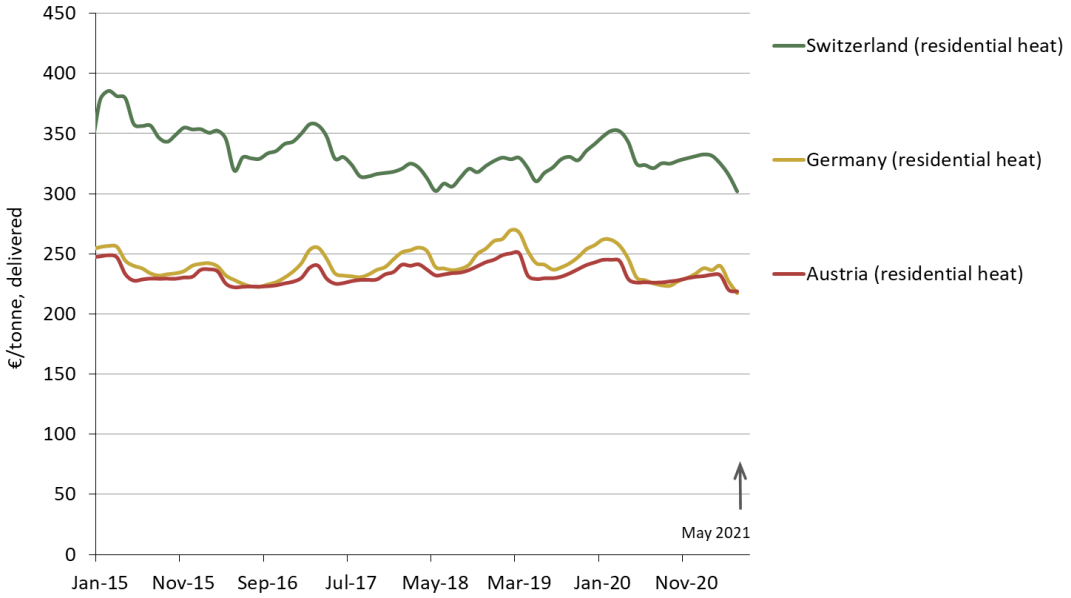
Heating pellet prices are to some degree correlated with industrial pellet prices, but without the extreme volatility that characterises the latter's spot market from time to time. In 2020/21, the wholesale price of heating pellets in the UK was in the range £120-125/t (€135-140/t), ex-warehouse (in bulk) according to market participants. In 2018/19, when the pellet market was a cyclically strong throughout Europe, the average wholesale price was around £150/t ex-warehouse. Due to the role of imports in the market, UK prices broadly follow European wholesale prices, plus or minus about £10/t depending on freight costs and UK market conditions.

Compared to industrial pellets, most of which are shipped in cargoes of 30,000-50,000t to specialist bulk terminals in Immingham, Liverpool or the Port of Tyne, heating pellets are typically shipped in coaster-sized vessels (<5,000t) to smaller ports such as Grimsby, Ipswich, Plymouth or Grangemouth. The pellets are shipped in bulk or as break bulk (in pallets of bagged pellets.) The pellets may also arrive in containers. Pellets that arrive as a bulk cargo may be bagged on arrival, depending on their intended end-use.

The importers of heating pellets typically sell the pellets ex-warehouse to local distributors who then deliver the pellets to retailers or directly to the larger end-users.

As points of reference, heating pellet retail prices in major European markets are shown in Figure 3. For many years, price trends have been relatively constant, but with regular seasonal variations.

Figure 3: Heating pellet prices 2015-2021



Source: Germany – DEPI; Austria – ProPellets; Switzerland – ProPellets
Note: all data relates to the price of heating pellets delivered in bulk (<6 tonne) and include taxes. All wood pellets are assumed to have a calorific value of 4.72MWh/t (17GJ/t).

For more detailed information and price history please see the following sources:

Germany - https://depi.de/pelletpreis-wirtschaftlichkeit
Austria - https://www.propellets.at/en/wood-pellet-prices
France - http://www.propellet.fr/indices-de-prix.html
Switzerland - https://www.pelletpreis.ch/de/preise/preisentwicklung

6. Alternative solid biomass fuels

Other solid biomass fuels include wood chips, energy crops and agricultural residues of various sorts. The UK's forests produced 2.6M green tonnes of wood fuel in 2019[1]. As fuel, wood chips have the advantage of being relatively inexpensive at the point of production – either in the forest or as a by-product of a sawmill, for example – but they have the disadvantage of being bulky and will usually have a high moisture content. The energy bulk density of wood chips (@30% mc) is typically 0.87MWh/m^3 compared to 3.1MWh/m^3 for wood pellets (@10% mc) or 10MWh/m^3 for heating oil[2]. So, while chips can be an ideal source of renewable energy when the supply chain is short, the low energy density of wood chips can make them uneconomic to transport over long distances. Energy density also influences storage requirements; to store the same amount of energy, wood chips require >3x more storage volume than wood pellets.

Data on European prices of wood chips traded on the Baltpool Biomass Exchange are available from https://www.baltpool.eu/en/ These prices are not necessarily representative of UK prices for which data are unavailable in the public domain.

Energy crops grown for use in power/CHP and for heating include miscanthus and Short Rotation Coppiced (SRC) willow and poplar. In 2019, the area of miscanthus grown in England was 8,171ha, producing around 100,000 dry tonnes depending on an estimate of yield. Of this, about half was used in UK power stations. The area of SRC in 2019 was 2,233 ha, producing around 25,000 dry tonnes depending, again, on the yield estimate used. Data on SRC prices are not available in the public domain.

The most abundant agricultural residue is straw from arable crops: wheat, barley, oats and oilseed rape. Straw is relatively inexpensive, though it is wrong to think of it as a waste. It used as animal bedding in livestock farming and has some nutritional value in animal feed. If ploughed in, it is a soil nutrient that can partly displace the use of chemical fertilizers. These benefits give straw a commercial value for non-energy end-uses. (Straw prices in England and Wales are currently breaking records at >£100/t, up from £52/t a year ago. See here: https://ahdb.org.uk/dairy/hay-and-straw-prices.)

Straw has a calorific value (~16GJ/t) only slightly lower than wood pellets (17GJ/t). However, a challenge that inhibits the use of straw as an energy feedstock is its high chlorine content. This can cause corrosion and slagging in a power station's boiler. Other challenges are the seasonality of supply and its energy bulk density of just ~1.1MWh/m^3. For energy end uses this makes straw costly to transport over long distances[3].

June 2021, produced by Hawkins Wright

[1] Source: Forest Research. https://www.forestresearch.gov.uk/documents/7825/FRFS020_TZKZgnZ.pdf
[2] Source: Forest Research. https://www.forestresearch.gov.uk/tools-and-resources/fthr/biomass-energy-resources/reference-biomass/facts-figures/typical-calorific-values-of-fuels/ (In practice, wood chips can have a moisture content >50%.)
[3] Assumes the transport of large round bales weighing 350kg with a volume of 1.4m^3.