Decarbonising UK Paper Mills

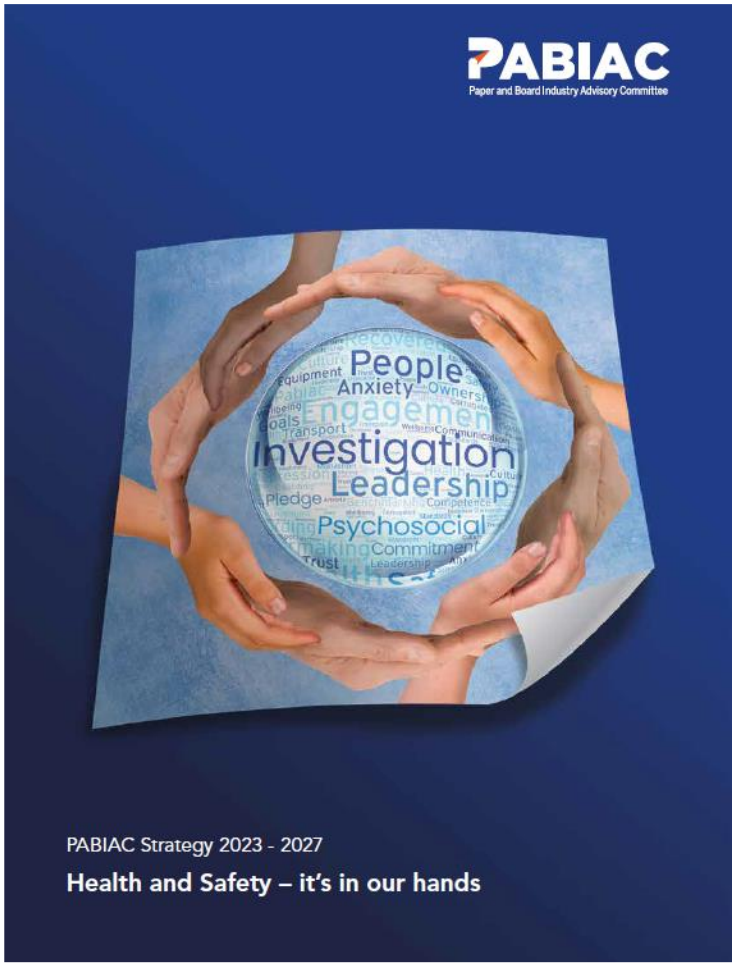
February 2024

UK Paper Sector - overview

- Print & Graphics
- Packaging
- Hygiene
- Speciality
- 3.9m tonnes capacity (circa 3.6mt production)
- 40 mills throughout the UK
- UK consumption circa 7.5m tonnes
- 5 closures since energy crisis
- New projects under development circa 1.2m tonnes production
- Circa 72% of raw material is recycled fibre
- Limited UK production of virgin fibre – most imported

- Total direct employment in SIC 17 (pulp, paper conversion) = 56,000
- Total indirect employment from SIC 17 = 59,000
- Total employment from SIC 17 activities = 115,000

PABIAC Strategy 2023 - 2027



Paper & Board Industry Advisory Committee

- Partnership between Industry, Government & Trade Unions

  Papermaking/tissue making
  Paper Conversion/Corrugated Sector
  Paper Recycling

- The strategy focuses on three specific objectives:
  - Critical tasks and human error
  - Accident Investigation
  - Physiosocial Health and Wellbeing

Sector Energy Use

6.9 TWh Gas (used in CHP or boilers)
3.7 TWh Solid Biomass & Waste (used in CHP)
0.2 TWh Other fuels

This gas & biomass produced:
1.7 TWh of electricity
7.1 TWh of heat

1.4 TWh of grid imported electricity
0.5 TWh CHP electricity exported to the grid

National policy to decarbonise grid supplied electricity by 2035 (possibly earlier).

Importance of Combined Heat & Power

Good match for the sector – has been seen as BAT….

CHP Grid imported electricity = 343 GWh

[Sector grid imported electricity = 1,327 GWh]

Electricity generated by CHP, used by mill = 1,313 GWh

[Proportion of sector electricity needs = 50%]

CHP Electricity exported to grid = 496 GWh

[Proportion of CHP electricity exported to grid = 27%]

CHP Gas consumed = 4,232 GWh

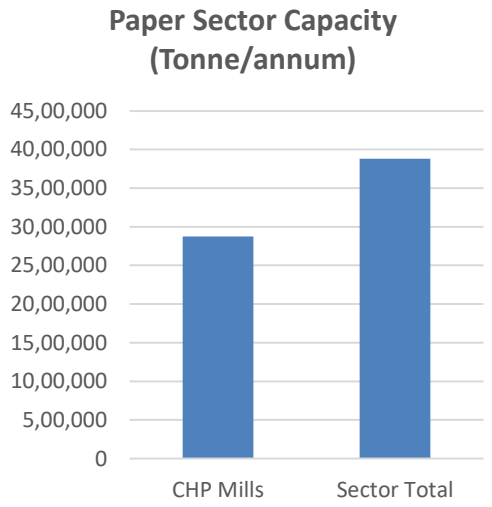
[Sector gas consumption = 6,830 GWh]

Waste & Biomass = 3,729 GWh (47% of all CHP combustion)

Sector Mills with CHP – Production

Mill Name	Capacity (tonne/annum)
UPM Caledonian	260000
Wepa	115000
Holmen Iggesund	220000
James Cropper	50000
Smurfit Kappa SSK	230000
Preston Board & Packaging	50000
Shotton Mill Ltd (Note 1)	-
Smurfit Kappa Townsend Hook	260000
DS Smith Kemsley	800000
Palm Paper	400000
Saica	450000
Sapphire	40000
Total	2875000
Proportion of Sector	74%

Note 1: Capacity circa 780,000t (commission late 2024) and tissue (210,000t) to follow



Sector Carbon Reductions since 1990

Using national carbon factors, and assuming a credit for electricity exported, the sector's fossil GHG emissions in 2022 were:

- 1.53 MtCO2 direct emissions - with a specific figure of 0.42 tCO2/t
- 0.24 MtCO2 indirect emissions

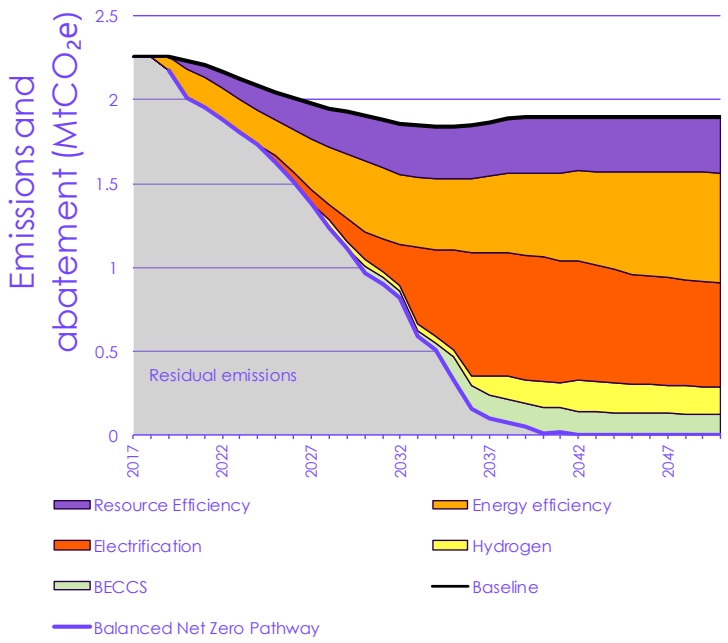
Compared with a base year of 1990:

- Direct fuel CO2 emissions were 73% lower
- Specific fuel CO2 emissions from direct fuel use were 49% lower

These reductions have been delivered by fuel switching (from coal & oil to natural gas & biomass), huge investment in CHP (both gas-fired and biomass) and progressive energy efficiency improvements.

Committee on Climate Change

Sources of abatement in the
Balanced Net Zero Pathway for the Paper and Pulp sector



Source: CCC analysis, BEIS (2020) *Provisional UK greenhouse gas emissions national statistics 2019*
Notes: The abatement from BECCS in this graph does not include the carbon captured, which is accounted for in the removals subsection of Chapter 3.

Paper Sector Net Zero Roadmap

- Assumptions:
  - Steady BAU energy efficiency improvements are counteracted by steady growth over the period
  - Total sector energy demand remains constant at 2021 levels (for heat & electricity) over the period 2023-50
  - Biomass mills continue as “currently” i.e. ignored for this study
- Base Case:
  - Residual requirements: 6.4 TWh heat & 2.5 TWh electricity
  - Assume heat requirement reduced by 15% due to resource efficiency and further energy efficiency developments – so 5.4 TWh
- Need to:
  - Replace heat provided by natural gas with a zero-carbon alternative
  - Replace electricity from gas CHP with grid electricity or a zero-carbon alternative
  - Decarbonising fossil heat is the key challenge

PP_2050Roadmap_March2023.pdf (thecpi.org.uk)

How to deliver

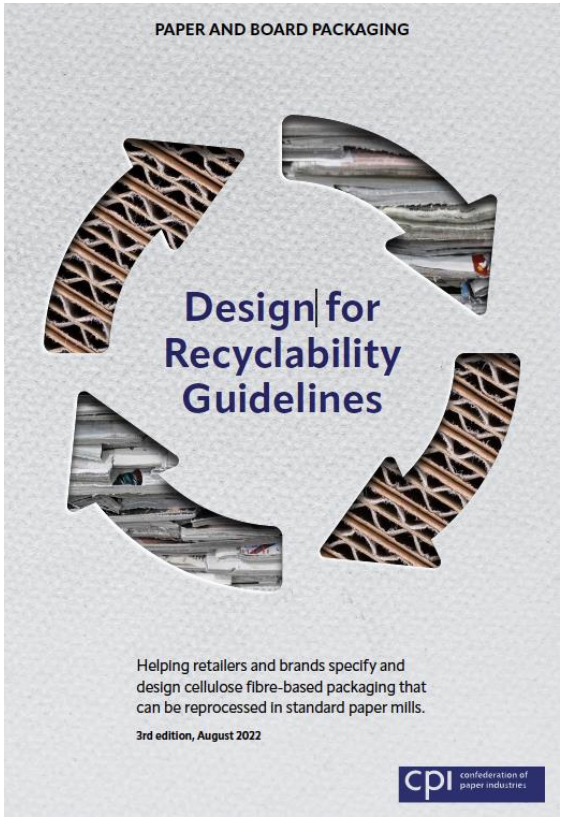
- **Resource efficiency**
  - light-weighting
  - eco-design
  - recycling
  - waste minimisation

- **Energy efficiency**
  - incremental improvements
  - best-in-class equipment
  - energy recovery
  - technical innovation – water-less papermaking?

- **Biomass & Energy from Waste**
  - preferential access to materials?
  - other existing users
  - carbon capture, utilisation/storage
  - biogas

Design for Recyclability Guidelines

- Originally developed in 2019, updated in 2020 & 2022
- Final review by the Recyclability Technical Expert Committee and discussions at the Recovered Paper Council.
- Aim of inspiring the next generation of packaging, assist innovation and optimise recyclate entering the supply chain.
- Policy section reviewed and distinction on different sources of contamination that can affect recyclability
  - Contamination due to product design
  - Contamination due to collection methods
  - Food contamination
  - Contamination due to harmful substances
- Encourages limit of non-paper components in new products to 5% of the pack weight, whilst making clear that this is a design guideline and not a determination of recyclability



Papercycle

- Wholly owned subsidiary of CPI, fully launched in May
- Framework for assessing recyclability.
- Recyclability and certification services for fibre-based packaging.
- Parameters and thresholds agreed by the UK Paper Industry using the European lab testing methodology.
- Increasing demand from brands and designers in the UK and Europe.
- Increased resource capacity to meet demand.
- Currently review of website.
- Intensification of PR and publicity in the new year and a networking event planned for Spring.
- Review in line with developments in 4evergreen and Defra recyclability assessment methodology.

Energy Efficiency & Biogas

- **Energy efficiency** – makes sense to drive down energy use with associated cost and environmental savings.
- Should be able to deliver 0.5% to 1% each year through good management.
- Increased use of system standards such as ISO50001.
- Support for new investments through the Industrial Energy Transformation Fund.
- Climate Change Agreements delivering tax discounts in return for meeting energy efficiency targets.
- UK Emissions Trading Scheme.
  Note some similarities to PAT scheme
- Energy efficiency requirements written into the site operating permission.

- **Biogas** – can be blended into existing supplies.
- Limited opportunity in the sector from process wastes.
- Support more generally for stand-alone plants using agricultural and other biogenic wastes.

Bio-Energy with Carbon Capture & Storage

Key technology for paper sector using process wastes & residues:

- Bio-genic wastes and forest materials are classed as zero carbon.
- Most virgin fibre mills make use of bioenergy and so are classed as zero carbon.
- Recycled fibre mills can make use of process residues.
- Capture and permanent storage of CO2 (BECCS) creates negative emissions.
- Lots of UK interest, especially by power generators.
- Sector also considering carbon capture & use – Flue2Chem.

Hydrogen in the UK

- Seen as a potentially important technology in replacing gas.

- H2 generation options:

- Green hydrogen – electrolysis from offshore-wind
- Blue hydrogen – with carbon capture at point of gas processing
- Hydrogen as a commodity shipped around the globe

- A number of regional projects are seeking to either blend H2 into existing supply networks or provide new H2 only connections direct to large industrial sites.

- Green hydrogen seen as a huge opportunity for the UK if the opportunity of off-shore generation can be delivered.

- Grant/revenue support being offered to develop commercial support of H2 (from electrolysers) to industrial users.

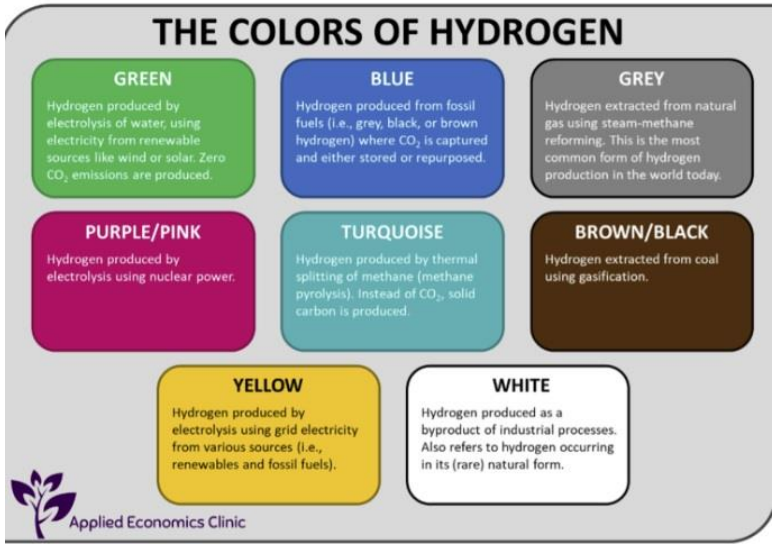
How to deliver

- **A new hydrogen-based economy**
  - blended into existing gas supply alongside biogas
  - separate new/repurposed distribution network for H2 supply to industrial sites
  - new medium for energy storage
  - operational cost implications
  - new/repurposed/ combustion equipment

- **Carbon capture/storage at gas terminals to make blue hydrogen**
  - new business model for gas suppliers?

- **Electrolysis to make green hydrogen**
  - zero carbon electricity required
  - support for business operational case

- **Opportunities site location specific**
  - financial support for business models
  - new support for dispersed sites



How to deliver

- **Electrification**

- policy intent is for zero carbon electricity from a decarbonised grid
- needs upgraded site grid connections
- and new on-site distribution network
- plus replacement drying equipment
- heat pumps – getting close to be proven technology
- on-site renewables
- power purchase agreements – more feasible as network costs addressed
- demand side reduction schemes/managing the grid
- batteries
- small modular nuclear seen as a UK opportunity

Grid connection issues:

The Government has commissioned a major new report to identify issues and propose measures to remove barriers.

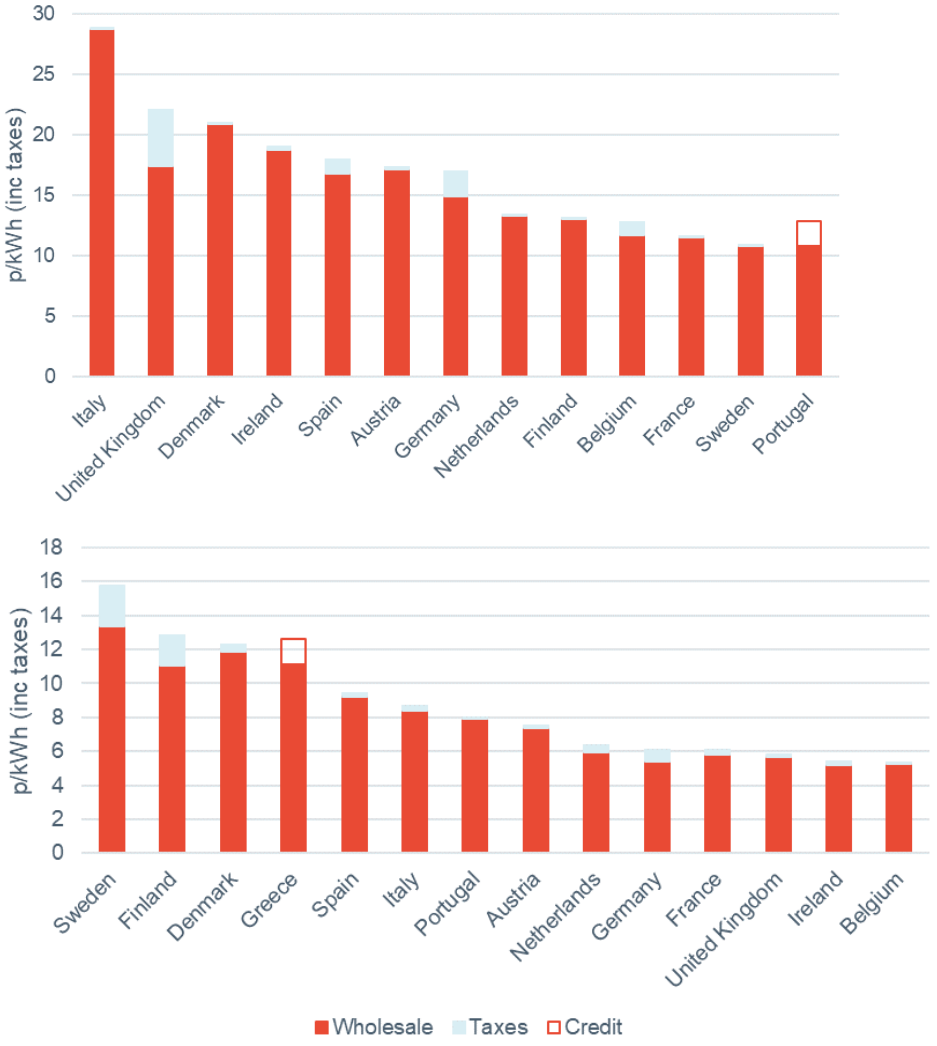
There's a total of 18 wide-ranging proposals, with an intention that the time to secure planning permission be halved from the current average of 12-14 years.

Call for evidence:

Fichtner Engineering and CPI publish analysis into the practicality of electrifying the UK Paper Ind

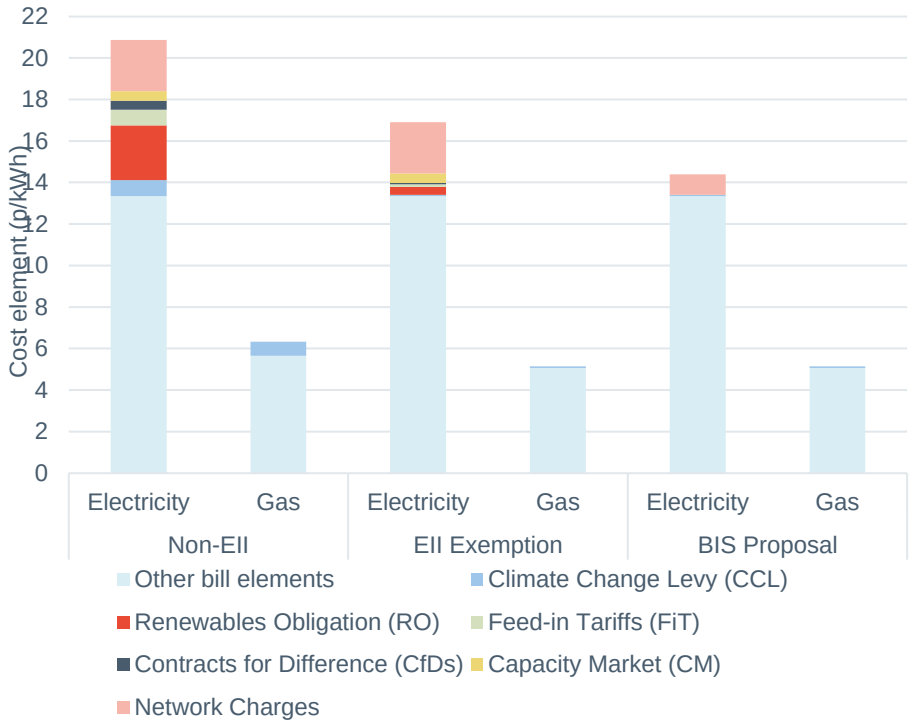
UK Electricity vs gas costs

As a historic major gas producer, and a major importer and trading hub, the UK has the third cheapest gas large-user price in Europe. However, UK electricity prices are the second highest in Europe, due largely to having the highest non-commodity costs – linked to network operation, support for low carbon generation and taxation.



Electrification – Heat Pumps

- Assuming other technical characteristics are suitable, heat pumps can multiply electricity conversion to useful heat
- We can look at the relative costs of fuels to calculate the required coefficient of performance (CoP) of a heat pump to deliver energy at the same cost
- Heat pumps can exceed these characteristics, currently – but not consistently
- Around 2.3-2.4 is the highest average CoP currently available

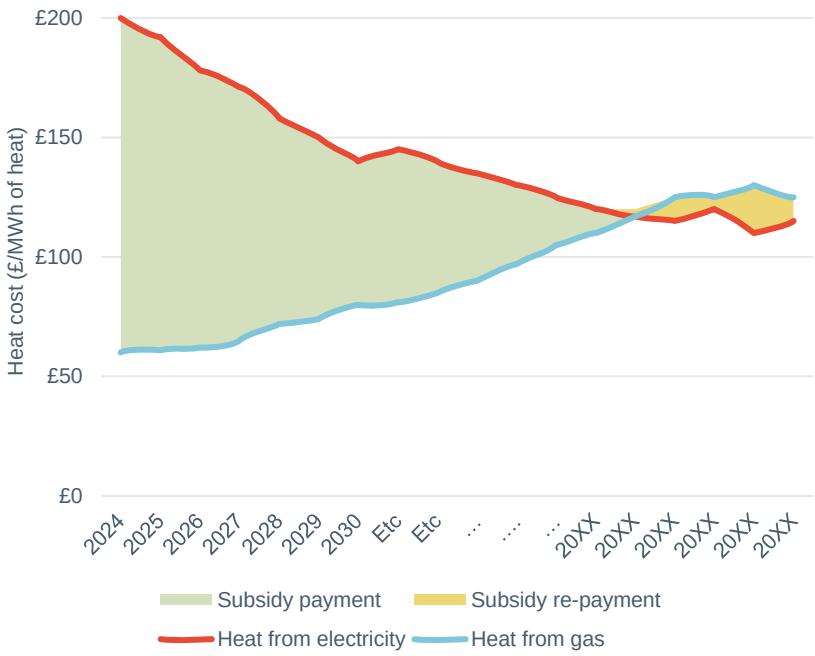


Electrification – heat CfD

Ongoing costs are not the only consideration – there are also the costs of conversion

How else could government support industry to make the transition?

- Revenue support: a heat Feed-in Tariff or Contract for Difference?
- Up-front capex support?
- Broader tax/ levy exemptions for electrified heating?
- Network connections support?
- Adjusting the counterfactual?
  - CBAM



Policy drivers for decarbonisation

- UK Emissions Trading Scheme

- mandatory annual reporting of CO2, with allowances required to be submitted

- some free allocations to protect sites from carbon leakage

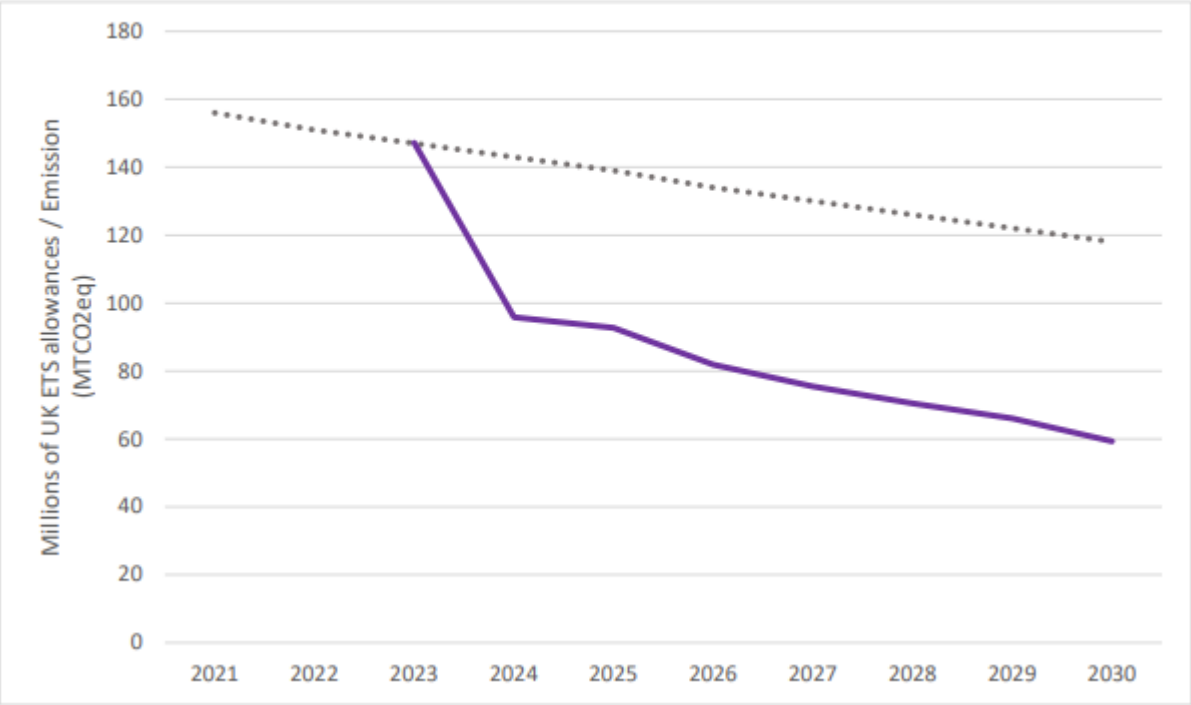
- free allowances reduce each year and less issued by Government

- Regulatory requirements imposing operational requirements on sites
- Reporting requirements to highlight energy performance
- Climate Change Agreements to drive energy efficiency

UK-ETS; EU/UK-ETS schemes evolution

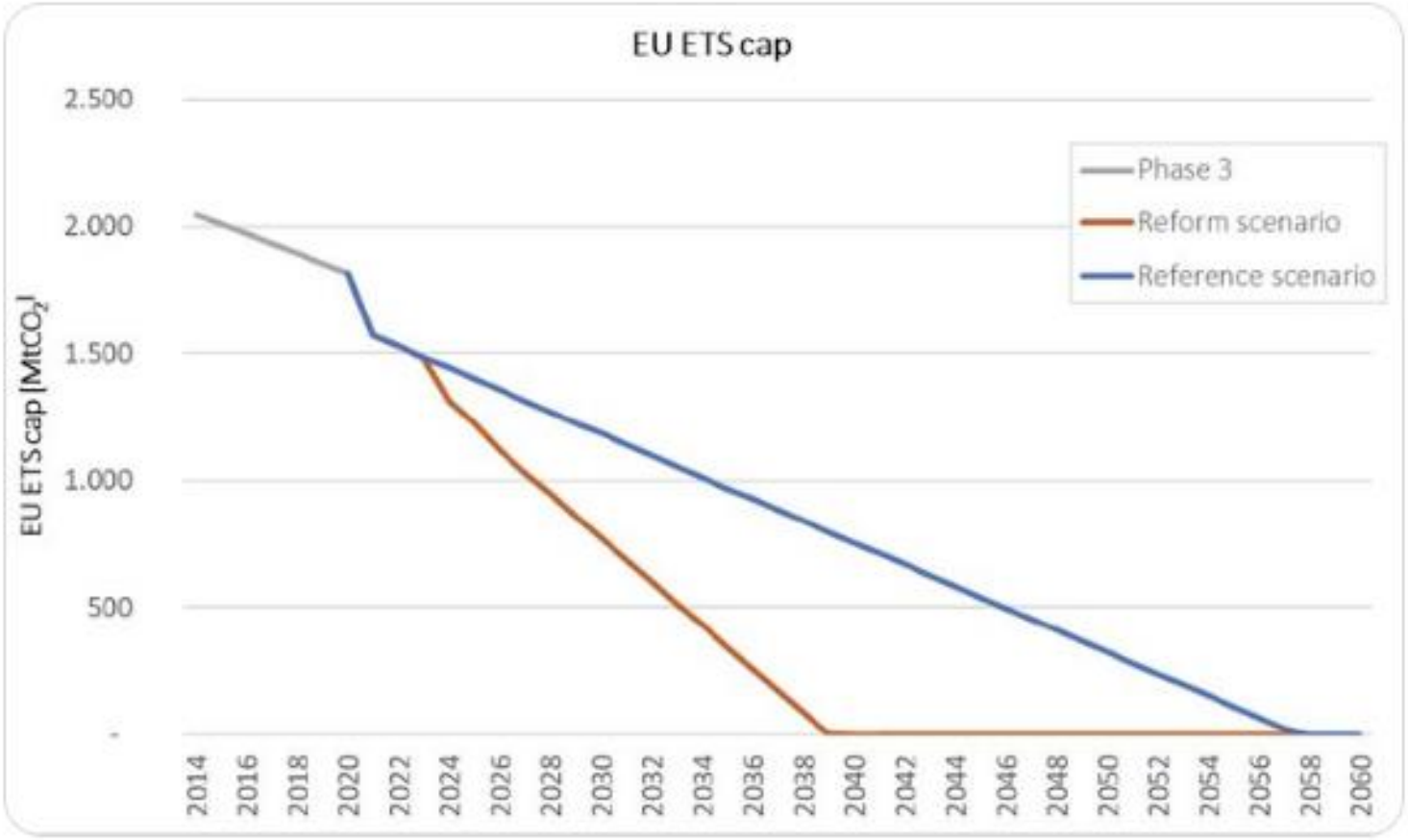
- BEIS consulted (March 2022) on how UK ETS might be changed to better reflect the Government's net-zero aspirations (likely reduction in Free Allocations to achieve the desired emissions path).

The CCC's proposed path for emissions for sectors covered by the UK ETS (purple), compared to the currently legislated cap (dotted line).



UK-ETS; EU ETS Reform for phase 4

An increase in the LRF from 2.2% to 4.4%



Carbon Borders (CBAM)

- The effects of ‘carbon leakage’ on UK industry.
- The UK Emissions Trading Scheme (UK ETS).
- Potential solutions to ‘carbon leakage’ including the role of Carbon Border Adjustment Mechanisms (CBAMs).
- EU already agreed CBAMS for several sectors that will result in the gradual withdrawal of free ETS allocations.
- UK following broadly similar policy.
- Paper not in the first set of sector – but could be extended to cover all ETS sectors – EU review in 2024.

EII Support 'Supercharger' - package

If electrification is to be a viable decarbonisation option, it needs to be economic:

- Increase of the 85% discount from Renewable Obligation, Feed-in-Tariff and Contracts for Difference charges to 100%.
- Capacity Market costs. Exemption to start by October 2024.
- Network Charges. From April 2024 onwards and intended to shield specified sectors from network charges – this being seen as one of the key reasons for higher electricity costs in the UK due to the lack of protection for industry. Retrospective payment at 60% of cost.

- Access is via acceptance into RO/FiT/CfD discount scheme – reassessment process involving GVA test at company level.
- 5-year re-application process.
- Policy attention now turning to gas intensive sectors – and what help they need. Uncertainty over CHP polices – GQCHP consultation due later this year…

These three measures together are expected to reduce the cost of grid supplied electricity by between £24 - £31 per MWh compared to the cost if the measures were not in place.
Total sector purchases of grid supplied electricity circa 1,500,000 MWh (2022) then these three policy measures will save UK papermakers between £36m - £46.5m pa at current prices once fully implemented.

Carbon leakage protection

Accepted as a risk –

UK ETS / CPS (Carbon Price Floor)

- Extended – applications all resolved?
- Retained GVA impact test

New assumed cost for UK ETS (£62.10); grid carbon reduced to 0.446(kg/CO2/kWh); £18 CPS tax - unchanged

Move to use of product benchmarks to set support levels

Funding to 2025 confirmed – initial discussions with key policymakers

Support schemes

Transforming Foundation Industries (£66m) – allocated – seeking more funding

- Multi strand programme
- Smaller R&D programmes (Network+ & TransFIRe)

Industrial Energy Transformation Fund (additional £185m) – phase 3 opened Jan 24

- Support for both feasibility studies and actual new projects (circa 30-50% of cost)

Green Gas Support Scheme

'provides financial incentives for new anaerobic digestion biomethane plants to increase the proportion of green gas in the gas grid.'

EU Horizon Project – UK now re-joined as part of NI protocol deal.

ETS Innovation Fund – using ETS auction revenue to support decarbonisation projects – nothing similar in the UK.

Thanks!

Steve Freeman

Executive Director – Energy & Climate Change

sfreeman@paper.org.uk