SUPPLY CHAIN COSTS OF BIOMASS COFIRING

REPORT CCC/286
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SCOPE OF PRESENTATION

• The costs associated with cofiring

• The biomass fuels available for cofiring

• Focus on the wood pellet market and future demand levels

• The GHG emissions associated with cofiring

• Levelised cost of electricity generation and the cost of CO₂ abatement
• Cofiring must be affordable in order to compete other renewable technologies

• A sustainable biomass supply is needed
  
  Environmental criteria – GHG savings, preservation of the environment
  Socio-economic criteria – security of food supply, workers and property rights
  Cross cutting criteria – Land use change, biodiversity and socio economic outcomes
COSTS ASSOCIATED WITH COFIRING BIOMASS

- In general, biomass is more expensive than the fossil fuels it replaces.
- Investment is required to upgrade and modify the existing infrastructure.
- This may include new port and rail infrastructure, which may be required in the exporting and importing countries.
- Investment is also required in the existing plant infrastructure, the levels of which are dependent on the cofiring ratios.
• Woody, such as pine and wood chips or wood pellets derived from those species.

• Herbaceous, plants that have a non-woody stem, including *Miscanthus* and switchgrass.

• Agricultural residues, such as rice husks, straw, bagasse (a residue from sugar cane crushing), palm kernel, olive residue or olive cake (the waste from olive oil mills).

• Pre-treated fuels, including torrefied, washed and steam exploded biomass
Wood pellets are the most widely used biomass type utilised in heat and electricity generation.

Wood pellets are made from roundwood, forest residues, wood chips, wood processing residues, storm salvage and diseased trees.

ISO 17225-2 is in place to regulate pellet quality.
Total DRAK consumption in 2016 was ~6.5 Mt feeding three 600 MW units.

40% of the pellet feedstock was sourced from sawmill residues, a genuine waste stream.

Only 19% sourced from low grade roundwood.

Source: DRAK (2017a)
• A snapshot of the Southeast USA
• Pellet plant locations (red)
• Saw mills (grey)
• Pulp mills (orange)

• Total pellet demand for electricity and heat production was 26 Mt in 2015.

• The EU 28 are the largest producer and consumer with ~13 Mt demand in the commercial and residential heating sectors.

• The majority of wood pellets used in the EU for electricity production are imported from North America.

Source: AEBIOM (2016)
WOOD PELLET FOB PRICE

- Free on board prices for October 2017
- Coal price at the time US$91/t

Source: Argus (2017a)
## COST OF PELLET FEEDSTOCK MATERIAL

Costs of pellet feedstocks as reported by the EIA (US)

<table>
<thead>
<tr>
<th>Feedstock type</th>
<th>Definition</th>
<th>Delivered feedstock cost (US$/t)*†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundwood/pulpwood</td>
<td>Roundwood harvested for industrial use</td>
<td>25–35</td>
</tr>
<tr>
<td>Sawmill residues</td>
<td>Sawdust and shavings</td>
<td>35–40</td>
</tr>
<tr>
<td>Wood product manufacturing residues</td>
<td>Sawdust and shavings</td>
<td>36–46</td>
</tr>
<tr>
<td>Other residuals</td>
<td>Logging residues, wood chips, post-consumer wood, unmerchantable wood and other</td>
<td>32–35</td>
</tr>
</tbody>
</table>

* The price range from January 2016 to June 2017, † Converted from short tonnes to metric tonnes (EIA, 2017b)

Source: EIA (2017)
Pellet prices are volatile

Prices are currently demand driven

Prices reduced by 25-30% due to change in Netherlands biomass policy

Source: Argus (2015-17)
Cost, insurance and freight prices driven by the cost of pellet production and freight rates.

Freight rates are US$ 20-30/t.

Historically, freight rates are volatile.

Source: WPAC (2017)
A new dedicated biomass reception area is required

New covered storage and conveyor systems

Upgrading of the existing or new dedicated milling infrastructure required

Modifications to combustion infrastructure are required
### Existing Plant Conversion Costs

<table>
<thead>
<tr>
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<th>Cofiring (US$000/MW)</th>
<th>Conversion (US$000/MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-development</strong></td>
<td>60</td>
<td>107 (64 – 153)</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>246</td>
<td>303</td>
</tr>
<tr>
<td><strong>Total CAPEX</strong></td>
<td>392 (267– 615)</td>
<td>411 (314 – 485)</td>
</tr>
<tr>
<td><strong>OPEX</strong></td>
<td>88</td>
<td>69 (59 – 81)</td>
</tr>
</tbody>
</table>

**NOTE:** Ranges for high and low estimates are reported in brackets. The original costs reported by DECC have been converted to US$\textsubscript{2016} for consistency using the conversion factors in Table 10.

Estimated costs of conversion of an existing pulverised fuel plant to 50% cofiring and full conversion to biomass

Source: DECC (2016)
Emissions associated with wood pellet production in North America and end users located in the EU (a) kgCO₂/t, (b) gCO₂/MJpellet.

Source: DECC (2016)
Emissions associated with wood pellet production in North America for use in the EU

Source: DRAX (2017b)
WOOD PELLETS CAN MEET THE STRICTER EMISSIONS TARGETS EXPECTED IN THE REDII EVEN WHEN SHIPPED LONG DISTANCES
The LCOE of cofiring is higher than for coal.

As the cofiring ratios increase so does the LCOE.

Cofiring is competitive with offshore wind and solar installations.

There is less uncertainty in the estimations of the LCOE for cofiring than other renewable technologies.
• The LCOE includes a carbon price of $30 following existing IEA methodology

• When we include a carbon tax wind and solar become, in some cases, cheaper than cofiring

• However the range in LCOE estimation is still significant compared to cofiring
• The determination of the cost of CO$_2$ abatement uses the LCOE including a carbon price of US$30/t

• Cofiring particularly at higher cofiring ratios can be competitive with other renewable technologies
The future competitiveness is driven by both market and policy factors.

The main market driver will be how the increase in demand in Asia will effect overall price and if the market will become supply side driven rather than demand side driven.

Competition may increase from other types of biomass, reducing the demand for wood pellets.

Policy has previously effected the market place and support should continue to be given to sustainable users of biomass.

There is a proposed clause in the EU RED II sustainability criteria requiring that producer countries are signed up to the Paris Agreement.
COFIRING IS COMPETITIVE WITH WIND AND SOLAR IN TERMS OF COST OF CO$_2$ ABATEMENT EVEN WITH THE INCLUSION OF A CARBON PRICE
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