

Decarbonising UK Ceramic Manufacturing

Underpinning the economy and
society's transition to net zero



Ceramics across the Economy & Net Zero Transition

A vast array of durable, long-life goods, from well-known products through to cutting-edge materials. Ceramics fulfil many essential roles across the UK economy (click logos for details):

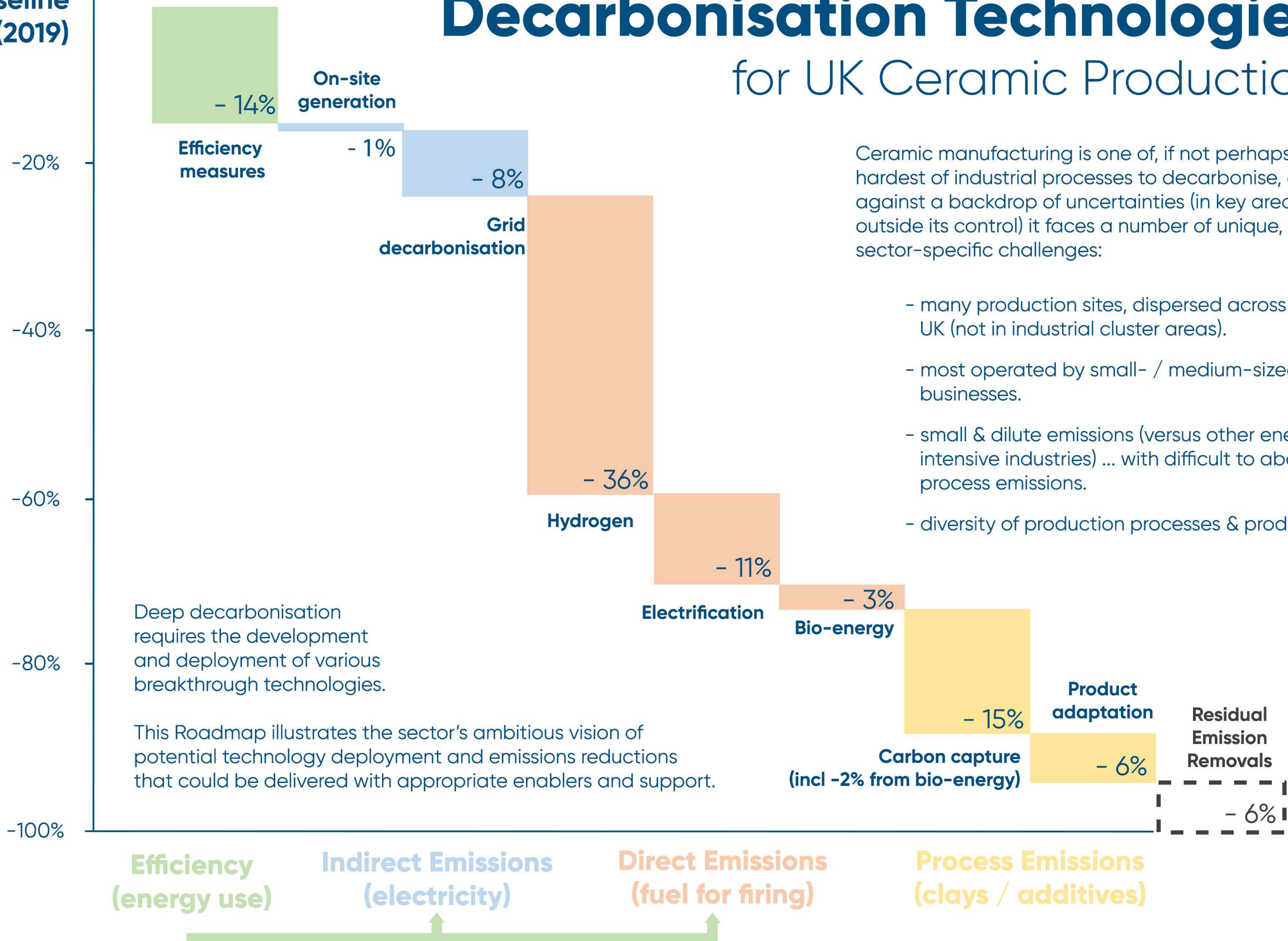


Enabling UK Ceramics Industry Decarbonisation

	Indirect emissions (electricity)	Direct emissions (fuels for firing)	Process emissions (clays / additives)
Funding to assist deployment of ...	<ul style="list-style-type: none"> ... efficiency measures, incremental (such as heat recovery and retro-fitting) and site-level (such as plant re-builds to adopt new technologies) ... upgrading electricity connections and on-site infrastructure ... Grants & interest-free loans for small- / medium-sized companies 		<ul style="list-style-type: none"> ... deployment of carbon-capture technologies for emission sources which are relatively small-scale and of dilute carbon dioxide concentration
R&D activities / funding into ...		<ul style="list-style-type: none"> ... electrification of larger-scale production processes (and material formulation changes) 	<ul style="list-style-type: none"> ... continued product adaptation and material substitution ... commercially-viable carbon capture for small-scale, dilute emission sources
Energy supplies	<ul style="list-style-type: none"> Prioritised network connection upgrades for on-site renewable power generation projects 	<ul style="list-style-type: none"> - Access to hydrogen supplies is fundamental, with rapid expansion of infrastructure / distribution network needed across dispersed sites - Prioritised network connection upgrades for sites looking to electrification - Access to bio-energy for limited site-specific applications (incl. bio-energy with carbon-capture) 	
Energy costs	<ul style="list-style-type: none"> Electricity network decarbonisation at least cost to industrial consumers 	<ul style="list-style-type: none"> Electricity - significant reduction in costs for UK ceramic producers (to support competitiveness and incentivise fuel-switching to electricity) Natural gas - in the fuel-switching transition, exemptions for new taxes / levies until commercially-viable alternatives are available 	
UK carbon costs	UK carbon costs (and industry exposure) must ensure international competitiveness , with carbon leakage protections specifically- aligned to the industry's decarbonisation deliverability		
Market/standards	Strong protection against carbon leakage risks and a level playing field for UK ceramic producers and their supply chains		
Residual emissions	Direct / indirect carbon offsetting mechanisms and holistic consideration of emissions over product lifecycle / value-chain		

Decarbonisation Technologies for UK Ceramic Production

Baseline (2019)



Ceramic manufacturing is one of, if not perhaps the hardest of industrial processes to decarbonise, and against a backdrop of uncertainties (in key areas outside its control) it faces a number of unique, sector-specific challenges:

- many production sites, dispersed across the UK (not in industrial cluster areas).
- most operated by small- / medium-sized businesses.
- small & dilute emissions (versus other energy-intensive industries) ... with difficult to abate process emissions.
- diversity of production processes & products.

Deep decarbonisation requires the development and deployment of various breakthrough technologies.

This Roadmap illustrates the sector's ambitious vision of potential technology deployment and emissions reductions that could be delivered with appropriate enablers and support.



Vision for UK Ceramics Industry

“ To reassert the UK’s global standing as a renowned and thriving destination for low-carbon, sustainable ceramic manufacturing, driven through material and technological innovation ”



INNOVATION

- Maintaining a high-level of Research and Development activities in the sector
- Development of new processes / technologies incl. additive manufacturing
- More-advanced products tackling societal challenges such as climate change, pollution, resource scarcity and population growth
- Advancing data / analytics, automation and digitisation



ECONOMIC

- Growing contribution to UK economy (pre-COVID growth being around + 9% per year)
- Continued significant capital investment in UK
- Improving resilience of UK supply chains and regional levelling up
- Increasing share of global markets and addressing UK ceramics’ balance of trade
- A global leader in advanced ceramics



ENVIRONMENT

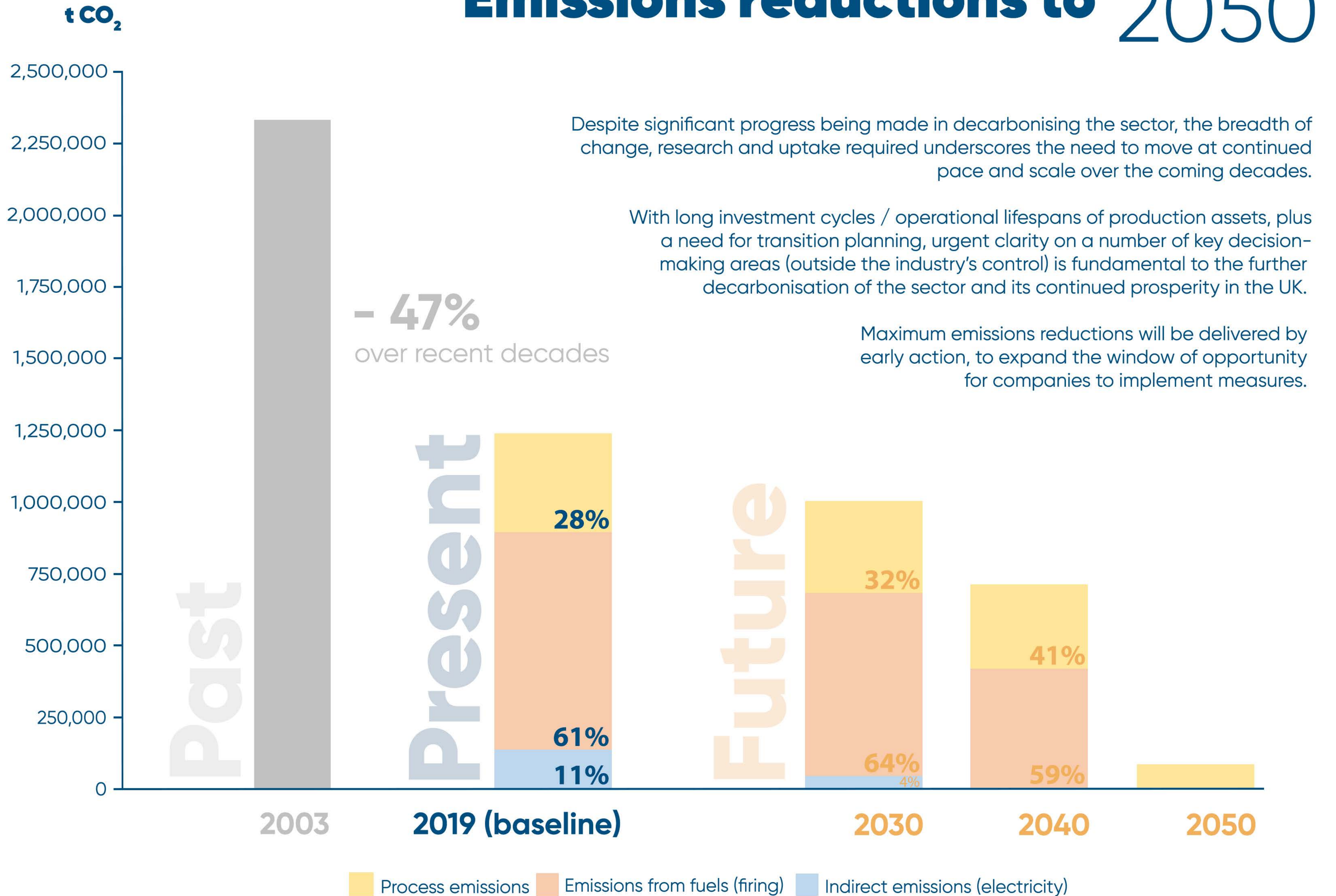
- Maintaining a low-carbon sustainable UK ceramic manufacturing sector
- Development, investment in and adoption of new low-carbon processes as well as new technologies
- Continuing development of critical components which support the global net zero transition through emission-savings downstream over product lifespan



PEOPLE

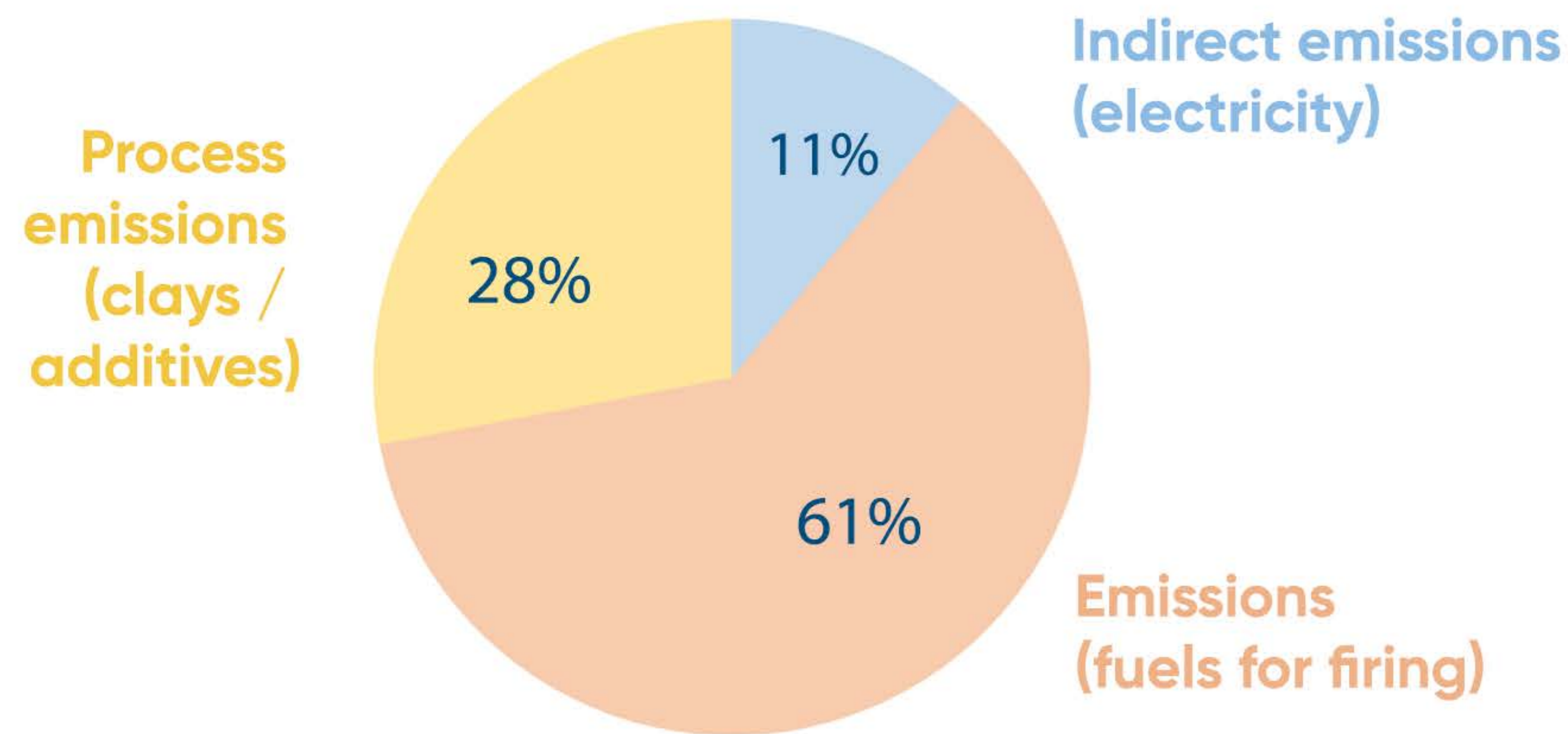
- Continuing the high levels of direct and indirect UK employment, both in primary production and up- and down-stream markets, often in rural areas
- Further job creation with diverse employment opportunities
- Up-skilling of employees in high-tech, low-carbon jobs and R&D activities

Emissions reductions to 2050



UK Ceramics Industry – Emissions breakdown

“ the type and scale of production process (and also emissions profile) has a big impact on the feasibility and commercial viability of decarbonisation technologies ”

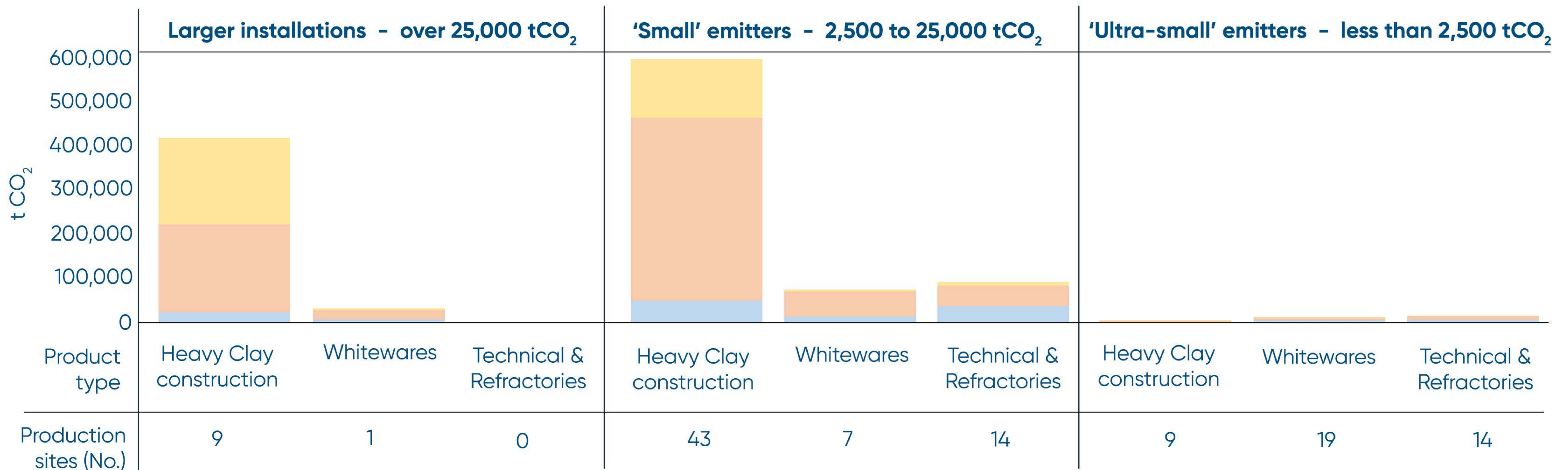


Each manufacturing site differs in terms of their:

- manufactured product/s and processes
- raw materials used, incl. clay types and mineral additives
- energy used for firing
- profile in type of emissions

To better-understand potential emissions reductions across the sector, baseline emissions data was divided by product group and scale of production emissions, with potential roll-out of existing and emerging technologies specifically considered for each 'Pot' (with considerable engagement with manufacturers on views).

“ Although the manufacturing process is energy-intensive, over 90% of ceramic production sites in the UK are classed as small or ultra-small emitters ”



“ 75% of the sector’s direct carbon emissions are covered under the UK Emissions Trading Scheme ”



Credit: Forterra Plc - new Desford factory



Credit: Wienerberger - Heat Recovery System at Broomfleet factory



Credit: Naylor Industries - Combined Heat & Power plant

The 2020s



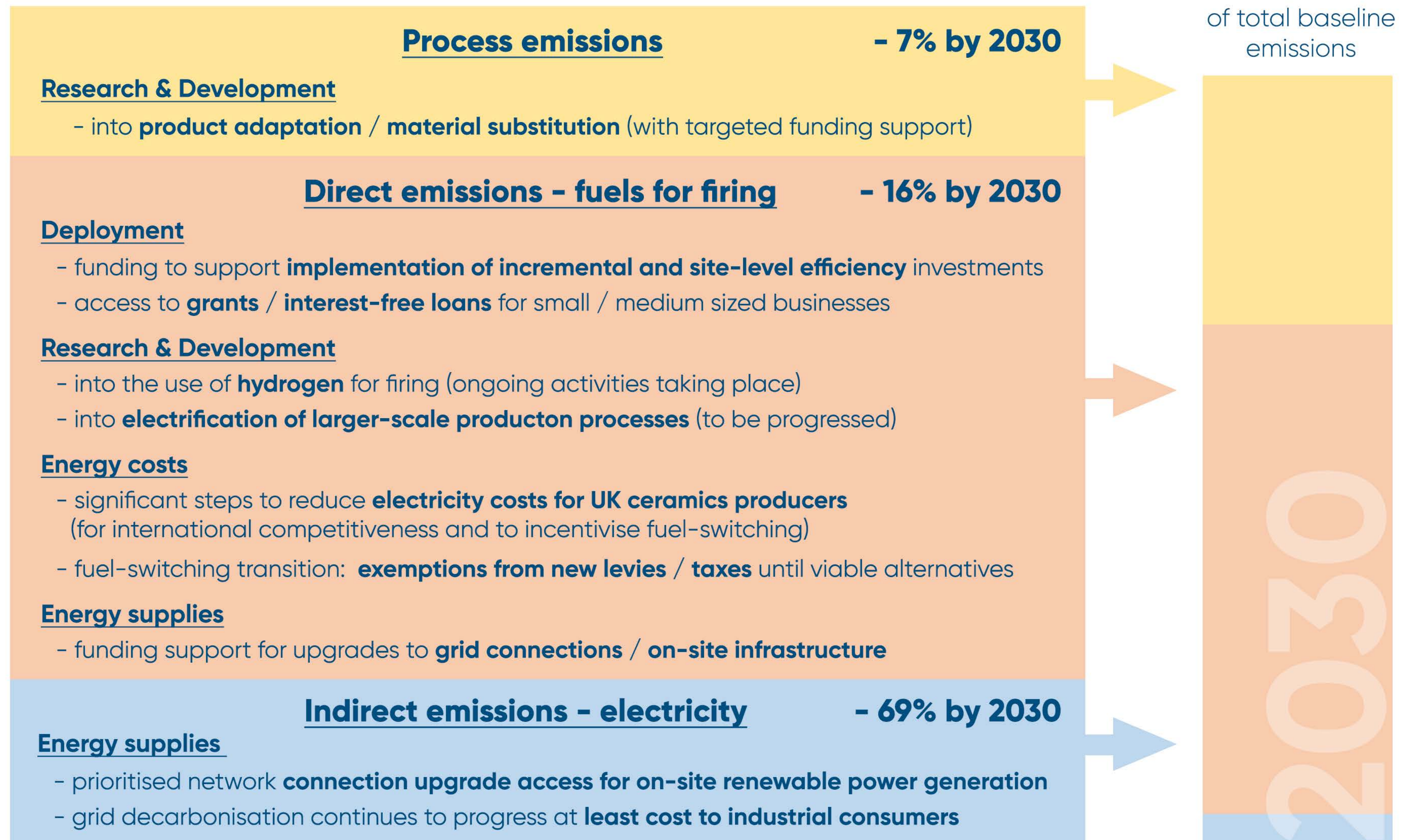
Credit: Churchill China - Solar Panel installation



Credit: Parkinson-Spencer Refractories - Wind Turbines and Battery Storage

Navigating 2020 - 2030

Key enablers





Credit: Glass Futures' Hydrogen test bed rig - Phase 1 'Hydrogen for the Ceramic Sector' research project



Credit: Michelmersh Brick Holdings Plc - HyBrick firing trials



Credit: Forterra Plc - Hydrogen firing trials

The 2030s

Navigating 2030 - 2040

Key enablers



Process emissions - 15% by 2040

Research & Development

- into the development of **commercially-viable carbon-capture abatement specifically for smaller-scale, dilute emission sources**
- into **product adaptation / material substitution** (with targeted funding support)

Direct emissions - fuels for firing - 45% by 2040

Deployment

- funding to support implementation of **incremental / site-level efficiency** investments
- access to **grants / interest-free loans** for small / medium sized businesses

Research & Development

- into **electrification of larger-scale production processes** (to be progressed)
- new **product formulations** for firing with alternative fuels (to maintain functional properties)

Energy costs

- significant reduction in **electricity costs for UK ceramics producers** (for international competitiveness and to incentivise)
- fuel-switching transition: **exemptions from new levies / taxes** until viable alternatives

Energy supplies

- rapid expansion of **hydrogen** infrastructure and distribution network to facilitate a step-change in its adoption **across dispersed sites**
- funding support for upgrades to **grid connections / on-site infrastructure**
- access to **bio-energy** for limited site-specific applications

Indirect emissions - electricity - 100% by 2040

Energy supplies

- network connection upgrades for **on-site renewable power generation projects (through prioritised access)**

- 43%
of total baseline emissions





The 2040s

Navigating 2040 - 2050

Key enablers

Process emissions

- 68% by 2050

Deployment

- funding to support **commercial viability** / **deployment of carbon-capture technologies** at specific sites, given high capital investment requirements and operational costs

Direct emissions - fuels for firing

- 104% by 2050

Deployment

- continued **financial support in transition of fuel-switching assets**, both in undertaking of retro-fit (more-likely with hydrogen) or new plant (required for larger-scale electrification)
- access to **grants** / **interest-free loans** for SMEs to help implement measures

Research & Development

- into **electrification of larger-scale production processes** (to be progressed)

Energy supplies

- rapid expansion of **hydrogen** infrastructure and distribution network to facilitate a step-change in its adoption **across dispersed sites**
- funding support for upgrades to **grid connections** / **on-site infrastructure**
- access to **bio-energy** for limited site-specific applications (incl. with carbon-capture)

Residual emissions

6% of baseline (2050)

Deployment

- use of **Carbon offsetting mechanisms** (undertaken by companies directly / indirectly)
- more holistic consideration of carbon emissions over **product lifecycle** / **value-chain**

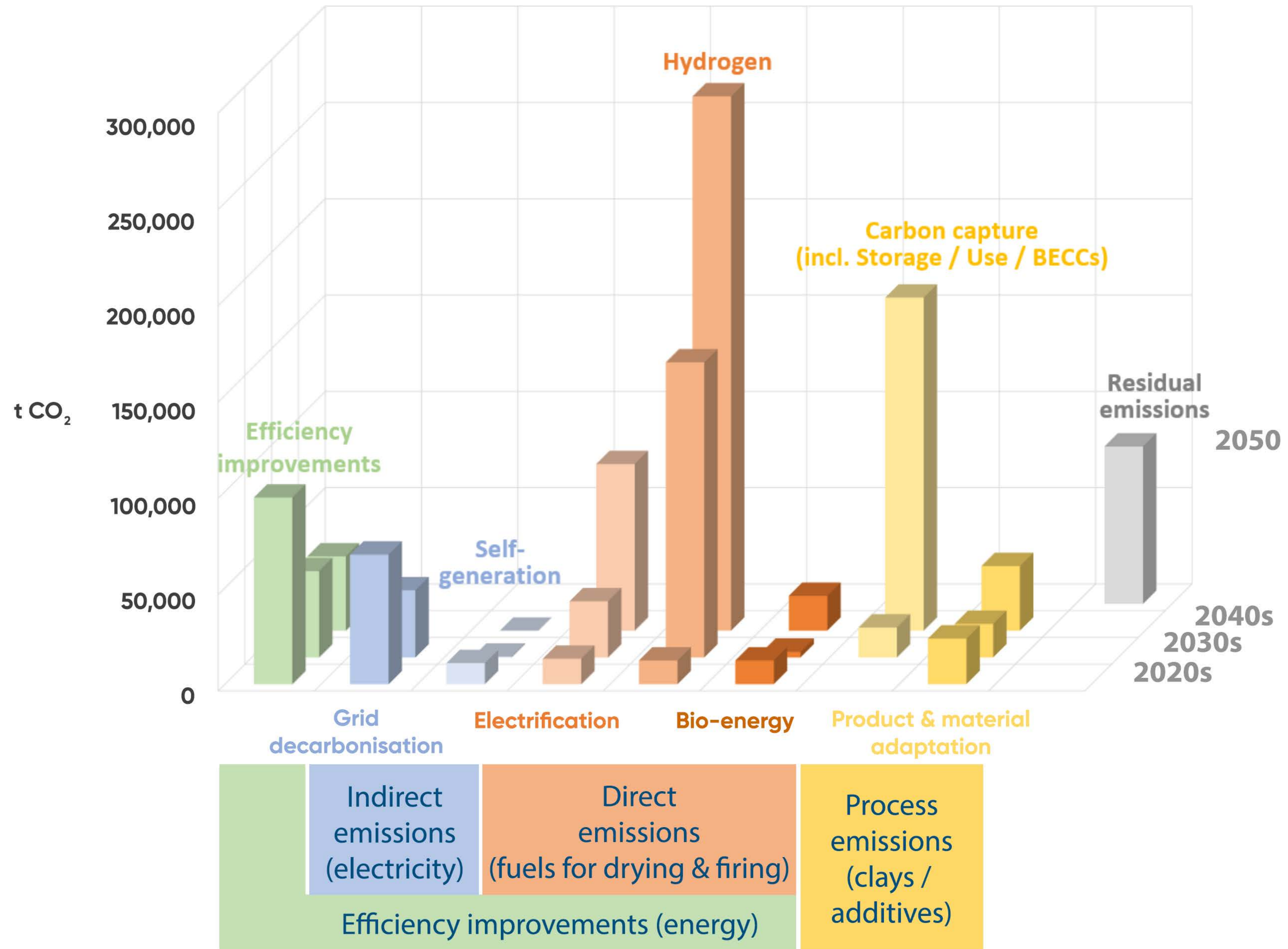
- 94%
reduction versus
baseline emissions

2050

2

2040

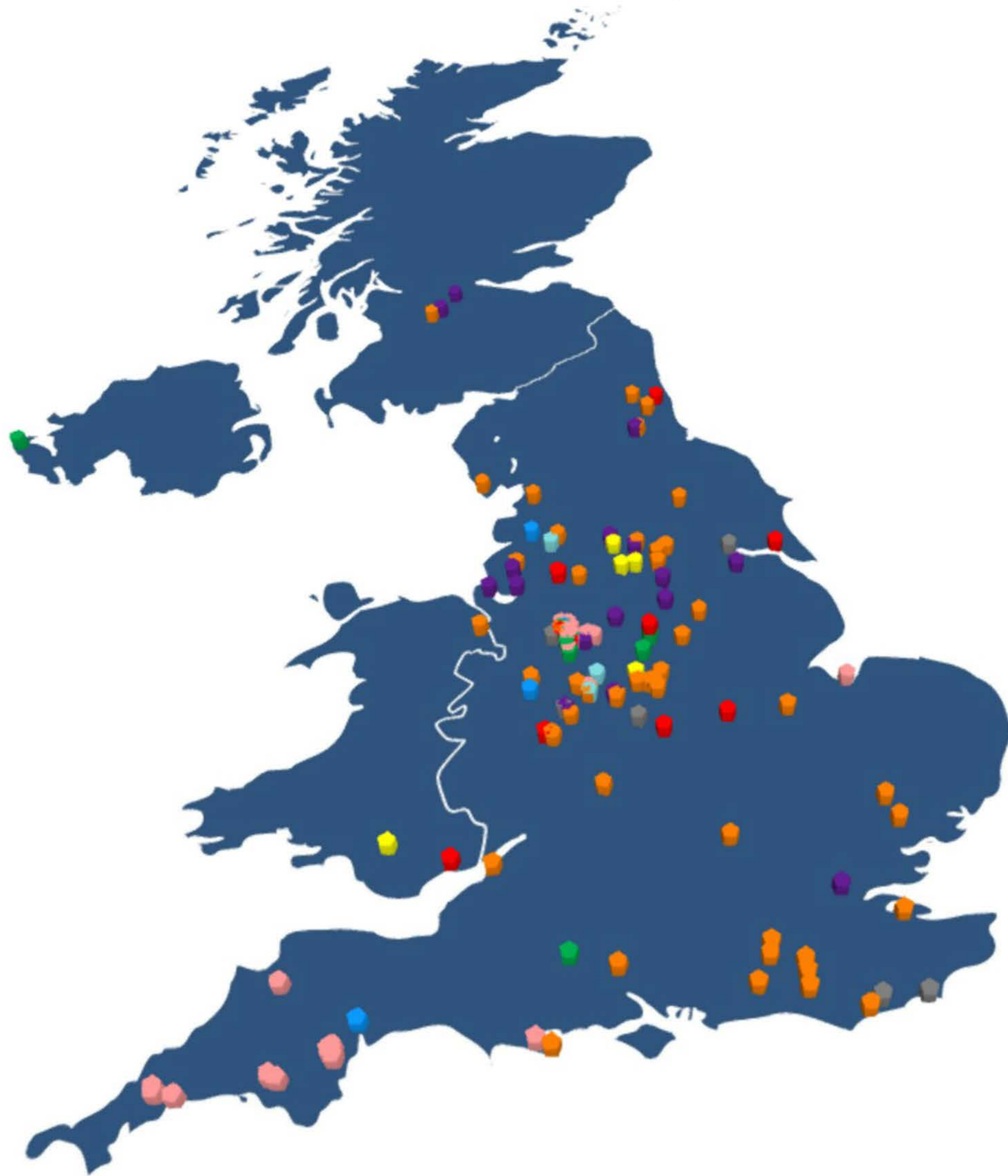
Projected technology emission reductions for UK ceramic manufacturing





Diverse products

- Clay brick
- Wall / floor tiles
- Technical ceramics
- Clay roof tiles
- Sanitaryware
- Refractories
- Clay drainage pipes & pots
- Tableware / giftware
- Suppliers to the industry



Many dispersed primary production sites

75% of companies in the sector are small/medium-sized businesses

Annual ceramic product sales of

£1.6
billion

A significant exporter

£600
million

£750 million

investment in the sector in upgrades to processes / technologies over the last

10 years

Strategically important for the

UK
economy

Being both a **foundation** and **advanced** industry, **ceramics** underpin most **critical activities**

17.5k

direct employees

with thousands more supported throughout up-stream and down-stream supply chains

