



# OPPORTUNITIES FOR **DECARBONISATION**

in Northern Ireland's Agri-Food,  
Manufacturing, & Construction Sectors



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UK





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# Executive Summary



The **MSW Driving Net Zero Transformation Programme** aims to accelerate Northern Ireland's transition to a low-carbon economy. This report, prepared by carbonfit, identifies key opportunities for decarbonisation within the **agri-food, manufacturing, and construction** sectors, which are pivotal to achieving Northern Ireland's Net Zero targets.

Each sector presents unique challenges and significant opportunities for emissions reduction, sustainable growth, and innovation.





## AGRI-FOOD SECTOR

The agri-food sector contributes **£1.67 billion to GVA** and employs approximately **35,000 people**, yet it accounts for **26% of Northern Ireland's greenhouse gas emissions**, predominantly from livestock and land use.

### Key Opportunities:

- **Sustainable Farming Practices:** Adoption of regenerative agriculture to improve soil health and biodiversity.
- **Circular Economy Models:** Using anaerobic digestion for food waste to generate renewable energy.
- **Renewable Energy Integration:** Deploying solar and wind solutions for cost and energy stability.

### Challenges:

Cost pressures, legislative barriers, and knowledge gaps among smaller producers.

### Recommendations:

1. Promote regenerative practices for long-term cost savings.
2. Foster supply chain collaboration to share learning and resources.
3. Implement carbon audits to establish benchmarks and reduction pathways.
4. Innovate waste management with anaerobic digestion systems.
5. Highlight industry leaders to inspire wider sustainability adoption.



## ADVANCED MANUFACTURING & ENGINEERING SECTOR

Manufacturing contributes over **£2.6 billion GVA annually**, supporting diverse industries such as food processing, aerospace, and machinery. The sector is highly energy-intensive, making it a priority for decarbonisation.

### Key Opportunities:

- **Energy Efficiency:** Technologies like LED lighting and smart metering reduce emissions and costs.
- **Resource Optimisation:** Circular economy principles address waste and regulatory pressures.
- **Renewable Energy Investments:** Solar and wind power improve energy security and emissions performance.
- **Advanced Innovation:** AI and digitalisation optimise processes, minimising waste and energy use.

### Challenges:

Technological gaps, weak market incentives for low-carbon products, and workforce skills deficits.

### Recommendations:

1. Establish emissions baselines using tools with alignment to the Greenhouse Gas Protocol.
2. Scale proven technologies such as smart metering and lean manufacturing.
3. Promote pre-competitive collaboration to share innovation costs.
4. Support workforce upskilling to address technological gaps.
5. Expand circular economy practices to reduce virgin resource use.



## Construction Sector

The construction sector has experienced significant growth, supporting over **8,000 jobs** and contributing to Northern Ireland's regional development. However, it remains a substantial source of emissions due to material production and energy use.

### Key Opportunities:

- **Material Efficiency:** Low-carbon cement and sand substitutes like quarry dust.
- **On-Site Renewables:** Solar and wind installations for energy autonomy.
- **Lifecycle Carbon Analysis:** Adopting frameworks like PAS 2080 ensures project-wide carbon efficiency.
- **Hydrogen Innovations:** Emerging technologies offer decarbonisation for heavy processes.

### Challenges:

Planning delays, grid connectivity issues, and client hesitancy due to cost constraints.

### Recommendations:

1. Advance off-grid renewable energy systems for flexibility and resilience.
2. Integrate lifecycle carbon standards (PAS 2080) into tenders.
3. Deliver quick wins such as green energy tariffs and alternative fuels like HVO.
4. Foster collaboration through initiatives like shared biomethane networks.
5. Embed energy-efficient solutions in site management and temporary infrastructure.



## All Sector Recommendations

The analysis identifies shared priorities across all three sectors:

### 1. Baseline Data and Measurement:

Accurate benchmarking tools enable targeted decarbonisation.

### 2. Renewable Energy and Circularity:

Solutions like solar, biomass, and waste-to-energy systems provide transformative benefits.

### 3. Knowledge and Skills Development:

Upskilling workers in green technologies is critical to closing skills gaps.

### 4. Collaboration and Innovation:

Industry clusters and shared infrastructure amplify impact and drive cost efficiencies.

Across all three sectors, the recommended activities are grounded in their ability to achieve maximum carbon reductions in a cost-effective manner:

### 1. Energy Efficiency:

Upgrading systems like compressors, pumps, and boilers to reduce energy consumption.

### 2. Renewable Energy:

Transitioning to green electricity and installing renewable energy systems such as solar PV and wind turbines.

### 3. Operational Improvements:

Enhancing processes, waste management, and site efficiency to reduce emissions and costs.

### 4. Low-Carbon Alternatives:

Adopting HVO as a cleaner fuel option and bio- refrigerants for cooling systems.



## Strategic Support

The following strategies can facilitate decarbonisation across sectors:

### 1. Financial Incentives:

Provide grants, subsidies, and low-interest loans for green technology adoption.

### 2. Capacity Building:

Develop training programmes in partnership with organisations like AMIC or carbonfit.

### 3. Advisory Services:

Offer tailored carbon assessments and transition roadmaps.

### 4. Shared Infrastructure:

Invest in collaborative renewable energy and circular economy hubs.

### 5. Policy Advocacy:

Simplify planning processes to accelerate renewable energy projects.

### 6. Promotional Campaigns:

Showcase local Net Zero success stories with clear business cases to inspire peer learning.

### 7. Networking Initiatives:

Host forums and workshops to foster cross-sector collaboration.

## Conclusion

Decarbonising Northern Ireland's **agri-food, advanced manufacturing and engineering,** and **construction** sectors offers a clear pathway to achieving Net Zero targets while driving sustainable economic growth. By implementing the recommendations and cross-sector strategies outlined in this report, businesses can be empowered to adopt sustainable practices, enhance competitiveness, and accelerate the region's Net Zero transformation.

# Introduction

The MSW Driving Net Zero Transformation Programme seeks to accelerate the MSW Region's and Northern Ireland's transition to a low-carbon economy. This report, prepared by carbonfit, explores opportunities for decarbonisation within the agrifood, manufacturing, and construction sectors. Each sector plays a vital role in achieving Net Zero targets, with unique challenges and opportunities:



**Agri-Food Sector:**

The agri-food sector is a cornerstone of Northern Ireland's economy, contributing £1.67 billion to Gross Value Added (GVA) and employing approximately 35,000 people, which accounts for 4.2% of total employment. Over 75% of Northern Ireland's land is used for agriculture, reflecting the sector's geographic prominence. However, agriculture is also responsible for 26% of the region's greenhouse gas (GHG) emissions, primarily from livestock and land use, emphasising the urgent need for sustainable practices and decarbonisation efforts (NIOPA, 2022; DfE, 2022).

**Advanced Manufacturing & Engineering Sector:**

Manufacturing remains one of the leading contributors to Northern Ireland's economy, supported by a diverse industrial base including food processing, machinery, and aerospace. The sector's value exceeds £2.6 billion GVA annually and supports significant employment across urban and rural areas. Energy-intensive operations make manufacturing a key target for emissions reduction, particularly through renewable energy adoption and process optimisation (DfE, 2022; INI, 2024).

**Construction Sector:**

The construction sector has experienced significant growth, with output reaching a 15-year high in 2024, demonstrating its vital role in regional development. The industry supports over 8,000 jobs and has a wide geographic spread, engaging in housing, infrastructure, and commercial projects. Construction contributes a considerable share of carbon emissions through energy use and material production, highlighting the importance of sustainable practices such as low-carbon materials and lifecycle carbon analysis (NISRA, 2024; INI, 2024).

This report highlights specific recommendations and cross-cutting themes to support decarbonisation and the transition to Net Zero. This analysis draws from carbonfit's own experience, a survey of carbonfit's clients and stakeholder insights from semi structured interviews undertaken from September to December 2024.

# Sectoral Insights & **Recommendations**





## Agri-Food Sector

### Opportunities and Current Trends

#### Sustainable Farming Practices:

Transitioning to regenerative agriculture and reduced reliance on synthetic inputs is a priority (DAERA, 2024). This shift addresses soil degradation, biodiversity loss, and long-term food security while meeting growing consumer demands for sustainability.

#### Circular Economy Models:

Innovations such as anaerobic digestion for food waste offer dual benefits of waste reduction and energy generation (Ellen MacArthur Foundation, 2020). This approach aligns with both environmental goals and cost-saving strategies by reducing landfill reliance with the associated GHGs, providing a low carbon fuel or fertiliser source and reducing costs of waste collection, fertiliser and energy procurement.

**Case Study:** McCulla are an NI based company that have used circular economy principles to transform their business. By installing an Anaerobic Digestion (AD) Plant on their farm they are able to create digestate to fertilise their fields that grow the produce they deliver to supermarkets. To close the loop, they collect waste food from supermarkets to feed the AD Plant which also produces bio fuel for the trucks that they use to deliver their produce to the supermarkets. This approach saves GHG emissions, reduces waste and saves fuel and fertiliser costs (McCulla, 2020).

#### Renewable Energy Integration:

Solar-powered milking systems and wind energy adoption reduce operational emissions and improve energy independence, ensuring long-term cost stability in volatile energy markets.

### Challenges

#### Cost Pressures:

Sustainability initiatives often conflict with consumer expectations for low food prices, placing economic strain on producers.

#### Legislative Barriers:

Outdated packaging regulations hinder the use of recycled materials, limiting opportunities for innovation in sustainable product design.

#### Knowledge Gaps:

Smaller producers often lack awareness of scalable solutions, such as DAERA's upcoming launch of a Carbon Footprinting Project for Farms linked to the Farm Sustainability Payment. The lack of awareness and detail associated with these opportunities limits SMEs capacity to identify and address key emission sources.

### Sectoral Recommendations

#### 1. Adopt Regenerative Practices:

Promoting soil health and biodiversity enhances resilience against climate change and reduces reliance on synthetic inputs, leading to cost savings over time. Biodiversity and regenerative practices are not just good for the planet, they're good for business too.

#### 2. Enhance Supply Chain Collaboration:

Collaboration fosters shared learning and resource efficiency.

**Case Study:** Glenarm Shorthorn's partnership with Hannans Meats has demonstrated how localised efforts can achieve sustainability goals. This partnership has created a scheme that assures that the animal husbandry is of the highest standard, the land is not over grazed, the herd sizes do not need to be too large, the farmer receives a premium price, the meat merchant has a steady supply of a high quality product and the consumer enjoys the most delicious meal. In this way, GHG emissions are kept low through shortened logistics and a reduced herd size, biodiversity is improved by promoting a rare breed animal and the farmer and the meat merchant can still turn a profit.

### 3. Utilise Carbon Audits:

Tools like DAERA's carbon audit map enable precise benchmarking, which is critical for setting measurable targets and tailoring reduction strategies. Carbon audits provide the clarity and direction businesses need to act effectively on sustainability.

### 4. Innovate in Waste Management:

Redirecting food waste to anaerobic digestion not only reduces emissions but also generates renewable energy, offering economic and environmental returns.

### 5. Leverage Industry Leadership:

Highlighting leaders inspires wider adoption of sustainability frameworks and demonstrates tangible benefits.

**Case Study:** Boatyard Gin are one of a growing number of companies to achieve B-Corp certification. This means that the company has been assessed against a range of sustainability indicators to prove that it is doing what it says it is doing to have a positive impact on people and the planet. Furthermore, it has changed its legal constitution to put the priorities of stakeholders above the priorities of shareholders.

As a result of adherence to this framework, B-Corps are brands that are recognised by consumers as more trustworthy, gain access to new markets, boost productivity through greater employee buy in and give investors greater confidence through enhanced due diligence.

## Top Carbon Reduction Activities for Agrifood SMEs

The agrifood sector faces specific challenges related to energy use, refrigeration, and waste management. The following actions are recommended:

1. Transition to **Green Supply Electricity** as a foundational step.
2. Upgrade **Motors and Pumps** to energy-efficient systems.
3. Replace traditional refrigerants with **Bio-Substitutes** to lower emissions.
4. Redirect **Food Waste to Anaerobic Digestion (AD) Plants** to generate renewable energy.
5. Optimize **Chillers** for greater energy efficiency.
6. Adopt **Hydrotreated Vegetable Oil (HVO)** for Heavy Goods Vehicle (HGV) fleet and machinery fuel.
7. Improve **Operational Efficiency** through process streamlining and energy management.
8. Upgrade **Boilers** for better energy performance.
9. Invest in **Wind Energy Options** where feasible for additional renewable energy generation.
10. Implement **Heat Recovery Systems** to repurpose waste heat from operations.

These activities address high-energy processes and carbon-intensive operations specific to agrifood businesses, providing significant environmental and economic benefits.

## Advanced Manufacturing & Engineering Sector

### Opportunities and Current Trends

#### Energy Efficiency:

Adopting technologies such as LED lighting and smart metering provides immediate cost reductions while lowering emissions (Energy Saving Trust, 2023). These investments often pay for themselves quickly through energy savings.

#### Resource Optimisation:

Circular economy principles, including material reuse and waste reduction, align with rising regulatory pressures and consumer preferences for sustainable products.

#### Renewable Energy Investments:

Solar and wind energy adoption not only reduces emissions but also shields businesses from future energy price volatility.

#### Advanced Innovation:

Deployment of AI and digitalisation allows manufacturers to optimise processes, reduce energy consumption, and minimise waste, providing competitive advantages.

### Challenges

#### Technological Gaps:

SMEs often face barriers to adopting advanced technologies due to high upfront costs and a lack of technical expertise.

#### Market Incentives:

Weak demand for low-carbon products discourages large-scale investment in green technologies.

#### Workforce Skills:

A lack of training and awareness hinders the adoption of new technologies and practices.

### Sectoral Recommendations

#### 1. Establish Carbon Baselines:

Tools like carbonfit support companies to measure their baseline emissions and align to the Greenhouse Gas Protocol. They can then identify emission hotspots, enabling manufacturers to focus on high-impact areas. Understanding where your emissions are coming from is half the battle. Once you have a baseline, the path forward becomes much clearer.

#### 2. Scale Proven Technologies:

Encouraging the use of smart metering and lean manufacturing principles fosters efficiency while minimising waste and energy consumption.

#### 3. Foster Pre-Competitive Collaboration:

Initiatives such as Invest NI's Green Economy Exchange promote shared innovation, reducing costs and accelerating progress. Collaboration between businesses and research centres accelerates the adoption of technologies that transform sustainability goals into reality.

#### 4. Support Workforce Upskilling:

Partnering with organisations like AMIC ensures workers are equipped to manage and innovate within sustainable manufacturing processes. Aligning skills training with Net Zero goals creates a workforce that's ready for the future.

#### 5. Expand Circular Economy Practices:

Scaling recycling systems and integrating alternative materials reduces reliance on virgin resources, addressing both environmental and cost challenges.

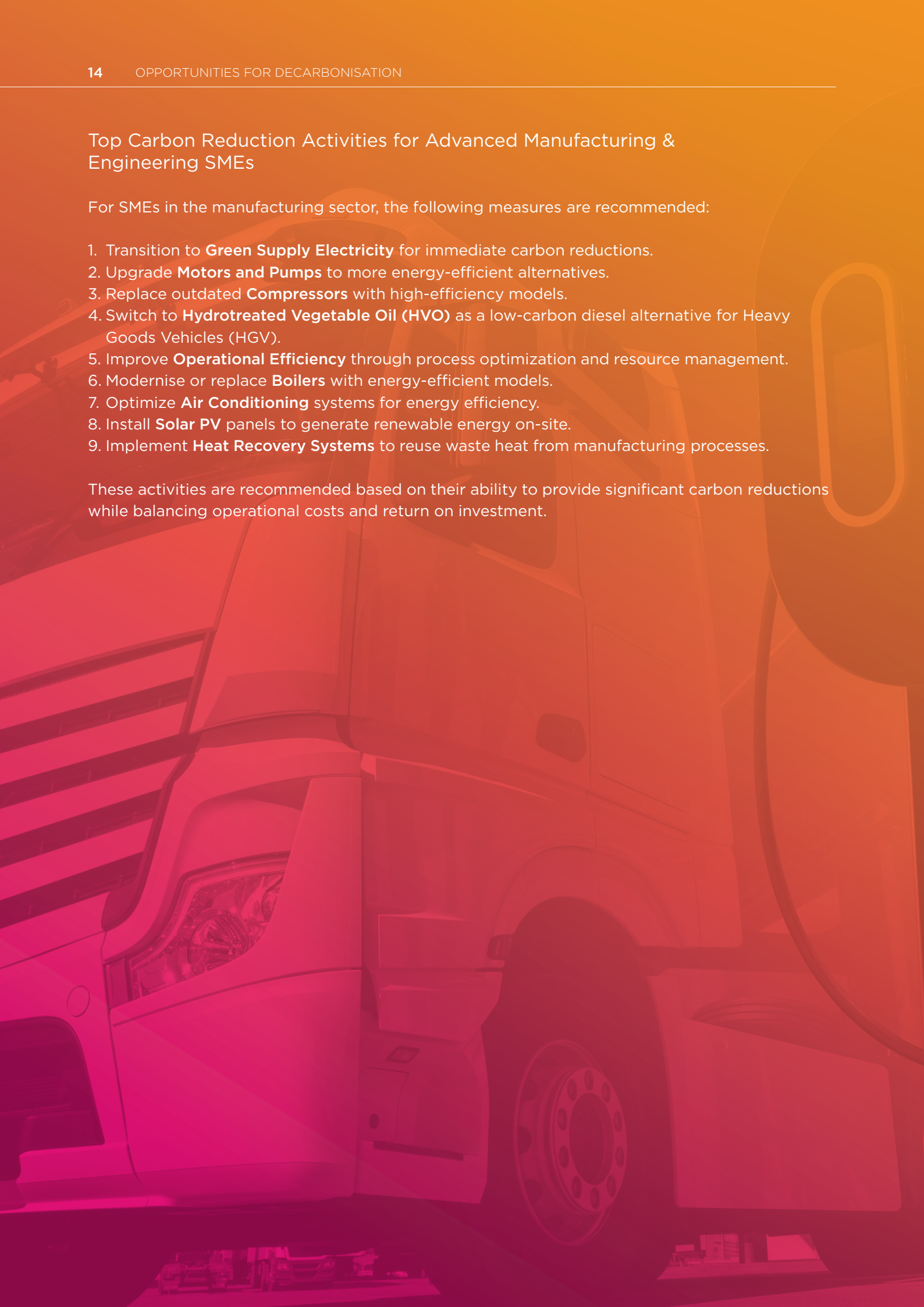


## Top Carbon Reduction Activities for Advanced Manufacturing & Engineering SMEs

For SMEs in the manufacturing sector, the following measures are recommended:

1. Transition to **Green Supply Electricity** for immediate carbon reductions.
2. Upgrade **Motors and Pumps** to more energy-efficient alternatives.
3. Replace outdated **Compressors** with high-efficiency models.
4. Switch to **Hydrotreated Vegetable Oil (HVO)** as a low-carbon diesel alternative for Heavy Goods Vehicles (HGV).
5. Improve **Operational Efficiency** through process optimization and resource management.
6. Modernise or replace **Boilers** with energy-efficient models.
7. Optimize **Air Conditioning** systems for energy efficiency.
8. Install **Solar PV** panels to generate renewable energy on-site.
9. Implement **Heat Recovery Systems** to reuse waste heat from manufacturing processes.

These activities are recommended based on their ability to provide significant carbon reductions while balancing operational costs and return on investment.



# Construction Sector

## Opportunities and Current Trends

### Material Efficiency:

Using quarry dust as sand substitutes and producing low-carbon cement reduces the carbon footprint of materials, a critical area for decarbonisation.

### On-Site Renewable Energy:

Solar and wind installations with battery storage provide energy autonomy, particularly in remote construction sites.

### Framework Adoption:

Standards ensure long-term compliance and sustainability. The **London Energy Transformation Initiative (LETI)** has produced guidance on low-carbon buildings, including embodied carbon and whole-life carbon considerations and **Publicly Available Specification (PAS) 2080**, provides a framework for reducing whole-life carbon emissions in infrastructure projects through collaboration across the value chain.

### Hydrogen Innovations:

Trials in hydrogen gas storage and applications in concrete production highlight emerging opportunities for decarbonising heavy construction processes.

## Challenges

**Planning Delays:** Lengthy approval processes for renewable installations and infrastructure upgrades impede progress.

**Grid Connectivity:** Limited capacity of the energy grid to accommodate distributed generation restricts renewable energy adoption.

**Client Hesitancy:** Funding constraints often lead clients to prioritise cost over sustainability.

## Sectoral Recommendations

- 1. Advance Off-Grid Solutions:** Off-grid energy systems, such as solar combined with battery storage, ensure uninterrupted power while reducing reliance on fossil fuels. Off-grid solutions give companies the flexibility they need while waiting for broader grid upgrades.
- 2. Embed Standards:** Integrating frameworks like PAS 2080 into tenders promotes consistent carbon reduction across projects. Embedding lifecycle carbon analysis early in projects is key to meeting long-term Net Zero objectives.
- 3. Encourage Quick Wins:** Implementing measures such as green energy tariffs and HVO fuels delivers immediate reductions while more complex solutions are developed.
- 4. Enhance Collaboration:** Knowledge-sharing initiatives, such as MPANI's Energy Valley project, foster innovation and resource efficiency.
- 5. Utilise Biomethane Networks:** Collaboration in Mid Ulster demonstrates how shared infrastructure for alternative fuels can benefit multiple stakeholders. Biomethane networks offer a cost-effective pathway to reducing emissions while building resilience into energy systems.

## Top Carbon Reduction Activities for Construction SMEs

In the construction sector, the recommended CR activities reflect the unique demands and opportunities of building sites and supply chains:

1. Transition to **Hydrotreated Vegetable Oil (HVO)** for Heavy Goods Vehicles (HGVs) to reduce fuel emissions.
2. Develop and implement comprehensive **Waste Management Plans** for construction sites.
3. Switch to **Green Electricity** for powering on-site operations.
4. Use **Eco Cabins** for temporary site accommodation to minimise energy use.
5. Enhance **Site Management Efficiency** to reduce waste and resource consumption.
6. Prioritise **Sourcing Local Building Products** to minimise transportation emissions.
7. Upgrade **Compressors** to energy-efficient models.
8. Electrify the **Construction Fleet and Machinery**, replacing fossil-fuel-powered equipment.
9. Introduce **Lighting Controls** on building sites to minimise unnecessary energy use.

These measures are cost-effective and align with the increasing pressure on construction firms to meet sustainability targets through operational and material efficiencies.



## All Sector Recommendations

The research carried out with Stakeholder and Representative Organisations for this study highlighted the following recommendations as being relevant to all sectors:

### 1. Baseline Data and Measurement

Accurate emissions baselines are essential for all sectors. Tools such as Carbonfit's platform and DAERA's carbon audit map offer scalable solutions for benchmarking.

### 2. Renewable Energy and Circularity

Renewable energy adoption and circular economy principles provide transformative opportunities. Scalable solutions like solar installations, biomass, and waste-to-energy systems should be prioritised.

### 3. Knowledge and Skills Development

Upskilling initiatives, led by organisations such as AMIC and Invest NI, are critical to bridging skills gaps. Programmes should target emerging technologies and operational best practices.

### 4. Collaboration and Innovation

Collaboration across sectors can amplify decarbonisation efforts. Industry clusters, such as those facilitated by Invest NI, enhance resource-sharing and drive innovation.

Drawing on over 20 years of experience in providing Net Zero solutions to companies in Northern Ireland, Aaron McClean, Associate Director at Carbonfit, has outlined tailored Carbon Reduction (CR) activities for SMEs in the manufacturing, construction, and agrifood sectors. These recommendations prioritise cost-effective measures that yield significant carbon reductions and are presented in a timeline order to guide companies on their decarbonisation journey.

Across all three sectors, the recommended activities are grounded in their ability to achieve maximum carbon reductions in a cost-effective manner. The measures prioritise:

#### 1. Energy Efficiency:

Upgrading systems like compressors, pumps, and boilers to reduce energy consumption.

#### 2. Renewable Energy:

Transitioning to green electricity and installing renewable energy systems such as solar PV and wind turbines.

#### 3. Operational Improvements:

Enhancing processes, waste management, and site efficiency to reduce emissions and costs.

#### 4. Low-Carbon Alternatives:

Adopting HVO as a cleaner fuel option and bio-refrigerants for cooling systems.

## Conclusion

Decarbonisation in Northern Ireland's agrifood, manufacturing, and construction sectors presents a pathway to sustainable economic growth. By implementing enhanced recommendations and addressing cross-cutting challenges, businesses can lead the transition to a Net Zero economy. Strategic support from industry bodies, government frameworks, and collaborative initiatives will be pivotal in achieving these goals.

To support companies from these key sectors in accessing and adopting the recommendations outlined in this report, the following strategies should be considered:

### 1. Financial Incentives:

Introduce tailored grants to offset the upfront costs associated with adopting renewable energy technologies, advanced waste management systems, or sustainable materials.

### 2. Capacity Building:

Develop training programmes in partnership with organisations like AMIC and local colleges to address skills gaps in green technologies and sustainable practices.

### 3. Advisory Services:

Establish a dedicated decarbonisation advisory service that provides one-on-one support, carbon footprint assessments, and roadmaps for transitioning to Net Zero operations.

### 4. Shared Infrastructure Projects:

Facilitate investment in shared infrastructure such as renewable energy installations, biomethane production facilities, and circular economy hubs to reduce individual costs and promote collaboration.

### 5. Policy Advocacy and Streamlining:

Work with government agencies to align regulations with decarbonisation goals, simplifying processes like planning permissions for renewable energy projects.

### 6. Promotional Campaigns:

Highlight success stories from local businesses that have successfully adopted sustainable practices, encouraging peer learning and inspiring others to follow suit.

### 7. Networking and Collaboration:

Host forums, workshops, and networking events to foster cross-sector collaboration and share best practices in sustainable operations.

**By implementing these actions,** businesses could be empowered to embrace sustainable practices and drive Northern Ireland's Net Zero transformation effectively.

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