The Sixth Carbon Budget and Welsh emissions targets – Call for Evidence
Question and answer form

Please limit your answers to <u>400 words</u> per question and provide supporting evidence (e.g. academic literature, market assessments, policy reports, etc.) along with your responses.

Introduction

The British Ceramic Confederation (BCC) is the trade association for UK ceramic manufacturing, representing the collective interests of all ceramic sectors. With 90-plus member companies, BCC represents around 90% of the industry's UK manufacturing capacity. Membership of the BCC is diverse and includes manufacturers of:

- Bricks
- Clay Roof Tiles
- Clay Drainage Pipes
- Gift and Tableware
- Floor and Wall Tiles
- Sanitaryware
- Refractories
- Industrial Ceramics
- Suppliers to the industry

Our membership comprises a range of mostly SMEs operating single manufacturing sites (75%), through to larger UK-based / multi-national organisations operating multiple sites. The UK sector (including suppliers) directly employs over 20,000 people and generates annual sales of £2bn, of which £600 million are exports.

The sector is a solution provider for the low-carbon economy, including highly durable products with low lifecycle carbon footprints; critical components for renewable power generation, storage and distribution; and long-life thermal insulation for high temperature processes (steel, glass, cement, petrochemical and ceramics etc.)

The industry is energy-intensive (but not energy-inefficient) with energy and climate costs making up to 35% of total production costs. 85% of the sector's energy use is natural gas (4.5 TWh; £76m pa). The remaining 15% mostly comprising electricity (0.65 TWh; £63m pa), however high UK industrial electricity prices (one of the highest in Europe) mean electricity accounts for over 40% of the sector's energy spend. Natural gas is mainly used for high-temperature firing (from around 1,000 to 1,750 °C); although there are a number of highly electro-intensive ceramic companies using specialist electric furnaces to fire higher (up to 2,750 °C). By virtue of the significance of energy to their overall costs, our members have continued to invest in, and maximise the efficiency of, their operations over several decades. As a result, the UK has some of the most energy and carbon-efficient ceramic manufacturing operations in the world.

All UK ceramic businesses compete in fiercely-competitive global markets and therefore the success of the sector is fundamentally reliant on internationally competitive energy, climate and environmental costs. Long-term clarity on energy, climate and environmental policy is also vital, as ceramics is a capital-intensive sector with long investment cycles. Given kiln lifetimes can be in excess of 40 years, companies' present-day decisions already endure beyond 2050.

The UK's global leadership towards a 'net-zero' future must involve establishing a supportive framework for UK manufacturers, recognising (and not undermining) the significant long-term investments already made in energy-efficient manufacturing processes; and incentivising further investments needed to deliver on the UK's climate aspirations; rather than by exporting emissions outside the UK. The ceramics sector is committed to playing its role in transitioning to a net-zero economy, providing this does not come at a cost to UK industrial competitiveness and manufacturing jobs. Addressing UK industrial energy / climate costs, and considering climate obligations on a global (rather than territorial) context are fundamental to this.

A. Climate science and international circumstances

Question 1: The climate science considered in the CCC's 2019 Net Zero report, based on the IPCC Special Report on Global Warming of 1.5°C, will form the basis of this advice. What additional evidence on climate science, aside from the most recent IPCC Special Reports on Land and the Oceans and Cryosphere, should the CCC consider in setting the level of the sixth carbon budget?

ANSWER:

The science of climate change and associated risks extend beyond BCC's area of expertise and therefore we are not in a position to comment on the relative strengths and weaknesses of the IPCC Special Report on Global Warming of 1.5°C (IPCC-SR1.5, October 2018) and other climate science reports. Nonetheless, we believe the report paints a comprehensive picture of the scale of the global challenge and have no reason to question the suitability of the report as a key reference point for the CCC's analysis.

Question 2: How relevant are estimates of the remaining global cumulative CO_2 budgets (consistent with the Paris Agreement long-term temperature goal) for constraining UK cumulative emissions on the pathway to reaching net-zero GHGs by 2050?

ANSWER:

The UK ceramic sector cautiously-welcomed Government's decision to target net-zero territorial greenhouse gas (GHG) emissions in the UK by 2050 (a commitment compatible with the Paris Agreement long-term temperature goal), provided the significant costs associated with this transition do not damage the sector's international competitiveness. UK ceramic businesses compete in international markets and therefore without genuinely equivalent global efforts (in terms of ambition, timescale, scope and enforcement) cascading down to overseas businesses, UK companies will become increasingly exposed to commercial disadvantage and the carbon / investment and job leakage risks that acting unilaterally entails.

The UK is leading the way on tackling climate change. However, it is critical that decarbonisation is not done unilaterally. Globally, the UK accounts for ~1%[1] of total GHG emissions and other countries must now step up to face what is truly a global challenge. UK industry needs to know we are not acting alone. To do so would be a well-intentioned but unfortunately futile act, further undermining the competitiveness of UK industry.

BCC appreciates that the CCC is obliged to propose a carbon budget based on domestic territorial emissions. However, this approach ignores the carbon embedded in imported goods. The UK is consuming an ever-increasing amount of imported goods and energy and this is increasing emissions elsewhere. BCC believe that consumption-based emissions accounting must play a much greater role in policy development. Further comments are provided later in this response.

1 CAIT Climate Data Explorer (Historical Emissions) – World Resources Institute

Question 3: How should emerging updated international commitments to reduce emissions by 2030 impact on the level of the sixth carbon budget for the UK? Are there other actions the UK should be taking alongside setting the sixth carbon budget, and taking the actions necessary to meet it, to support the global effort to implement the Paris Agreement?

ANSWER:

With respect to the international context, we urge the CCC to be extremely careful in interpreting countries' revised Nationally Determined Contributions (NDCs) that may emerge by the end of 2020, and every five years thereafter, as part of the Paris Agreement's 'ratchet up' mechanism. NDCs significantly vary in their scope, content, legal nature and often lack detail about stated ambitions. This lack of comparability hinders a robust understanding of countries' ambitions and priorities, and how they compare against one another.

As long as different countries do not share the same climate ambition as the UK, there is a risk of carbon, investment and job leakage, either because production is transferred from the UK to other countries with lower ambition or because UK products are replaced by more carbon-intensive imports. Global emissions will not fall and will likely increase as we import and transport goods (over great distances) from less-efficient producers.

It must also be noted that the UK's climate ambitions already go further and faster than competing nations. The binding UK target to cut GHG emissions to net-zero by 2050, coupled with the binding five-yearly carbon budget 'stepping stones', are already extremely challenging, especially in the absence of similar commitments internationally. Few countries have a net-zero ambition to date. So far, only 67 of the UN's 193 member states – accounting for less than 15% of global emissions – have a net-zero ambition in place[2]. The world's largest CO_2 emitters, in particular, are not doing enough to address the problem. Any additional UK actions are thus likely to further reduce investment and international competitiveness of industry, whilst increasing exposure to leakage risks.

Question 4: What is the international signalling value of a revised and strengthened UK NDC (for the period around 2030) as part of a package of action which includes setting the level of the sixth carbon budget?

ANSWER:

As noted already, the UK will not solve global warming on its own. The UK already has extremely ambitious climate policies. Other nations across the globe now need to step up efforts to cut GHG emissions.

In the absence of equivalent global action on emissions or full compensation to mitigate the effects, the policy actions that arise from unilateral ambition directly undermine the ability of the UK's energy-intensive industries (EIIs) to compete in international markets.

2 The Net-Zero Challenge: Global Climate Action at a Crossroads (Part 1), World Economic Forum, December 2019

B. The path to the 2050 target

Question 5: How big a role can consumer, individual or household behaviour play in delivering emissions reductions? How can this be credibly assessed and incentivised?

ANSWER:

The behaviour of consumers is an important factor in delivering carbon reductions. Current UK policy results in increased energy and climate costs for UK manufacturers. Cumulatively, these impose significant costs and undermine the competitiveness of UK EIIs. Customers currently buy mainly on price, meaning more expensive, lower-carbon UK products can be overlooked in favour of cheaper, high-carbon imports.

Government, working with sectors and customers (which for ceramics includes: consumers, distributors, building merchants, procurement departments and architects), should look to create markets for lower-carbon products and products that yield in-service energy / carbon savings, to increase market pull for such products through better informed customer decisions.

Alongside mitigation to offset unilaterally high energy / carbon costs, to help maintain competitiveness, manufacturers of such products should also benefit from lower corporate / business / operational taxes.

Question 6: What are the most important uncertainties that policy needs to take into account in thinking about achieving Net Zero? How can government develop a strategy that helps to retain robustness to those uncertainties, for example low-regrets options and approaches that maintain optionality?

ANSWER

Key uncertainties for the ceramic sector to achieve net-zero include:

- **Maintaining competitiveness**. Throughout the net-zero evolution, our ability to compete fairly with overseas producers must be upheld. UK industry must remain internationally-competitive to avoid exporting jobs and importing carbon, potentially increasing global emissions.

- **Developing low-cost hydrogen as an essential low-carbon fuel.** Hydrogen has a critical role to play in replacing natural gas. At-scale production, storage, pipeline distribution and use in industrial, high temperature 'direct firing' applications all need significant and urgent development.

- **Generating and distributing increased supplies of low-carbon electricity at affordable and competitive cost.** This will require sustained investment in low-carbon generation and extensive network reinforcement (to meet increased demand). In order to facilitate the electrification of heat in ceramics, decarbonised electricity needs to be cost-effective. At present, where it is technically possible to do so, firing using electricity entails a five-fold increase in energy costs compared to gas; and this differential is rising as the grid decarbonises.

- **Support and policy direction for other potential decarbonisation options**. These include syngas / biomass and Carbon Capture, Utilisation, and Storage (CCUS).

Question 6: What are the most important uncertainties that policy needs to take into account in thinking about achieving Net Zero? How can government develop a strategy that helps to retain robustness to those uncertainties, for example low-regrets options and approaches that maintain optionality?

To tackle these uncertainties, we need the following (which are further explored in our responses to questions 22 and 25):

1. **A regulatory framework that supports both decarbonisation and industrial competitiveness.** Decarbonisation must not be achieved by 'offshoring' UK industry. If the UK gets this right, we could become a world leader in industrial decarbonisation. Get this wrong, and UK industry will become uncompetitive, close operations and global emissions will rise.

2. **An internationally-level playing field on energy and carbon costs.** All UK ceramic businesses require fair and internationally-competitive energy and climate costs. The current cumulative cost of energy and climate policy regime is extremely challenging and threatens company viability in the medium-term. The sector receives very little relief from the indirect costs of decarbonisation passed on in electricity bills (indirect EU ETS, CPS, RO, FiT, CfD) and urgent action to drastically reduce industrial electricity costs is needed if the sector is to retain an internationally-competitive position. Electrification of high-temperature heat will remain uneconomic for the foreseeable future.

3. **Substantial funding to support industrial decarbonisation.** Meeting the net-zero challenge whilst maintaining competitiveness will require extensive financial support from Government to accelerate the development and deployment of both proven and innovative new technologies.

4. **Greater focus on consumption emissions alongside territorial emissions.** Consumption-based emission statistics (that include the emissions embedded in imported goods) must play a far greater role in UK climate policy development and emissions accounting, as they give a more comprehensive indication of the UK's total carbon footprint and help guard against offshoring of emissions. There is nothing to be gained if decarbonisation is achieved through deindustrialisation to countries with less strict carbon constraints.

5. **Greater focus on lifecycle emissions.** When assessing the impact and contribution of manufactured goods, we need to look beyond the production phase. The long lifecycle, durability and heat resistance of ceramics contribute to energy, carbon and resource efficiency over the entire lifetime of the product, including use and end-of-life phases.

Question 7: The fourth and fifth carbon budgets (covering the periods of 2023-27 and 2028-32 respectively) have been set on the basis of the previous long-term target (at least 80% reduction in GHGs by 2050, relative to 1990 levels). Should the CCC revisit the level of these budgets in light of the net-zero target?

ANSWER:

No, the existing fourth and fifth carbon budget must be maintained. Like other energy-intensive industries, the ceramic sector is capital-intensive and has long investment cycles. Consequently, long-term clarity on energy, climate and environmental policy is vital to

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underpin high capital cost, long-term investments in new equipment and innovation required to deliver energy/carbon savings. Continuous alterations to policies and targets lead to uncertainty, deterring such investment, and can render existing investments unviable. Indeed, the CCC has itself long advocated that one of the primary advantages of setting carbon budgets at least twelve years in advance of them starting is the long-term certainty and stability this provides businesses, investors and society to operate within. As we are currently mid-way through the third carbon budget (2018-22) we should not, at this late stage, be interfering with the next two, already legislated, carbon budgets.

The UK already has more ambitious climate policies and targets than most other countries, meaning UK manufacturers competing in a global market place are acutely-exposed to the carbon / investment / job leakage risks associated with the higher ambition levels. Further increasing ambition would further exacerbate these risks. Manufacturing simply cannot be maintained in a unilaterally high business cost environment that damages profitability, stifles investment and pushes the production of energy/carbon-intensive goods to countries with lower carbon constraints.

The UK's EII's have already invested heavily in the decarbonisation of their processes. To achieve the next level of decarbonisation, major investment in new technologies and infrastructure will be needed. This is not achievable for EII's individually (either financially or technically) but will need the co-operation of multiple organisations (including Government) and will take time to implement. The UK's EII's should not be mandated to decarbonise before these other processes have been developed and proven.

The existing fourth and fifth carbon budgets already represent a significant increase in emissions reduction pace compared to the first three budgets. We also note that the UK is currently off track in terms of meeting the fourth and fifth carbon budgets, illustrating just how strenuous the existing targets already are.

Question 8: What evidence do you have of the co-benefits of acting on climate change compatible with achieving Net Zero by 2050? What do these co-benefits mean for which emissions abatement should be prioritised and why?

ANSWER:

We believe achieving net-zero GHG emissions in the UK will bring co-benefits, such as more comfortable homes (from better energy-efficiency), improved health (from better air quality and more active travel choices) and ecosystem benefits (from afforestation).

There may be economic benefits too. If the UK gets industrial decarbonisation right, we could become a world leader in the policies and processes that will attract low-carbon manufacturing to the UK. However, get this wrong, and the financial burden of decarbonisation will result in UK industry becoming uncompetitive, being forced to close or relocate and increasing global emissions.

Regarding energy-efficiency of buildings, clay construction products (bricks and clay roof tiles) have long been recognised as an energy-efficient solution. Clay construction products have low heat conductivity and high thermal mass (which helps moderate the interior

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temperature of buildings - keeping them cooler in the summer and warmer in the winter); contributing to the building's energy efficiency. Clay products have a long service life, are re-usable upon demolition and are completely inert. While their production requires upfront energy and CO_2 emissions to produce, over their lifetime these are outweighed by the energy / carbon savings made by a building's occupiers, coupled with minimal emissions associated with maintaining clay building elements (walls, roofs etc.) during use.

In addition to consumption-based emissions accounting, it is essential that a full lifecycle approach to emissions is adopted (i.e. 'cradle-to-grave' or 'cradle-to-cradle') rather than a short-sighted perspective that only considers emissions in the production phase (i.e. cradle-to-gate). Further comments on this can be found in our response to question 25.

C. Delivering carbon budgets

Question 9: Carbon targets are only credible if they are accompanied by policy action. We set out a range of delivery challenges/priorities for the 2050 net-zero target in our Net Zero advice. What else is important for the period out to 2030/2035?

ANSWER:

It is essential that policies are agreed as soon as possible to ensure industry knows the preferred decarbonisation pathway. For ceramics, this involves understanding whether the decarbonisation of high temperature heat (>1000 °C) is best met via electrification, bioenergy or hydrogen. Time is short. UK industry will need to transition to low or zero carbon operations in just three decades. Long asset lifespans (typically 40 years for ceramic kilns) mean 2050 is already less than one investment cycle away!

There is evidence that investment is being withheld from the UK, given the increasing potential for existing industrial assets (e.g. state-of-the-art, gas-fired kilns) to become 'stranded' (i.e. suffer from unanticipated or premature write-downs, devaluations, or conversion liabilities), coupled with an uncertain decarbonisation pathway. A clear low carbon heat strategy will enable industry to understand the risks and invest in decarbonisation technology accordingly. Government must commit to urgently developing a new low-carbon heat strategy.

Question 10: How should the Committee take into account targets/ambitions of UK local areas, cities, etc. in its advice on the sixth carbon budget?

ANSWER:

Reporting the progress of local areas / cities will have some benefit in measuring success. However, we believe the overall national view will need to predominate. There are likely to be significant differences between regions (for example proximity to CCUS / hydrogen infrastructure and more expensive network reinforcement costs in rural areas). Infrastructure is unlikely to be rolled out uniformly across all areas and will need to cross city-region and county boundaries. The ceramic sector does not believe the Committee should be setting targets for different areas of the UK.

Question 11: Can impacts on competitiveness, the fiscal balance, fuel poverty and security of supply be managed regardless of the level of a budget, depending on how policy is designed and funded? What are the critical elements of policy design (including funding and delivery) which can help to manage these impacts?

ANSWER:

We recognise that there are difficult trade-offs between all of these areas and a limited number of ways the costs of funding the net-zero transition could fall, namely:

- Domestic consumers;
- Businesses / industry;
- Taxpayers;
- Government borrowing, i.e. future taxpayers;
- Reducing other areas of public spending.

Energy-intensive industries, including ceramics, produce primary inputs for much of what we manufacture and consume, in some of the most advanced manufacturing plants of their kind globally. They contribute hugely to the social and economic fabric of the country; and are key to our sustainable, resource-efficient, net-zero future. Throughout the entire transition, it will be essential to keep these industries globally-competitive, in order to retain their vital employment and economic benefits; whilst avoiding the outsourcing of their emissions to less carbon-constrained countries.

Businesses make dispassionate investment decisions, considering the cumulative impact of policy costs (including energy and climate costs) often for different countries – inside and outside Europe. Under a unilaterally high business cost regime, manufacturers will stop investing and look to run down their UK plants. Domestic producers will go out of business and multi-national companies will relocate manufacturing elsewhere; resulting in the products instead being imported. The operating conditions for UK energy-intensive industries must match Government's climate ambitions.

Given the short timeframe, the scale of the decarbonisation challenge and potentially very significant costs, it is clear industry cannot shoulder this burden and remain internationally competitive. Government support and clear national policy, that simultaneously supports both decarbonisation and industrial competitiveness, are urgently needed if the UK is to retain its industrial manufacturing base.

We also note that energy-intensive industries already contribute significant financial resources under a wide range of existing energy / climate schemes (e.g. EU ETS allowances; indirect costs of funding low carbon power generation; and other fiscal / environmental taxation measures).

Question 12: How can a just transition to Net Zero be delivered that fairly shares the costs and benefits between different income groups, industries and parts of the UK, and protects vulnerable workers and consumers?

ANSWER:

A just transition to net-zero needs energy-intensive industries, like ceramics, to stay in the UK. As noted in our responses to question 6 and 22, we believe this requires: i) a regulatory

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framework that supports both decarbonisation and industrial competitiveness; ii) an internationally-level playing field on energy and carbon costs; iii) significant funding to support industrial decarbonisation; iv) greater focus on consumption-based emissions accounting and v) greater focus on lifecycle emissions.

Ceramic manufacturing plants are spread across the UK, albeit with notable concentrations around Stoke-on-Trent / Midlands, Yorkshire and the south-west. Our 160 sites provide good quality jobs often in economically challenged or semi-rural areas.

The impact of losing this industry would be significant. In assessing policies, it is important that Government considers their impacts holistically, including: employment (e.g. loss of jobs and skills); economic (e.g. loss of gross value added (GVA), tax revenues to HM Treasury); financial costs to Government (e.g. increased unemployment and social security benefit payments); and the significant social costs for the individuals affected and their communities. It is also important to include the knock-on effects, both up and down the supply chain.

Without UK manufacturing, the UK market demand for products would still remain; and instead these products would be imported. This would likely give rise to increased global CO_2 emissions through less-efficient manufacturing processes; more carbon-intensive fuel; more carbon-intensive electricity; and significantly greater transportation distances (with associated transport emissions).

Decarbonisation must not be achieved through de-industrialisation as this merely shifts the carbon abatement problem overseas, whilst also losing the associated employment and economic benefits. Investment in energy-intensive manufacturing not only has the potential to achieve environmental targets, it can also support regional growth and economic rebalancing, whilst helping to maintain and grow UK skills and employment.

D. Scotland, Wales and Northern Ireland

Question 13: What specific circumstances need to be considered when recommending an emissions pathway or emissions reduction targets for Scotland, Wales and/or Northern Ireland, and how could these be reflected in our advice on the UK-wide sixth carbon budget?

ANSWER:

We ask the CCC, where possible, to encourage similar targets across the UK rather than divergence across the devolved administrations. Different rules, obligations and targets lead to increased costs and administrative burdens for businesses operating throughout the UK and could give rise to competitive distortions between the home nations.

Question 14: The Environment (Wales) Act 2016 includes a requirement that its targets and carbon budgets are set with regard to:

- The most recent report under section 8 on the State of Natural Resources in relation to Wales;
- The most recent Future Trends report under section 11 of the Well-Being of Future Generations (Wales) Act 2015;
- The most recent report (if any) under section 23 of that Act (Future Generations report).

a) What evidence should the Committee draw on in assessing impacts on sustainable management of natural resources, as assessed in the state of natural resources report?

b) What evidence do you have of the impact of acting on climate change on well-being? What are the opportunities to improve people's well-being, or potential risks, associated with activities to reduce emissions in Wales?

c) What evidence regarding future trends as identified and analysed in the future trends report should the Committee draw on in assessing the impacts of the targets?

d) Question 12 asks how a just transition to Net Zero can be achieved across the UK. Do you have any evidence on how delivery mechanisms to help meet the UK and Welsh targets may affect workers and consumers in Wales, and how to ensure the costs and benefits of this transition are fairly distributed?

ANSWER:

Question 15: Do you have any further evidence on the appropriate level of Wales' third carbon budget (2026-30) and interim targets for 2030 and 2040, on the path to a reduction of at least 95% by 2050?

ANSWER:

Question 16: Do you have any evidence on the appropriate level of Scotland's interim emissions reduction targets in 2030 and 2040?

ANSWER:

Question 17: In what particular respects do devolved and UK decision making need to be coordinated? How can devolved and UK decision making be coordinated effectively to achieve the best outcomes for the UK as a whole?

ANSWER:

Co-ordination of decisions and policies is essential in creating effective, long-term UK policy. Without co-ordination there is a risk of increased bureaucratic burdens for industry and competitive distortions between the home nations.

E. Sector-specific questions

Question 18 (Surface transport): As laid out in Chapter 5 of the Net Zero Technical Report (see page 149), the CCC's Further Ambition scenario for transport assumed 10% of car miles could be shifted to walking, cycling and public transport by 2050 (corresponding to over 30% of trips in total):

a) What percentage of trips nationwide could be avoided (e.g. through car sharing, working from home etc.) or shifted to walking, cycling (including e-bikes) and public transport by 2030/35 and by 2050? What proportion of total UK car mileage does this correspond to?

b) What policies, measures or investment could incentivise this transition?

ANSWER:

Question 19 (Surface transport): What could the potential impact of autonomous vehicles be on transport demand?

ANSWER:

Question 20 (Surface transport): The CCC recommended in our Net Zero advice that the phase out of conventional car sales should occur by 2035 at the latest. What are the barriers to phasing out sales of conventional vehicles by 2030? How could these be addressed? Are the supply chains well placed to scale up? What might be the adverse consequences of a phase-out of conventional vehicles by 2030 and how could these be mitigated?

ANSWER:

Question 21 (Surface transport): In our Net Zero advice, the CCC identified three potential options to switch to zero emission HGVs – hydrogen, electrification with very fast chargers and electrification with overhead wires on motorways. What evidence and steps would be required to enable an operator to switch their fleets to one of these options? How could this transition be facilitated?

ANSWER:

Question 22 (Industry): What policy mechanisms should be implemented to support decarbonisation of the sectors below? Please provide evidence to support this over alternative mechanisms.

a) Manufacturing sectors at risk of carbon leakage

b) Manufacturing sectors not at risk of carbon leakage

c) Fossil fuel production sectors

d) Off-road mobile machinery

ANSWER:

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All ceramic businesses operate in internationally competitive markets and are acutely-exposed to carbon, investment and job leakage risks. To support industrial decarbonisation, we need:

1. **A regulatory framework that supports <u>both</u> decarbonisation <u>and</u> industrial competitiveness.** Decarbonisation must not be achieved by offshoring UK industry. Instead, we need fair and equitable policies that incentivise investment, innovation and emissions reduction, whilst enabling the long-term sustainability of UK manufacturing. This needs genuine partnership between industry and Government.

2. **An internationally-level playing field on energy and carbon costs**. All UK ceramic businesses depend on fair and internationally-competitive energy and climate costs to remain in business. Higher costs damage competitiveness, reduce the capacity to invest, and potentially increases global emissions. UK electricity costs are deeply uncompetitive at present. Our members pay around 80% more than the EU average, typically £120/MWh, which has been a dominant factor in numerous decisions to invest and/or relocate away from the UK. Just 5 out of our 90 member companies receive relief from indirect renewable power generation costs - Renewables Obligation (RO); Feed-in-Tariff (FiT); and Contracts for Difference (CfD) - as UK criteria are more stringent than many other EU countries (e.g. Germany / Italy) where compensation is much broader. In addition, the sector is totally uncompensated for indirect EU ETS and UK-only Carbon Price Support (CPS) costs. Urgent action to drastically reduce high industrial electricity costs is needed, including: i) no increases to (or new) levies on energy or carbon emissions for energy-intensive businesses; ii) immediate abolition of CPS; and iii) extensive broadening of relief for all energy-intensive sectors from the indirect costs of low-carbon power generation (indirect EU ETS, RO, FiT and CfD).

3. **Substantial funding to support industrial decarbonisation.** In recent decades, the UK ceramics industry has invested heavily in measures to improve energy/carbon efficiency. However, it is clear meeting the net-zero challenge, whilst maintaining competitiveness, will require extensive financial support from Government to accelerate the development and deployment of both proven and innovative new technologies. In its European Green Deal, the EU has unveiled a €1 trillion investment plan to support the region's transition towards meeting its net-zero goal. Significant amounts of this will be used to support energy-intensive industries. UK industry needs equivalent funding, with ceramics having its fair share. Key decarbonisation technologies for the sector include: energy/carbon/resource efficiency measures; hydrogen; electrification of large kilns; and syngas / biomass. Unlike some EIIs, on-site implementation of CCUS is likely to be more muted due to ceramic factories being more numerous, smaller in size and geographically dispersed in locations away from industrial clusters; rendering CCUS impractical and costly. These technologies also require significant national infrastructure investment; without which industrial decarbonisation cannot progress.

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b) Manufacturing sectors not at risk of carbon leakage

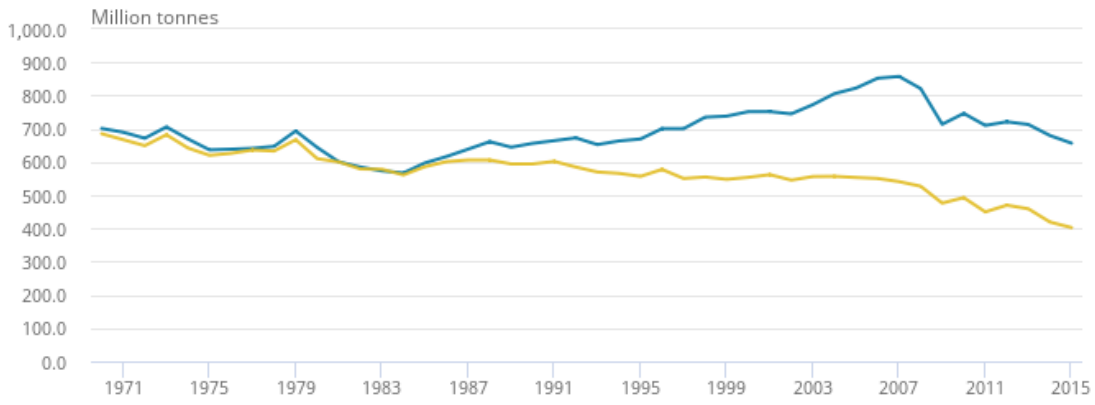
c) Fossil fuel production sectors

d) Off-road mobile machinery

4. **Greater focus on consumption emissions alongside territorial emissions**. Consumption-based emission statistics (that include the emissions embedded in imported goods) must play a far greater role in UK climate policy development and emissions accounting, as they give a more comprehensive indication of the UK's total carbon footprint and help guard against offshoring of emissions. Latest ONS figures[3] worryingly indicate: i) consumption-based emissions in the UK have barely changed since the 1970s; ii) observed reductions in UK territorial emissions have largely happened at the expense of outsourcing manufacturing; iii) the UK has one of the largest per head levels of net CO_2 imports. Outsourcing emissions is no solution to a global problem; we need to cut all emissions, not just those included in the UK's territorial account. To achieve this, territorial and consumption emission statistics should be reported at the same time; and the remit of the CCC changed to cover consumption as well as territorial emissions. The UK must be more transparent in accounting for our overall carbon footprint.

Figure 9: Decoupling of GDP per head from CO2 emissions seems to have happened at the expense of outsourcing manufacturing

Different measures of CO2 emissions, 1970 to 2015, UK



Source: Eora, 2018, World Resource Institute, 2017 and Department for Business, Energy and Industrial Strategy, 2019b

Source: ONS

5. **Lifecycle approach to emissions.** See response to question 25.

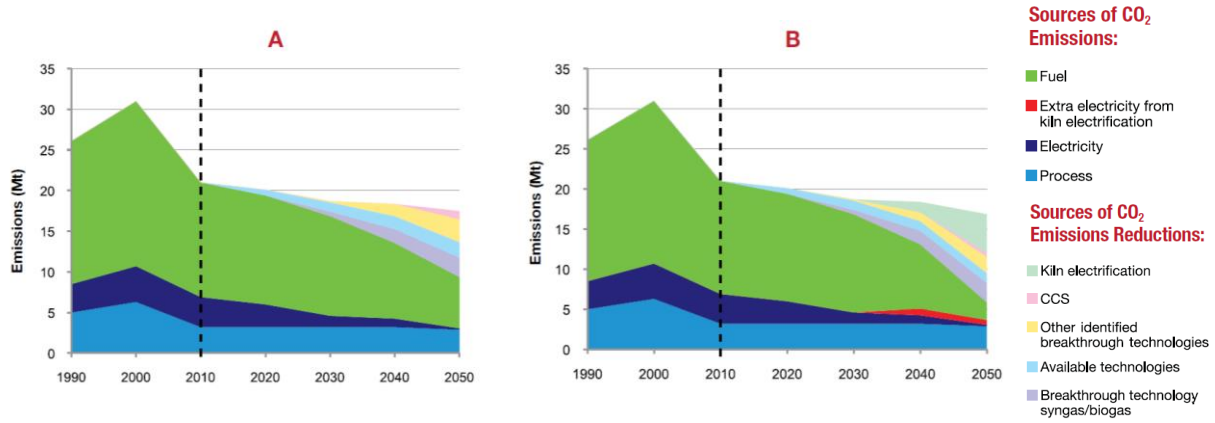
[3] The Decoupling of Economic Growth from Carbon Emissions: UK Evidence (figure 9), ONS, October 2019

Question 23 (Industry): What would you highlight as international examples of good policy/practice on decarbonisation of manufacturing and fossil fuel supply emissions? Is there evidence to suggest that these policies or practices created economic opportunities (e.g. increased market shares, job creation) for the manufacturing and fossil fuel supply sectors?

ANSWER:

We draw CCC's attention to three documents which focus on opportunities and challenges to decarbonisation and energy efficiency in the ceramics industry: the European ceramic industry association (Cerame-Unie) 2050 roadmap[4]; the UK industrial decarbonisation 2050 roadmap[5]; and UK industrial decarbonisation action plan[6], the latter two being joint pieces of work between the UK Government and the UK ceramics sector (with equivalent studies in seven other heat-intensive sectors).

These documents highlight the various technologies (best-available and identified breakthroughs) which will be needed to decarbonise the UK ceramics industry and the emission reductions that might be achieved when deployed under various assumptions and scenarios. Under a supportive legislative framework, high levels of decarbonisation could be possible. However even under the most optimistic pathways (maximum technical potential with unlimited funds and no international competitiveness concerns), complete decarbonisation is unattainable, mainly due to unavoidable process emissions (in a sector less suited to CCUS). Under a net-zero target, these residual emissions will need to be offset by removing an equivalent amount of emissions from the atmosphere.



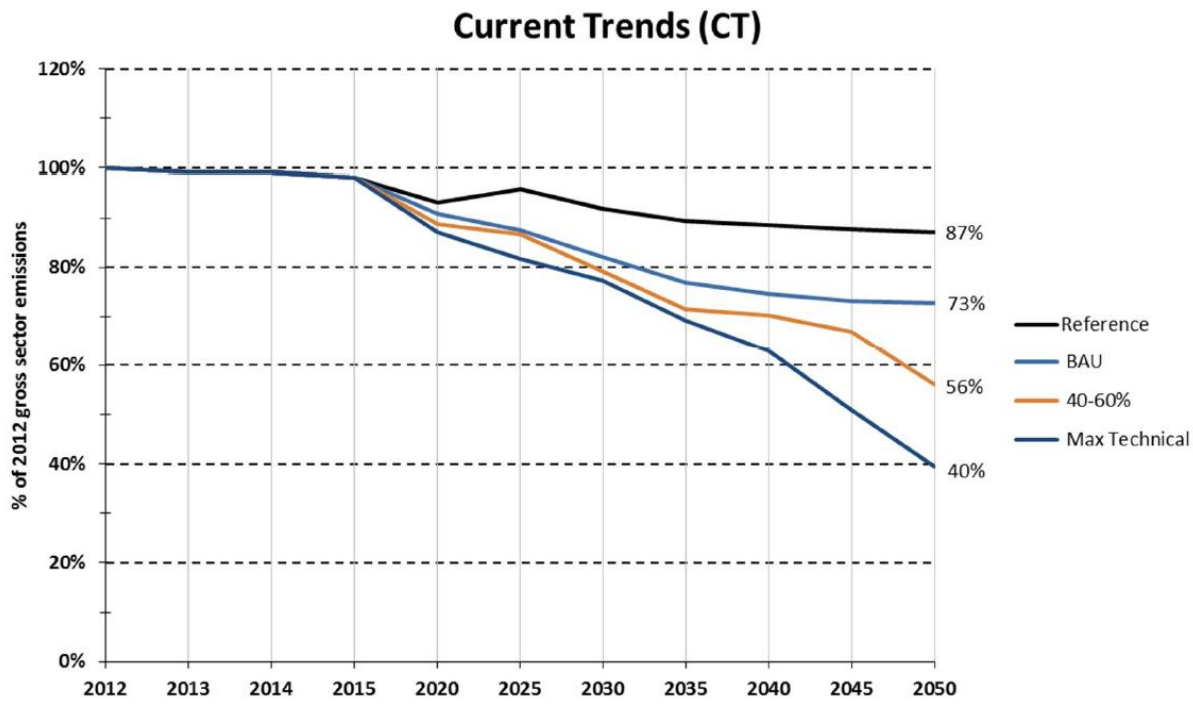
Source: Cerame-Unie 2050 Roadmap

4 Paving the Way to 2050: The Ceramic Industry Roadmap; Cerame-Unie; 2012

5 Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050: Ceramics Sector, BIS/DECC and British Ceramic Confederation; 2015

6 Industrial Decarbonisation and Energy Efficiency Action Plans, BEIS and British Ceramic Confederation; 2017

Question 23 (Industry): What would you highlight as international examples of good policy/practice on decarbonisation of manufacturing and fossil fuel supply emissions? Is there evidence to suggest that these policies or practices created economic opportunities (e.g. increased market shares, job creation) for the manufacturing and fossil fuel supply sectors?



Source: Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050

It is vital the CCC acknowledge the enormous challenges ahead to decarbonise industry whilst retaining international competitiveness; the extent of government support required and the long-investment cycles in manufacturing industries such as ceramics.

Question 24 (Industry): How can the UK achieve a just transition in the fossil fuel supply sectors?

ANSWER:

It is important to protect the jobs that currently rely on oil and gas production. Developments in CCUS and hydrogen will be important.

Question 25 (Industry): In our Net Zero advice, the CCC identified a range of resource efficiency measures that can reduce emissions (see Chapter 4 of the Net Zero Technical Report, page 115), but found little evidence relating to the costs/savings of these measures. What evidence is there on the costs/savings of these and other resource efficiency measures (ideally on a £/tCO2e basis)?

ANSWER:

Question 25 (Industry): In our Net Zero advice, the CCC identified a range of resource efficiency measures that can reduce emissions (see Chapter 4 of the Net Zero Technical Report, page 115), but found little evidence relating to the costs/savings of these measures. What evidence is there on the costs/savings of these and other resource efficiency measures (ideally on a £/tCO2e basis)?

When assessing the impact and contribution of manufactured goods, policymakers need to look beyond the production phase. The long lifecycle, durability and heat resistance of ceramics contribute to energy, carbon and resource efficiency over the entire lifetime of the product. Bricks[7], clay roof tiles[8] and clay drainage pipes[9] have life spans in excess of a hundred years, with little or no maintenance and no end of life emissions. In flooring[4], the expected lifetime of ceramic tile is 50 years, far longer than competitor materials. Specialist long-life refractories[4] have the durability to outlive more conventional products, saving the emissions associated with manufacturing many times over. Tableware manufacturers and suppliers have also worked collaboratively to improve the energy-efficiency of manufacturing by reducing the firing temperatures and number of firing cycles required[6].

Policymakers need to take a lifecycle view of emissions (i.e. 'cradle-to-grave' or 'cradle-to-cradle' rather than a short-sighted perspective that only considers emissions in the production phase (i.e. 'cradle-to-gate'). Without a policy shift to measure emissions based on the whole lifecycle rather than during production only, there is a danger that legislation will misguidedly drive consumers to goods made in less carbon-constrained countries or to other less durable products with higher annualised emissions. This approach would be detrimental both to the UK economy and global emissions.

Question 26 (Buildings): For the majority of the housing stock in the CCC's Net Zero Further Ambition scenario, 2050 is assumed to be a realistic timeframe for full roll-out of energy efficiency and low-carbon heating.

a) What evidence can you point to about the potential for decarbonising heat in buildings more quickly?

b) What evidence do you have about the role behaviour change could play in driving forward more extensive decarbonisation of the building stock more quickly? What are the costs/levels of abatement that might be associated with a behaviour-led transition?

ANSWER:

Question 27 (Buildings): Do we currently have the right skills in place to enable widespread retrofit and build of low-carbon buildings? If not, where are skills lacking and what are the gaps in the current training framework? To what extent are existing skill sets readily transferable to low-carbon skills requirements?

ANSWER:

7 Brick Development Association: Sustainability

8 Roof Tile Association: Quality Control

9 Clay Pipe Development Association: Durability

Question 28 (Buildings): How can local/regional and national decision making be coordinated effectively to achieve the best outcomes for the UK as a whole? Can you point to any case studies which illustrate successful local or regional governance models for decision making in heat decarbonisation?

ANSWER:

Question 29 (Power): Think of a possible future power system without Government backed Contracts-for-Difference. What business models and/or policy instruments could be used to continue to decarbonise UK power emissions to close to zero by 2050, whilst minimising costs?

ANSWER:

Question 30 (Power): In Chapter 2 of the Net Zero Technical Report we presented an illustrative power scenario for 2050 (see pages 40-41 in particular):

a) Which low-carbon technologies could play a greater/lesser role in the 2050 generation mix? What about in a generation mix in 2030/35?

b) Power from weather-dependent renewables is highly variable on both daily and seasonal scales. Modelling by Imperial College which informed the illustrative 2050 scenario suggested an important role for interconnection, battery storage and flexible demand in a future low-carbon power system:

   i. What other technologies could play a role here?

   ii. What evidence do you have for how much demand side flexibility might be realised?

ANSWER:

We believe all of the technologies listed (intermittent renewables; battery storage; CCS-abated biomass (BECCS); CCS-abated gas generation; new nuclear; hydrogen generation; and interconnectors) all have an important role in the future generation mix. However, huge uncertainty surrounding deployability and costs exist. CCS will be essential, but remains in its infancy. BECCS plants offer the potential for negative emissions, which are essential to meet net-zero. New nuclear will also be needed. However new nuclear policy is currently in disarray following the recent cancellation of major projects; and credible plans are urgently needed to progress the remaining projects. In all cases, the cost of low-carbon electricity costs needs to be internationally-competitive, throughout all stages of the net-zero transition, to allow EIIs to survive. Industrial electricity costs are already extremely high and there is a real danger that the UKs EII's will be offshored because of the difficulty in decarbonising their production economically.

We agree that there are often extended periods where intermittent renewables produce little output. Often these coincide with periods of increased demand (e.g. cold, still winter evenings) and last far longer than battery storage is able to handle and longer than desirable for demand response. These pressures will intensify as demand for electricity increases (for transport and electrification of heat). Dispatchable generation, notably CCS-abated gas generation, will be a necessity. Flexible power generation from hydrogen could be an important technology, with blue hydrogen (produced from the steam reforming of natural gas, with CCUS) being an important transition fuel before green hydrogen (produced via

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electrolysis of water using renewable power) becomes viable (from a cost and availability perspective).

In the ceramics industry there is very little capability of gas or electricity demand-side response, given the preponderance of large, continuous kilns. For many kilns, safely shutting down and re-starting does not occur readily, requires careful planning with plenty of notice to gradually cool down / heat up the kiln (which can take weeks) and results in periods of less energy/carbon-efficient operation upon re-start. Rapid, uncontrolled cooling risks damaging the kiln, potentially irreparably, as well as losing high value products. Only a relatively small amount of the sector's energy demand, often that used in batch operations, is compatible with a demand side response.

Question 31 (Hydrogen): The Committee has recommended the Government support the delivery of at least one large-scale low-carbon hydrogen production facility in the 2020s. Beyond this initial facility, what mechanisms can be used to efficiently incentivise the production and use of low-carbon hydrogen? What are the most likely early applications for hydrogen?

ANSWER:

We believe hydrogen has a critical role in reducing emissions from buildings, industry, transport (including shipping) and power sectors. Given the major envisaged role for hydrogen, it is essential that progress towards the development and deployment of low-carbon hydrogen at scale starts now. It is clear, given the range of potential uses, that more than one large-scale, low-carbon hydrogen production facility will be needed by 2030. Thought also needs to be given as to whether hydrogen will be blended with natural gas or whether existing gas distribution networks will be repurposed to carry 100% hydrogen.

Hydrogen is well-suited to industrial, high temperature 'direct firing' applications, where the combustion gases need to come into direct contact with the product being produced (e.g. in furnaces and kilns). Part of the appeal is that it may be feasible to retrofit existing kilns, rather than replacing with a radically different design (as would be required under the electrification of large, continuous kilns). However, industrial firing is in its infancy, with Toyota in Japan having only recently developed the world-first, general purpose hydrogen burner for industrial use[10]. Regarding its deployment in ceramics, a number of technical unknowns

[10] Toyota Develops World's First General-purpose Hydrogen Burner for Industrial Use ; November 2018

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exist, including: i) flame characteristics / burner development; ii) impact of high moisture in the kiln atmosphere on products, refractory linings and the steel kiln structure; iii) embrittlement of pipework; iv) increased NO_x emissions; and v) safety considerations. In order to establish the practicality of switching to hydrogen, pilot projects in the sector are urgently required.

In addition to availability and overcoming technical challenges, cost will also be a significant barrier to uptake, given hydrogen will inevitably be more expensive than natural gas; and industry needs to remain internationally competitive.

Question 32 (Aviation and Shipping): In September 2019 the Committee published advice to Government on international aviation and shipping and Net Zero. The Committee recognises that the primary policy approach for reducing emissions in these sectors should be set at the international level (e.g. through the International Civil Aviation Organisation and International Maritime Organisation). However, there is still a role for supplementary domestic policies to complement the international approach, provided these do not lead to concerns about competitiveness or carbon leakage. What are the domestic measures the UK could take to reduce aviation and shipping emissions over the period to 2030/35 and longer-term to 2050, which would not create significant competitiveness or carbon leakage risks? How much could these reduce emissions?

ANSWER:

Question 33 (Agriculture and Land use): In Chapter 7 of the Net Zero Technical Report we presented our Further Ambition scenario for agriculture and land use (see page 199). The scenario requires measures to release land currently used for food production for other uses, whilst maintaining current per-capita food production. This is achieved through:

- A 20% reduction in consumption of red meat and dairy
- A 20% reduction in food waste by 2025
- Moving 10% of horticulture indoors
- An increase in agriculture productivity:
  - Crop yields rising from the current average of 8 tonnes/hectare for wheat (and equivalent rates for other crops) to 10 tonnes/hectare
  - Livestock stocking density increasing from just over 1 livestock unit (LU)/hectare to 1.5 LU/hectare

Can this increase in productivity be delivered in a sustainable manner?

Do you agree that these are the right measures and with the broad level of ambition indicated? Are there additional measures you would suggest?

ANSWER:

Question 34 (Agriculture and Land use): Land spared through the measures set out in question 33 is used in our Further Ambition scenario for: afforestation (30,000 hectares/year), bioenergy crops (23,000 hectares/year), agro-forestry and hedgerows (~10% of agricultural land) and peatland restoration (50% of upland peat, 25% lowland peat). We also assume the take-up of low-carbon farming practices for soils and livestock. Do you agree that these are the key measures and with the broad level of ambition of each? Are there additional measures you would suggest?

ANSWER:

Question 35 (Greenhouse gas removals): What relevant evidence exists regarding constraints on the rate at which the deployment of engineered GHG removals in the UK (such as bioenergy with carbon capture and storage or direct air capture) could scale-up by 2035?

ANSWER:

Question 36 (Greenhouse gas removals): Is there evidence regarding near-term expected learning curves for the cost of engineered GHG removal through technologies such as bioenergy with carbon capture and storage or direct air capture of CO_2?

ANSWER:

Question 37 (Infrastructure): What will be the key factors that will determine whether decarbonisation of heat in a particular area will require investment in the electricity distribution network, the gas distribution network or a heat network?

ANSWER:

Without CCUS, electrification of heating currently appears to be the only feasible technology to decarbonise industrial gas combustion. Combined with electrification of transport (particularly with rapid charging) and electrification of domestic heat, there will need to be significant infrastructure investment both in low-carbon electricity generation and distribution.

CCUS will be needed to enable the UK to decarbonise heat with hydrogen (using steam methane reformation and natural gas) but it will require substantial investment in CCUS networks and infrastructure along with the development of hydrogen networks.

It will be important to know the cost of these solutions to enable decisions to be made about investments. How these infrastructure investments will be funded will be key. All of the UKs EII's are already finding it increasingly difficult to compete with their international competitors as a result of UK energy and carbon costs. The costs associated with drastically increasing low-carbon electricity generation and distribution will be significant. These costs must not be piled onto UK manufacturers otherwise they will be priced out of the UK, only for their products to be replaced by imports (leading to net increases in global emissions).

Question 38 (Infrastructure): What scale of carbon capture and storage development is needed and what does that mean for development of CO_2 transport and storage infrastructure over the period to 2030?
ANSWER: