Rialtas na hÉireann
Government of Ireland

Roadmap for the Decarbonisation of Industrial Heat

Prepared by the Department of Enterprise, Trade and Employment

The Purpose of this Roadmap

Over the next decade the green transition will substantially alter the business environment. Businesses should prepare now for the changes underway. A strategic approach to the transition will allow your manufacturing business to take advantage of its opportunities to grow and to thrive.

This Roadmap advises manufacturers about what to expect from Government in the coming years and what the operating environment for decarbonised manufacturing will look like up to the end of the decade, including:

— supports available to help your business,

— policies that will facilitate decarbonisation,

— regulations that will incentivise decarbonisation.

Informed by the Sustainable Energy Authority of Ireland's (SEAI) National Heat Study, the Roadmap demonstrates a credible path for industry and policy makers to achieve the decarbonisation targets set for heat use in manufacturing.

Emissions from industry in Ireland account for roughly 10% of national Greenhouse Gas (GHG) emissions. As a step towards Ireland's binding commitment to being net zero by 2050, the Minister for Enterprise, Trade and Employment has responsibility to reduce industrial emissions by 20% by 2025 and 35% by 2030, relative to 2018 levels.

Who is this Roadmap for?

This Roadmap is for manufacturers and industrial facility operators with on-site fossil fuel use.

In particular, it is for businesses in the major manufacturing sectors in Ireland, including the food & beverage, pharmaceuticals and life-sciences, chemicals and materials, product and equipment manufacturing sectors.

This Roadmap will also guide policy makers and state agencies. It offers a shared understanding between Government, agencies and industry, setting out the pathway to reduce and ultimately remove GHG emissions from our manufacturing sectors.

This Roadmap will be a 'living' document, and updated to reflect the progress made by businesses.

This Roadmap is an action under Climate Action Plan 2023; Action EN/23/3(TF)

Action Plan for Manufacturers

Decarbonisation is now a competitive priority for all manufacturers. Manufacturers will need to take steps to decarbonise your business. A crucial first step will be to engage with your enterprise agency, whether that's Enterprise Ireland, IDA Ireland, the Sustainable Energy Authority of Ireland, Údarás na Gaeltachta, or a Local Enterprise Office.

These agencies are already working with manufacturing companies to support the green transition. With advice and support, your business can address energy efficiency on site to right-size energy demand; so that energy use matches the energy required to operate. Auditing, monitoring and tracking energy use are important first steps to understanding your energy use and emissions.

After energy efficiency steps have been implemented, seek emissions reductions through switching away from fossil fuels. Manufacturers should consider electrifying all heat requirements below 150°C.

Where it is not possible to electrify heat in manufacturing processes, other ways of decarbonising should be pursued, for instance through biomass or biomethane. As each site and manufacturing process is different, with different energy and heat requirements, the agencies can advise and support the acquisition and installation of low carbon heat technologies for your business.

Your business should communicate its sustainability journey to your customers, suppliers and stakeholders. Annual reports, company strategies and mandatory reporting should demonstrate the steps you have taken to decarbonise and your trajectory to reaching net-zero as an organisation. This will demonstrate to stakeholders a commitment to the green transition, and will help to embed competitiveness and resilience in a changing market place that is increasingly demanding sustainability from customers, suppliers and investors.

Engage with and get support from your Enterprise Agency

Assess

Undertake an energy audit.

Monitor

Install digitalisation/energy monitoring systems.

Plan

Plan a programme of decarbonisation projects starting with efficiency to 'right size' your use, and then switch away from fossil fuels.

Invest

Implement Energy Efficiency measures or Energy Efficient Design.

Implement fuel switching projects.

Communicate

Report trajectory to net zero through company strategy, annual report and reporting requirements.

Communicate your achievements to customers & stakeholders.

Decarbonising our Manufacturing Sector

The most appropriate technology to decarbonise manufacturing processes depends, in part, on the type of heat required. The SEAI's National Heat Study classifies heat use into high grade heat (above 500°C), medium grade heat (150–500°C), medium-low grade heat (100-150°C) and low temperature heat (under 100°C).

Energy monitoring and management systems, are a low-risk, low-cost starting point for reducing emissions, reducing future investment costs and improving energy performance.

Industrial heat decarbonisation will rely first on electrification of heat through heat pumps and electric boilers. This will primarily take place where heat use is medium-low or low grade heat. Depending on the specifics of the site, manufacturing processes using heat grades above 150°C will remove fossil fuels by using a range of technologies including biomass, biomethane and improved energy efficiency.

New greenfield investment and expansions will be required to align with decarbonisation objectives. State agencies will support businesses to ensure that new growth is low carbon and future-ready.
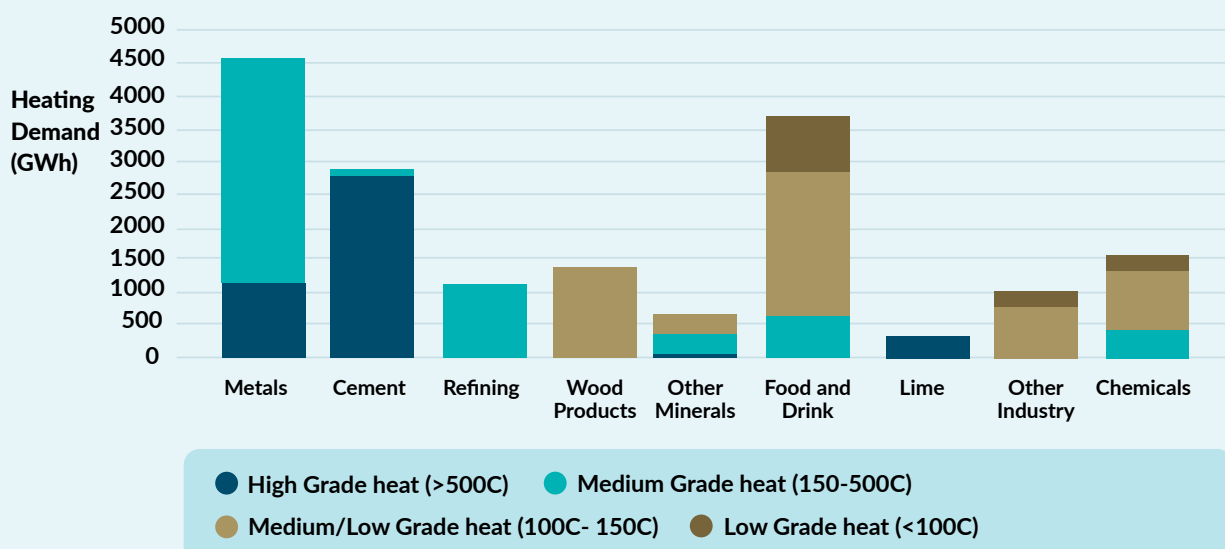
Ireland's national approach to decarbonising industry will focus on the large emitters and highest impact actions first. Large industrial sites that are part of the EU Emissions Trading Scheme, including in the alumina, cement and food and drink sectors for example, account for approximately 80% of total industrial emissions in Ireland, and are where the largest carbon savings can be made. However, with carbon taxes set to increase in the coming years and growing societal and commercial expectations to ensure the sustainability of products, services and supply chains, all businesses will need to remove fossil fuels from their manufacturing processes.

The business case for low carbon, more efficient manufacturing processes is increasingly clear. Reaching our national abatement targets will require businesses to make investments in new processes, shifting away from those that rely on fossil fuels and other unsustainable practices. These investments are necessary and unavoidable, there are competitive opportunities for those that move early and decisively.

This industrial transformation will require several billion euro of private investment by our manufacturing sectors. State agencies will support these investments with hundreds of millions of euro in support of decarbonisation projects during this decade.

Heat demand in industry by sector and temperature grade

Source: SEAI National Heat Study

Bar chart. Y-axis: Heating Demand (GWh), from 0 to 5000. Categories: Metals, Cement, Refining, Wood Products, Other Minerals, Food and Drink, Lime, Other Industry, Chemicals.

Legend:
- High Grade heat (>500C)
- Medium Grade heat (150-500C)
- Medium/Low Grade heat (100C- 150C)
- Low Grade heat (<100C)

Industry Emissions in Ireland: Roadmap Scope
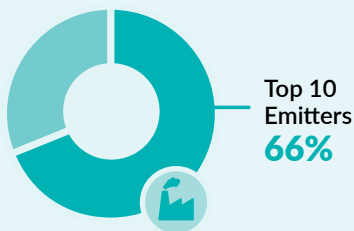
Industry emissions arise from two types of activity:

i) combustion of fuel to create heat required during manufacturing, this also includes combined heat and power plants which produce both heat and electricity; and

ii) industrial process emissions, which are those generated chemically during the manufacturing process, such as the release of CO2 from limestone during cement clinker production.

Industrial process emissions primarily arise from the cement sector. These emissions are outside the scope of this Roadmap and are being examined separately through the Cement and Construction Sector Decarbonisation Working Group. This Roadmap primarily addresses manufacturing combustion emissions.
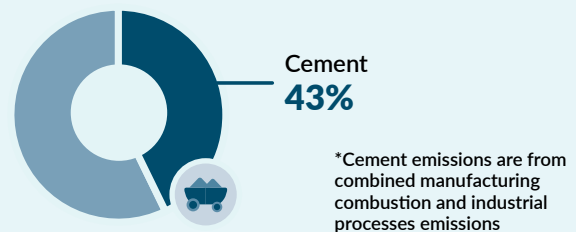
The Climate Action Plan outlines a strategy to reduce the use of cement in buildings and infrastructure; to use modern methods of construction, to promote alternative low carbon and reformulated cements and to begin investigations of technologies to directly prevent process emissions from primary cement production, including the exploration of the feasibility of Carbon Capture, Utilisation and Storage (CCUS).

In the medium-term, decarbonisation in cement production will arise through cement reformulation and fuel switching in its manufacture; shifting over 90% of fuel inputs away from fossil fuels to lower carbon fuel sources is required.

Top 10 emitters as a proportion of total industry emissions 2022

Top 10 Emitters
66%

Cement as a proportion of total industry emissions 2022

Cement
43%

*Cement emissions are from combined manufacturing combustion and industrial processes emissions

Industry emissions by sector breakdown 2018-2022

Millions of Tonnes CO$_2$ eq.

Year	Industrial Processes	Manufacturing Combustion
2018	33%	67%
2019	33%	67%
2020	31%	69%
2021	35%	65%
2022	35%	65%

● Industrial Processes Emissions ● Manufacturing Combustion Emissions ● Total Industry Emissions

Decarbonisation of Industry: Trajectory to 2030

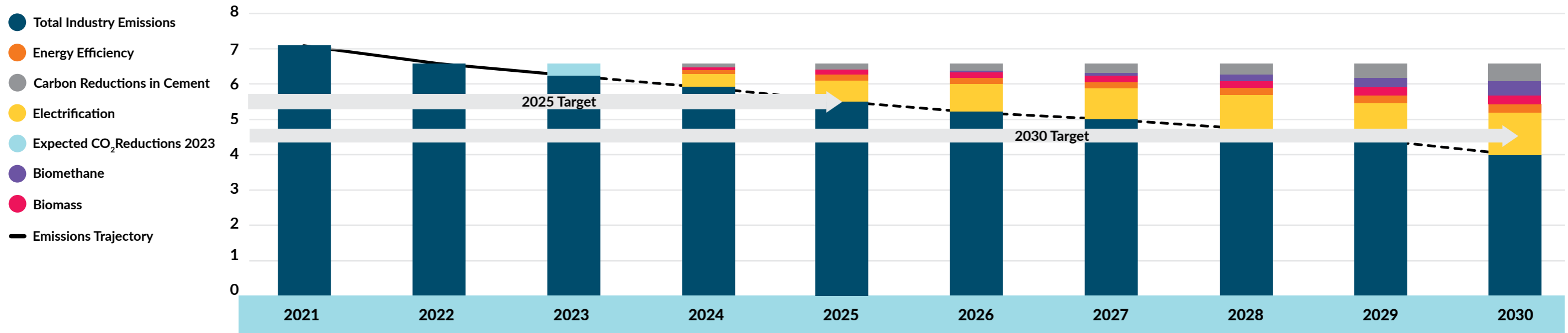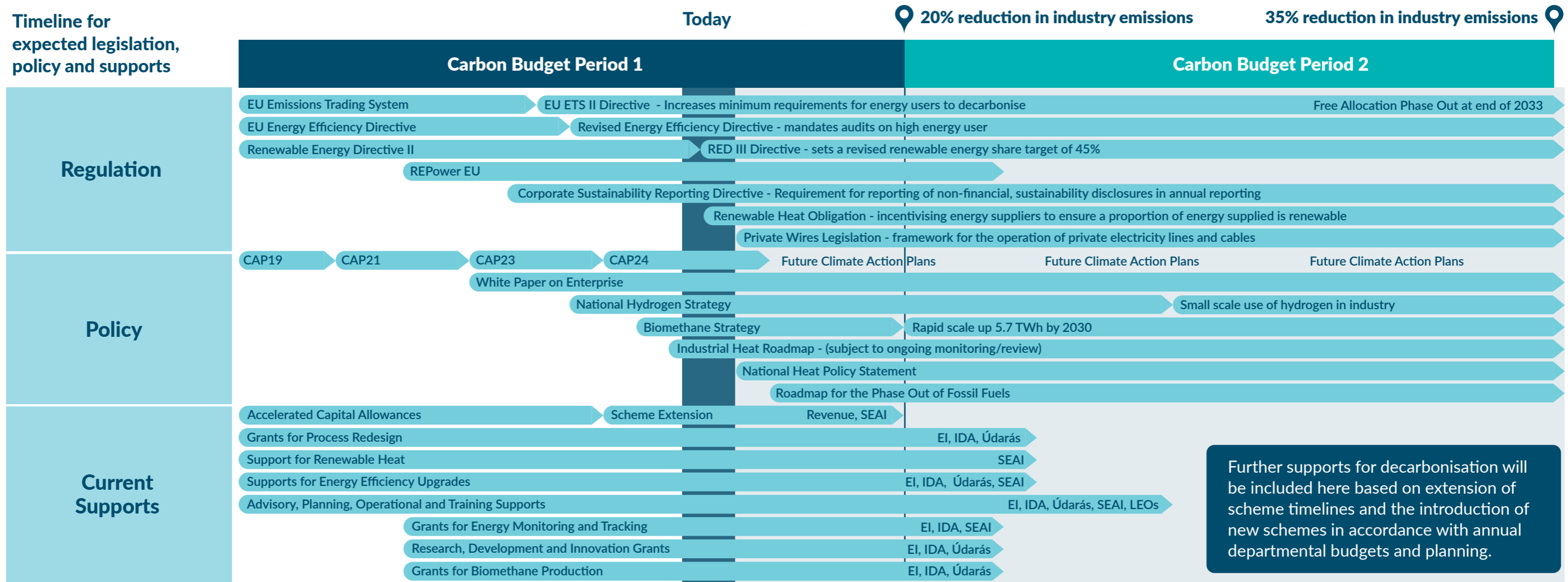Projected trajectory of industry emissions to 2030 showing the greenhouse gas abatement (measured in millions of tonnes of CO2eq) by decarbonising technology.

Legend:
- Total Industry Emissions
- Energy Efficiency
- Carbon Reductions in Cement
- Electrification
- Expected CO_2 Reductions 2023
- Biomethane
- Biomass
- Emissions Trajectory

Chart Y-axis: 0, 1, 2, 3, 4, 5, 6, 7, 8

Chart X-axis (years): 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030

2025 Target

2030 Target

Today | 20% reduction in industry emissions | 35% reduction in industry emissions

Timeline for expected legislation, policy and supports

Carbon Budget Period 1 | **Carbon Budget Period 2**

Regulation

- EU Emissions Trading System → EU ETS II Directive - Increases minimum requirements for energy users to decarbonise → Free Allocation Phase Out at end of 2033
- EU Energy Efficiency Directive → Revised Energy Efficiency Directive - mandates audits on high energy user
- Renewable Energy Directive II → RED III Directive - sets a revised renewable energy share target of 45%
- REPower EU
- Corporate Sustainability Reporting Directive - Requirement for reporting of non-financial, sustainability disclosures in annual reporting
- Renewable Heat Obligation - incentivising energy suppliers to ensure a proportion of energy supplied is renewable
- Private Wires Legislation - framework for the operation of private electricity lines and cables

Policy

- CAP19 → CAP21 → CAP23 → CAP24 → Future Climate Action Plans | Future Climate Action Plans | Future Climate Action Plans
- White Paper on Enterprise
- National Hydrogen Strategy → Small scale use of hydrogen in industry
- Biomethane Strategy → Rapid scale up 5.7 TWh by 2030
- Industrial Heat Roadmap - (subject to ongoing monitoring/review)
- National Heat Policy Statement
- Roadmap for the Phase Out of Fossil Fuels

Current Supports

- Accelerated Capital Allowances → Scheme Extension → Revenue, SEAI
- Grants for Process Redesign — EI, IDA, Údarás
- Support for Renewable Heat — SEAI
- Supports for Energy Efficiency Upgrades — EI, IDA, Údarás, SEAI
- Advisory, Planning, Operational and Training Supports — EI, IDA, Údarás, SEAI, LEOs
- Grants for Energy Monitoring and Tracking — EI, IDA, SEAI
- Research, Development and Innovation Grants — EI, IDA, Údarás
- Grants for Biomethane Production — EI, IDA, Údarás

Further supports for decarbonisation will be included here based on extension of scheme timelines and the introduction of new schemes in accordance with annual departmental budgets and planning.

Energy Efficiency

Key performance indicator

Reduce fossil fuel demand through energy efficiency in manufacturing processes by 10% by 2030.

Description

There are opportunities to improve energy efficiency both to drive absolute emission reductions, and to reduce energy consumption while continuing economic growth. The benefits of energy efficiency are well established; lower running costs and increased profit margins, more resilience to energy price and carbon tax increases, lower emissions and the reputational advantages that come with improved sustainability. Measures that will address these inefficiencies include process integration, heat recovery, steam efficiency, energy management systems, and a range of other measures and technologies.

State supports

— Accelerated Capital Allowance for energy efficient equipment
— SEAI Support Scheme for Energy Audits (for non-obligated entities)
— Green Transition Fund
— Environmental Aid
— SEAI Large Industry Energy Network

Regulation

A practical approach to energy efficiency includes the use of regulation to promote energy efficiency gains and exclude the worst performing practices and equipment. The revised ETS Directive will require energy users to implement measures with a payback period of less than 3 years or face a 20% reduction in their free allocations.

Energy Efficiency Obligation Scheme (EEOS) mandating obligated parties (those energy companies that are obligated) to deliver energy savings and reach targets assigned to them in the period to 2030. The EU Emissions Trading Scheme and the Carbon Tax will incentivise decarbonisation by assigning a price to a business's emissions.

EU Energy Efficiency Directive requires that:

– enterprises with an average annual consumption higher than 85 TJ of energy over the previous three years will be required to implement a certified energy management system by 11th October 2026;
– enterprises with an average annual consumption higher than 10 TJ of energy over the previous three years, which do not implement an energy management system are subject to a mandatory energy audit every four years.

Enabling measures

— Government will consider regulatory requirements for new industrial investments and/or significant upgrades to be designed in accordance with a high efficiency standard such as I.S. 399 for Energy Efficient Design.
— Government will explore further tax measures that can be implemented to support installation of energy efficient equipment.
— Government will consider mandating the largest energy users to publicly report the carbon intensity of their energy use, under the implementation of the National Energy Demand Strategy.

Electrification ⚡

Key performance indicator

70-75% share of carbon neutral heating in total fuel demand by 2030.

Description

Heat pumps are a proven technology that are available for purchase and installation today, with the potential to decarbonise industrial processes that use heat up to 150°C, and perhaps higher. Industrial heat demand includes 7TWh annually of heat under 150°C. Delivering the CAP23 target to 2030 of 55% electrification of low and low-medium grade heat would require 1TWh of electricity and provide 3.5TWh of industrial heat. This could lead to the abatement of 750,000 tonnes of CO2eq. The electrification of heat takes place in the context of a progressively more decarbonised electricity system. While the cost of a unit of gas is currently cheaper than the cost of a unit of electricity, this is in part offset by the far greater efficiency of heat pumps. A further 400,000 tonnes of CO2 eq. could be abated through the direct electrification of steam and high temperature heat at large industrial sites.

State supports

— Support Scheme for Renewable Heat from SEAI
— Green Transition Fund
— Environmental Aid
— SEAI Excellence in Energy Efficiency Design (EXEED)
— Accelerated Capital Allowance for energy efficient equipment

Regulation

Regulation will work in tandem with enterprise supports to incentivise and facilitate smart metering and energy management, on-site generation, and electric and thermal storage opportunities for manufacturing premises. The electrification of heat in Ireland, including industrial heat will place significant demand on the energy system. It will be enabled by transformative rollout of renewable generation (particularly wind) by 2030, and reinforcement of the electricity grid.

ESB Networks will look to develop specific flexibility contracts with large energy users, to incentivise electrification and storage of heat needs while supporting demand flexibility in the electricity system. The EU Emissions Trading Scheme and the Carbon Tax will incentivise decarbonisation by assigning a price to a business's emissions.

Enabling measures

— Where technically feasible, Government will consider making electrification of industrial low to medium-low grade heat mandatory at greenfield and redevelopment of existing facilities.
— Enterprise Ireland, IDA Ireland and SEAI will continue an engagement strategy with clients, focussing on high impact projects, to encourage, facilitate and support investments in decarbonised heat.
— Private wire regulations to provide a potential off-grid solution for the generation and supply of electricity will be progressed.
— Investment in and upgrading of the electricity grid will be delivered to enable the widespread electrification of heat.
— Government will consider the expansion of the list of eligible equipment under the Accelerated Capital Allowance for energy efficient equipment.

Biomass

Key performance indicator

70-75% share of carbon neutral heating in total fuel demand by 2030.

Description

Biomass is a suitable renewable technology for decarbonising industrial heat, particularly at temperatures above 150°C (medium grade heat). CAP23 identified 20% of medium grade industrial heat (1.2TWh) as having the potential to be decarbonised through biomass. This would provide an abatement of 250,000 tonnes of CO2eq. However, the potential identified depends on a sufficient supply of certified biomass and the suitability of sites to enable industry to switch fuels. At present biomass plays a small role in industrial heat use, primarily in the agri-food and wood products sectors.

There is scope to expand biomass use and expand circularity in the agri-food and wood products sectors, but all sectors can consider biomass as a potential means of transitioning to decarbonised heat.

State supports

— Support Scheme for Renewable Heat from SEAI
— SEAI EXEED
— Green Transition Fund
— Environmental Aid

Regulation

Renewable Heat Obligation to drive availability of renewable fuels through energy suppliers. Renewable energy sourced from biomass needs to fulfill certain criteria to be classed as sustainable. These criteria are determined by the Renewable Energy Directive. The latest revision to the Renewable Energy Directive strengthened the requirements for sustainable biomass.

The EU Emissions Trading Scheme and the Carbon Tax will incentivise decarbonisation by assigning a price to a business's emissions.

Enabling measures

— Highlight successful and impactful decarbonisation projects using biomass, particularly in sectors where renewable feedstock supply chain integration may provide multiple benefits.
— Government will consider how timelines for certification of biomass as sustainable can be reduced, with policy to support supply chains maturing in key sectors.
— Government will assess regulatory barriers to the use of biomass in industrial heat, including in the licensing and planning processes for heat users:
— Examine timescales for the EPA to review/grant new IED licenses.
— Examine planning barriers for on-site fuel storage and biomass heat systems.

Biomethane

Key performance indicator

At least 2.1 TWh consumption of zero emission gas used for industrial heating by 2030.

Description

Biomethane is already firmly established and available on the European market and has the potential to replace some of the natural gas used to supply high temperature heat in industry. Due to the higher cost of biomethane, this pathway is anticipated to only be cost-effective in the decarbonisation of high temperature heat primarily, or where other solutions such as electrification are unavailable.

The National Biomethane Strategy sets out the policy framework that will guide the sector to achieving the target of 5.7TWh of indigenously produced biomethane. Of this, at least 2.1 TWh of consumption of zero emission gas is targeted for industrial heating by 2030. If achieved, this is projected to abate 400,000 tonnes of CO_2eq annually from industry.

State supports

— REPowerEU – capital supports, as set out in the National Biomethane Strategy, for the development of anaerobic digestion plants is expected to reduce the price of biomethane.
— Green Transition Fund
— Environment Aid

Regulation

The Renewable Heat Obligation – will compel energy providers to buy a certain percentage of their heat supply from renewable products. The RHO recognises biomethane as one of the key fuels the heat industry will seek to use to meet its obligations.

The EU Emissions Trading Scheme and the Carbon Tax will incentivise decarbonisation by assigning a price to a business's emissions.

Enabling measures

Barriers to the development of a biomethane industry in Ireland will be addressed through the implementation of the National Biomethane Strategy.

🏗️ State Support for Industrial Decarbonisation

A range of supports for your business to invest in decarbonising your operations and facilities are available from State enterprise agencies; EI, IDA, SEAI and the LEOs.

All businesses should engage with your relevant agency and discuss the wide range of actions you can take to decarbonise your operations and become more sustainable. The agencies are available to guide your business through the steps that you can take. The Climate Toolkit 4 Business is a useful starting point for businesses who have yet to get started on their green transition.

Manufacturers should seek to engage with these agencies, who can offer a range of supports tailored to the needs of individual manufacturing sites. These supports range from grants for the installation of technologies that directly contribute to decarbonising heat, to funding for research, development and innovation to facilitate the planning and development of new products, services or processes in the areas of sustainability and decarbonisation. Supports are also available for external expertise and consultancy services. These include initial sustainability planning, environmental management capabilities, energy audits, energy efficient design and the development of detailed plans for carbon reduction.

💡 Skills & Supply Chain

A variety of skills will be required and new supply chains will develop as industry and Government invest to reach these shared decarbonisation objectives.

The skills that industry will rely on to decarbonise its processes will overlap somewhat with those needed to decarbonise other sectors. The Heat and Built Environment Taskforce works closely with the Department of Further and Higher Education, Research and Science (DFHERIS), and stakeholders across further and higher education to ensure an appropriate pipeline of training and MicroCreds is available to supply this demand. The Taskforce will consider skills and supply chain issues as they arise including any potential barriers to delivery or supply chain risks that can be best mitigated by the State.

In addition, SOLAS is developing Ireland's first National Strategy on FET Skills for the Green Economy, which will identify how the Further Education and Training sector can directly meet the skills needs of new and emerging green occupations. DFHERIS and its agencies also provide specialist supports and training options for businesses to help them in their decarbonisation journeys. The Skillnet Climate Ready Academy provides leadership and skills support to develop operational and strategic sustainability for Irish businesses.

⚙️ Emerging Technologies

The technologies discussed in this Roadmap are those that are currently expected to help industry in Ireland reach its targets for carbon abatement, however other technologies are rapidly developing that will help to further decarbonise manufacturing in the future.

For instance, thermal storage, long duration energy storage and on-site renewal energy generation are already demonstrating their potential for abating manufacturing emissions when coupled with renewable electricity on the grid. The National Hydrogen Strategy expects niche applications of green hydrogen gas for use in industrial heating towards the end of this decade and further applications for high temperature heat in industry by the mid-2030s.

Research, development and innovation (RDI) will play a key role in advancing technologies that will facilitate the transition to net-zero manufacturing. Several of the supports available through the Enterprise Agencies are available to industry for RDI. RDI will also help to improve the efficiency of and reduce the costs of the technologies available today. In the future, technical advancements mean that heat pumps may be able to operate efficiently at temperatures above 200°C for example. The Government and its agencies remains open-minded as to the potential for other or new technological innovations that significantly reduce carbon emissions, and will support businesses to invest in the processes or technologies that can demonstrate these opportunities.

🏭 The Net Zero Business Environment

The economy of the future will be a net zero one. Over the next decade the renewable energy revolution and the transition to a carbon neutral economy will substantially alter the business environment.

Those businesses who fail to decarbonise their processes risk losing customers and competitiveness. The policies of Government and the EU will continue to promote a business environment fit for a net-zero economy. Elements of this business environment will include:

Corporate finance and corporate reporting will increasingly be shaped by the sustainability credentials of your business, and will play a role in determining access to finance. The Corporate Sustainability Reporting Directive (CSRD) sets mandatory reporting requirements for companies to disclose climate and environmental data, while the Corporate Sustainability Due Diligence Directive (CSDD) will oblige companies to monitor their activities to identify and mitigate adverse environmental impacts arising from their operations, their subsidiaries and their chain of activities.

The Renewable Energy Directive sets targets for the share of energy used, including heat use, that must be from renewable sources. Compliance with the Directive will require Ireland to significantly accelerate the adoption of renewable heat sources.

The planned Renewable Heat Obligation will create a statutory demand for renewable heating fuels, such as biomethane. Energy suppliers will be required to buy a certain percentage of their heat supply from renewable products.

The Heat Policy Statement and Roadmap for the Phaseout of Fossil Fuels, to be published this year, will determine how we use fossils fuel in industry in the future. They will set out the plan for how a coordinated phaseout of fossil fuel use would be implemented.

Additional new demand for heat use in industry will need to be developed in a more efficient and decarbonised manner. Future investment in the economy and the investment in new sites will be aligned with our decarbonisation objectives, with energy efficiency principles embedded into site planning and development. Enterprise agencies will ensure that new growth is low carbon, in line with the policy set out in the White Paper on Enterprise.

Enabling Measures

— Private wire legislation will facilitate private installing, operating, and owning of private electricity infrastructure, which would provide a potential off-grid solution for the generation and supply of electricity for decarbonisation of low temperature heat.

— The CRU is working with Eirgirid, ESB Networks, and Gas Networks Ireland to deliver an Energy Demand Strategy to drive decarbonisation of our electricity network, ensure increased grid capacity is delivered, and ensure new industrial development is net zero ready.

— Battery storage solutions on the grid and site specific electric and thermal solutions will support grid development, flexibility, industry resilience and reduced renewable energy curtailment.

— Policy design will continue to consider how to appropriately incentivise decarbonised heat and disincentivise fossil fuel use, acknowledging the role that price signals and market certainty play in driving private investment in manufacturing processes, and the energy that powers them.

— The enterprise agencies will focus on decarbonisation opportunities among the largest emitters first, with a cascading approach to medium and smaller emitters thereafter in order to achieve economies of scale and maximising the impact of grant support.

— Assess the impact of planning and consenting on decarbonising industrial heat, in particular EPA legislation should be amended to provide powers to the EPA to facilitate fuel switching through a technical amendment to a site's licence, rather than a requirement applying for a new licence.

— Relevant State agencies will continue to meet through focussed, sectoral Working Groups to discuss ongoing progress decarbonising the industry in Ireland. Summaries of this work will be reported into the Heat and Built Environment Taskforce.