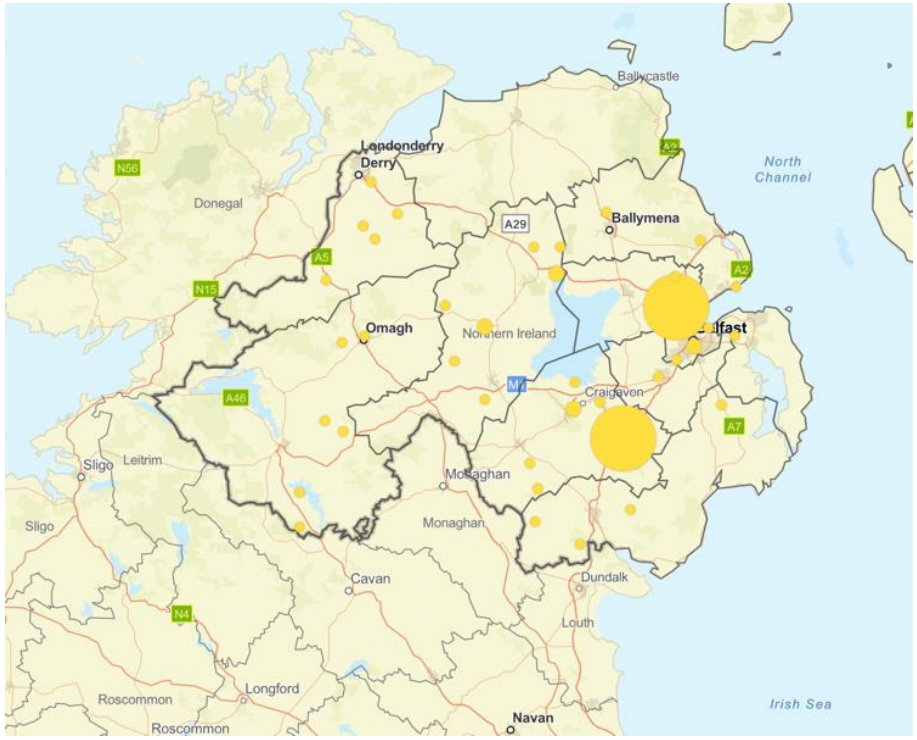
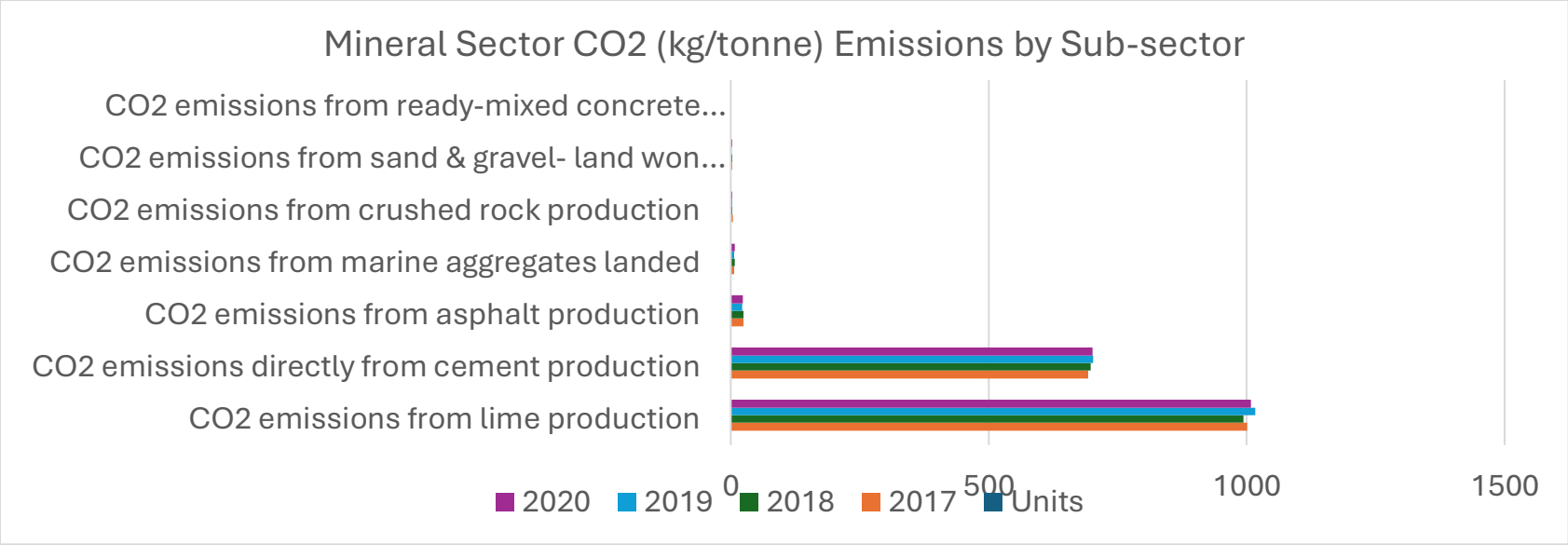
Mineral Products Scope:

The mineral products sector in Northern Ireland covers the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and silica sand industries. The mineral products sector accounts for £650 million annually (quarrying itself representing approximately £400 million)[1], 2.75% of the regional Northern Ireland economy (GDP)[2], 1.75% of Northern Ireland's GVA, and contributes up to 23% of Northern Ireland's industrial carbon emissions.





Mineral Product Industry Carbon Intensive Operations

Cement and lime are the most carbon intensive (mineral product) operations, due to the high temperatures required to produce them, and the release of carbon dioxide from calcium carbonate raw materials at high temperatures. Matter can be removed using explosives (carbon monoxide emissions) and heavy machinery running on fossil fuels. Pulverisation of matter accounts for 40% of mining's energy use. Water used to separate minerals (treatment of water also requires significant energy usage).

CONTEXT

- **Significant global change across energy sector**

The objective of MPANI–Camirus engagement is to develop or consolidate a MPANI perspective to input into the ID-NI process and

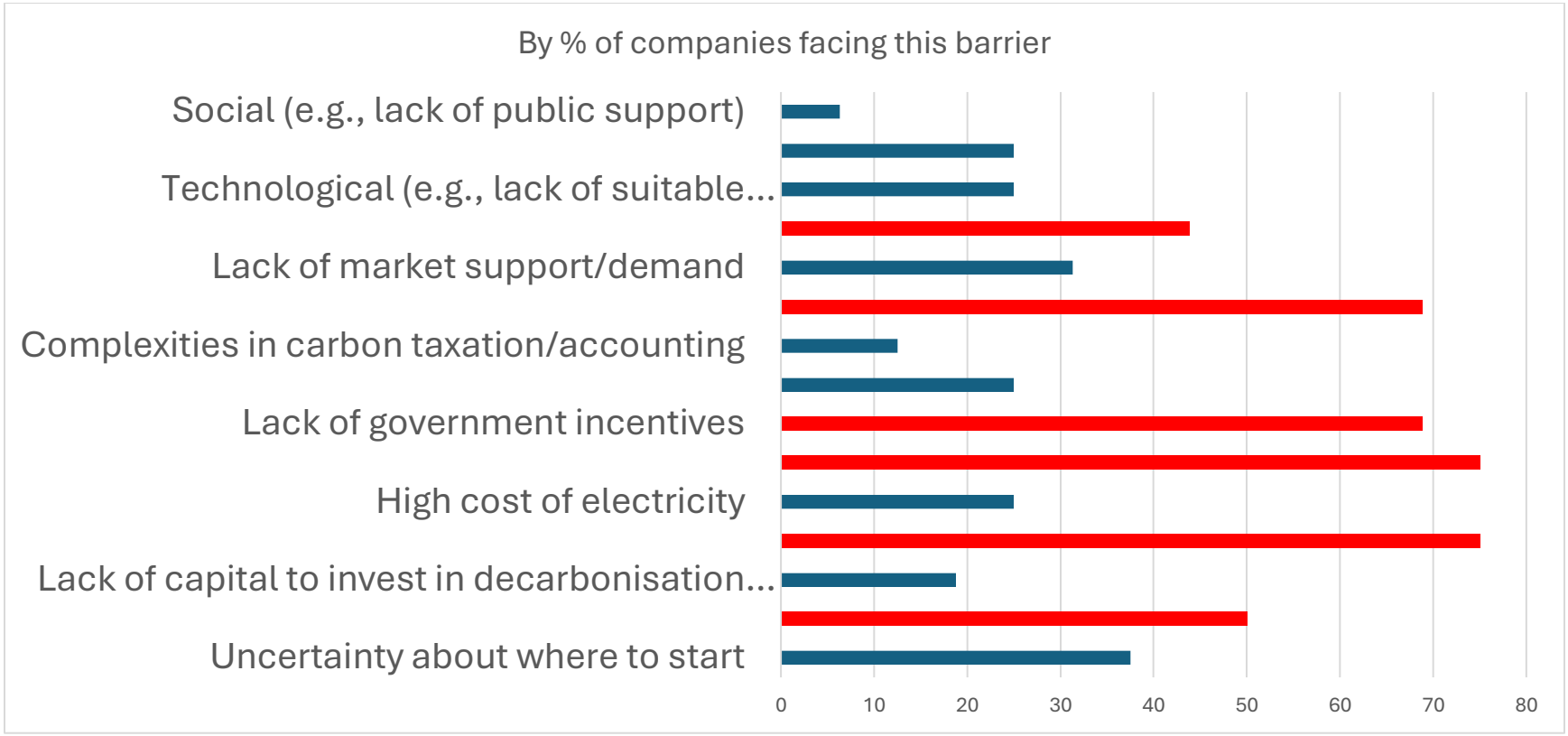
- Transition to net zero
- Cost allocation; protectionism; customer attitudes
- Diversity of technology and policy options

- **ID-NI project opportunity**
  - consolidate funding/support requirements
  - focus discussion with energy sector
  - highlight and address energy issues inhibiting competitiveness
- **Industry-led**

POSITION PAPER:

- We anticipate ~60%-80% of industrial decarbonisation challenges will be common
- However, important we distinguish 20-40% per sector that are unique/particularly critical
- Important to put industrial and sector contribution and significance in context for national policymakers and funders (in London, Dublin and Brussels)
- We have time to iterate

MPANI MEMBERS IDENTIFIED OBSTACLES TO DECARBONISATION


By % of companies facing this barrier
Social (e.g., lack of public support)
Technological (e.g., lack of suitable...
Lack of market support/demand
Complexities in carbon taxation/accounting
Lack of government incentives
High cost of electricity
Lack of capital to invest in decarbonisation...
Uncertainty about where to start
0
10
20
30
40
50
60
70
80

IDNI
Industrial Decarbonisation
Northern Ireland

Project funding

Public

- IETF
- Innovation/UKRI
- BEAS 2025+
- UKIB
- Hydrogen

Private

- Solar/Wind
- other

Regional funds

- City Deals
- Investment Zone
- UKIB/Wealth Fund
- Shared Island Funds

Energy regulation

- Green (industrial) power pool
- Power purchase agreement
- Delink electricity and gas prices
- Socialise (connection) charges
- Regionalise infrastructure investment costs

Taxation and incentives

- CBAM
- Cap and trade (ETS)
- EII Exemptions

Emissions-reduction related projects

ENERGY EFFICICENY

- Switch to energy-efficient machinery
- Several projects related to material efficiency, cement replacement, energy and water efficiency.
- Blower system for moving materials to different areas of site

CEMENT & CONCRETE

- Working towards Cem 111 in specific products with ambitions to reach lower cement content over time
- Investing into R&D for low-carbon product solutions
- Low carbon cements & electric company cars
- Using geopolymer concrete in a demonstration project

FUEL-SWITCHING

- Alternative fuel including green hydrogen, SCM (supply chain management?)'s & CCUS projects
- Trials of low carbon fuels, renewables at sites, Breedon Balance eco products,
- Alternative fuel substitution with solid recovered fuel (SRF), lean (OpEx) programme

SOLAR

- Considering ground-mount Solar PV
- Planning for a PV solar installation
- Actively installing renewable energy technology and EV chargers.

Potential technologies or solutions for emissions reduction

Technology or approach	Emissions source	Technology Maturity	Economic Considerations	Magnitude/significance of tech (proportion of emissions)
Recycling of product materials	Process/end-use	Mature – primary, secondary and aggregates	Processing of waste materials can be energy and labour intensive – better to plan ahead to create materials that will again meet technical specifications	Small potential. Use of recycled (construction and demolition) waste and by-products of other industries (secondary) is a small part of reducing overall emissions. Britain: 75% of waste actively reprocessed and re-used. 90% of 'hard' construction waste recycled as aggregate[5] (the largest waste stream in the economy).
Onsite Renewable Generation	Indirect emissions, logistics.	Mature, attractive technology. 1/3 of land in NI owned by M.P sector.	Northern Ireland Energy Strategy 'Path to Net Zero Energy' includes a target to meet 70% of electricity consumption from a diverse mix of renewable sources by 2030[6]. Market for generating cheaper electricity - very attractive considering electricity prices	Medium/significant. Potential to play a medium/significant part in reducing emissions to direct emissions from operations, indirect emissions and logistics.
Fuel-switching: Biomass and biofuels	Process (potentially sufficient to generate over 70% of the heat used for cement	Early-stage Not operational commercially in UK. Problems - CO^2 storage, biomass harvests harming ecosystems.	Substantial cost – not viable. Potential for further market distortions and unintended impacts on the decarbonisation of the UK cement and lime industries. This is poor value for public money and a poor outcome for the environment.	Low potential. Currently technologically and environmentally **not viable** – but the technology and projected generation of heat has the **potential** to supply a large proportion of heat required within sector.

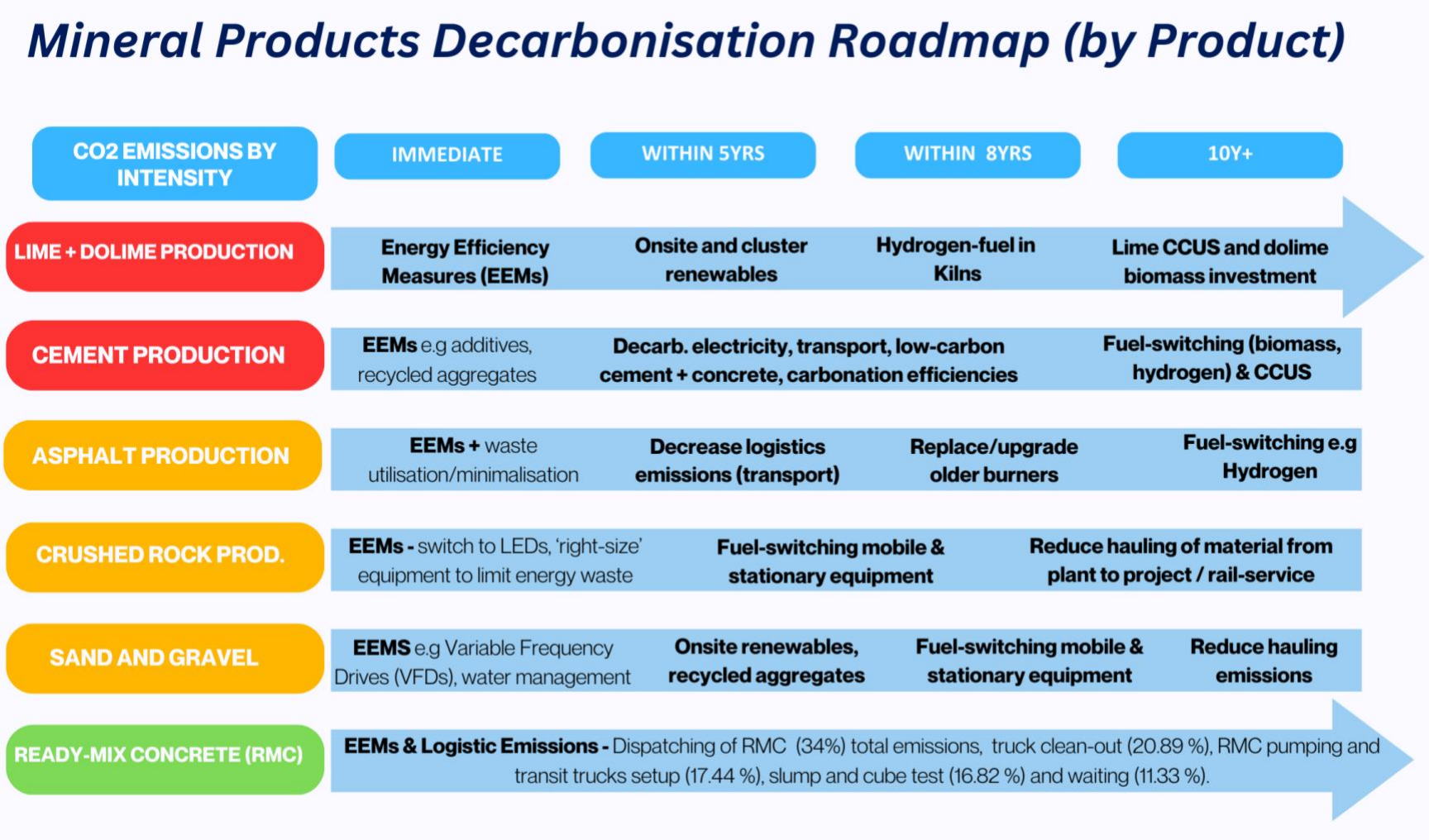
	production) .			
Fuel-switching: Hydrogen	Process Needs to be delivered or produced on-site.	Early-stage (despite the technology itself being old, no current pathway to viably implement or rationalise its use)	Substantial cost: / requires substantial subsidy as seen in international applications Lose 25% of energy in electrolysis process. Critically this converts it into heat. Must then be converted BACK into electricity again for usage.	Medium potential. Could address significant emissions (given significant subsidy + infrastructure costs) Applications: transportation & power. Reduction in the use of fossil fuel in site activities (Scope 1 emissions) and material transportation (Scope 2 emissions) Hanson Cement's Ribblesdale plant in Lancashire received £3.2M funding - cement kiln's main burner now net-zero[7]. [NOTE – USING GREY HYDROGEN – no CCUS]
Fuel-switching: electrification[8] in transport	Process and direct emissions from operations, logistics.	Electric instead of diesel vehicles (BEVS) Large grid investments required Also potential for electrification in the form of plasma energy[9] (for cement sector) – BEIS Energy Innovation Prog.	Electricity will also be required to power other decarbonisation technologies, especially carbon capture (see below).	Medium-significant magnitude. Long lead times for electricity grid network updates. Potential to address direct, indirect and logistics emissions. Until recently, companies unable to make a profit from electricity provided for mobility, and the network has been run on a free-to charge model that disincentives growth or maintenance + a grid retains an unusual charging system that discourages innovation and new connections -In Northern Ireland the connecting party is expected to cover at least some of the cost of those upgrades where their connection is the tipping point that makes the upgrade necessary (internationally, you pay just for the connection itself).

CCUS (Carbon Capture, Use and Storage)	Process and direct emissions from operations	Mid, in-use worldwide and projects popping up. Can be retro-fitted to existing plants. Significant, and maybe the only option to reduce emissions in cement industry.	CCUS will not just involve high capex costs but will also incur considerable ongoing operational costs. CCUS projects in the cement and lime sectors indicate that deployment of carbon capture could double the cost of production. If the competitiveness of mineral products is to be maintained, Government support must continue beyond first of a kind projects in clusters to projects at dispersed sites[10].	Significant potential to curb large process emissions?, direct emissions and indirect emissions. Huge potential for cement industry in particular – final recommendations will be decisive on CCUS for mineral products sector.
Geothermal Energy Production	Process and direct emissions from operations	Early/mid NI - favourable geology with significant untapped potential for geothermal energy. Feasibility studies underway in NI (Belfast & Antrim). Low emissions - Geothermal power plants do not burn fuel to generate electricity, but may release small amounts of sulfur dioxide and carbon dioxide (99%	There is significant potential for the use of both shallow and deep geothermal energy resources for the production of heat, and possibly electrical power, in Northern Ireland. Extracting such heat creates steam that is used to drive generators that create green electricity. Most geothermal power plants inject the geothermal steam and water that they use back into the earth. (Renew the geothermal resource and to reduce emissions from the geothermal power plants)	Medium capacity potential – in FUTURE (needs R&D) GeoEnergy NI Project – June 2023 - £3 million project from the Department for the Economy (DfE) is set to explore the potential for geothermal energy in Northern Ireland. (Already has early governmental support – and successful in international applications[11]. Producing local, sustainable, and low-carbon energy and is available 24 hours a day, 365 days a year, whatever the weather.) NZ application significant. Drawbacks: Development cost + time, specialised maintenance, emissions[12].

		less than FF pp). Geothermal power plants use scrubbers to remove the hydrogen sulfide naturally found in geothermal reservoirs.		
Enhanced Rock Weathering	Indirect emissions	Very early. Rain in atmosphere combines with CO_2 to form carbonic acid. When this acid falls on land, the CO_2 interacts with rocks and soil, mineralises and is stored in solid carbonate form[13]. ERW accelerates this process by spreading crushed silicate rock on agricultural land, increasing the surface area of the rock and therefore increasing its contact with CO_2.	Current waste fines production can partially fulfil the short-term demand of crushed rock for EW in the UK, the production of basic silicate rocks would need to increase by ~ 30 - 170 to meet the extraction scenarios. Therefore ERW, would need to be employed in conjunction with other carbon-emissions reduction technologies to reach net zero.	Low significance. Future strategy, R&D to be done. Minerals crushed to a fine texture and transported to their point of use. Challenges: the high energy demands of pulverizing rocks and understanding the full impacts of adding silicates to soils and oceans under real-world conditions.

There are also multiple opportunities for mineral products to be used to capture and store carbon. These are valuable for overall reduction of society's carbon emissions but not directly relevant to industrial decarbonisation, so are not included here.

Where industrial decarbonisation (i.e., reduction in site carbon emissions) can be supported by growing markets for lower or zero carbon products (e.g., thinner or composite granite slabs) this is included as an approach and typically will be supported or accelerated by demand-side policy measures.



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