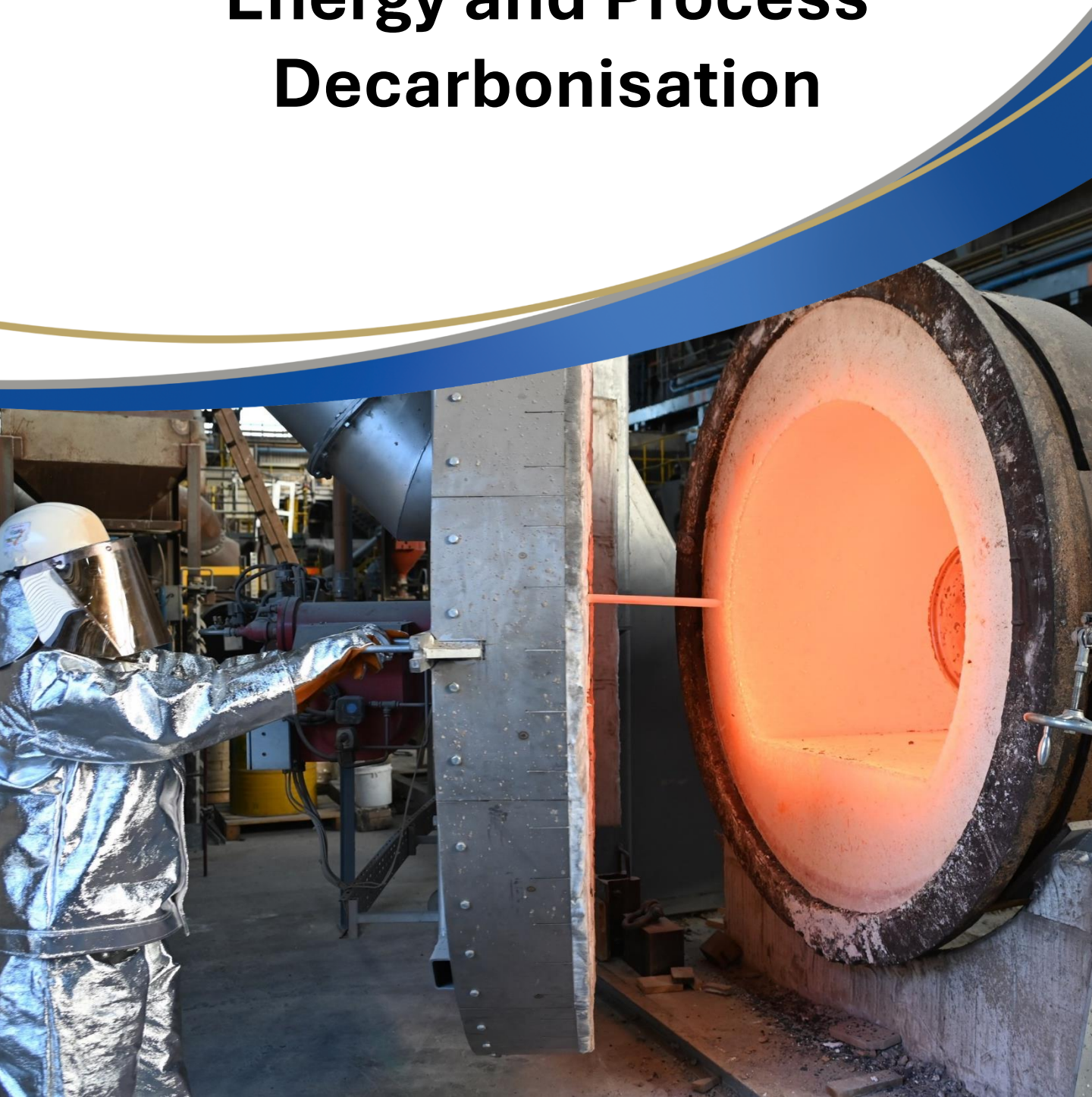
Materials Processing Institute

Services Portfolio

Energy and Process Decarbonisation



Energy and Process Decarbonisation Services Portfolio

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Feasibility Studies

Discrete event simulation modelling	To optimise process operations to reduce energy and fuel costs and increase decarbonisation.
Carbon capture integration study	Pilot test capturing CO_2 from processes (furnace off-gas, EAF, etc.) and repurposing it in a chemical process (e.g., carbonating residues) to reduce emissions.
Process simulation for optimisation	Use computational models (Computational Fluid Dynamics, thermodynamic simulations) to optimise furnaces/processes design or process parameters for lower energy use and emissions before physical trials.
Waste heat recovery assessment	Examine where waste heat can be captured from processes (like off-gases or cooling water) and how it can be reused to improve overall efficiency.
High-temperature heat pump integration study	Investigate using electric heat pumps for moderate-temperature process heating to reduce direct fossil fuel use.

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Feasibility Studies

Energy storage integration study	Examine how integrating thermal energy storage (like molten salts or phase change materials) into industrial heating processes can smooth demand and allow renewable energy use.
Plant-wide material flow optimisation	Analyze the flow of materials and products in a plant to reduce unnecessary reheating or transport (saving energy and emissions).
Greenhouse gas monitoring and reporting service	Implement systems to continuously monitor CO_2 and other greenhouse emissions at key points in a process and generate reports for compliance and improvement.
Feasibility study for process electrification	Assess which parts of a client's process can be switched from fossil fuels to electrical heating (or other clean energy), including technical and economic feasibility.
Hybrid heating systems (gas + electric)	Investigate combining electric heating (induction/microwave) with traditional gas heating for flexibility and reduced peak CO_2 output.

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Feasibility Studies

Decarbonising heat treatment operations	Find ways to perform heat treatments (annealing, tempering) using either renewable-powered electric furnaces or optimized cycles to cut energy use.
Improving yield to reduce carbon per tonne	Implement process changes that increase metal yield (less waste and rework), thereby decreasing the energy and CO_2 per ton of final product.
Thermodynamic analysis for alternative processes	Use thermodynamic modelling to design new low-carbon metallurgical processes (like direct metal reduction with alternative reagents) before experimental trials.
Off-gas analysis for emissions reduction	Continuous monitoring of furnace off-gases (CO, CO_2, NO_x) to adjust combustion or process parameters on the fly, minimizing emissions.

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Energy and Emission Optimisation

Battery-electric equipment study	Assess replacing diesel or gas-fired mobile equipment (or support systems) in a plant with battery-electric or hybrid versions to reduce onsite emissions.
Process safety analysis & safe operating envelope modelling	Ensure safe, reliable, and compliant operation of industrial processes under varying conditions.
Decarbonisation roadmap and strategy development and consulting	Identify cost-effective pathways to reduce carbon footprint, improve energy efficiency, and comply with regulations.
Track process operations for unsafe operations/conditions	Real-time analysis of process parameters with predictive detection of abnormal conditions before they occur.

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Energy and Emission Optimisation

Life Cycle Assessment (LCA) and Environmental Product Declaration (EPD)	Quantify environmental impact (carbon footprint, energy use) of introducing new technology or process changes in production. Independently verified document that transparently reports the environmental impact of a product or material.
Energy efficiency audit and optimisation	Analyse industrial processes to identify energy losses and propose modifications to improve efficiency and reduce CO_2 per unit product.

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Process Optimisation

Alternative fuel burner testing

Evaluate new burner designs using alternative fuels (biogas, ammonia, syngas, etc.) for furnace heating to ensure stable operation and lower CO_2/NO_x emissions.

Oxygen usage optimisation in EAF

Determine the optimal oxygen blowing practices in an EAF to minimise electrical energy consumption and reduce electrode usage (thus lowering CO_2 footprint).

Hydrogen embrittlement testing

Expose materials (steels, welds) to hydrogen-rich environments at temperature to see if mechanical properties are affected, guiding use in hydrogen economy.

Materials testing for low-carbon infrastructure

Evaluate materials performance under industrially relevant atmospheres, testing metals and ceramics (including concrete) produced via low-carbon pathways — such as reduced-clinker cement formulations and novel steelmaking routes, to verify compliance with industry standards.

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Process Optimisation

Burner retrofitting for low-carbon fuels	Demonstrate modifications to existing burners to allow use of biofuels or hydrogen-rich gas, ensuring flame stability and efficiency.
Hydrogen production integration	Evaluate on-site hydrogen generation (electrolysis) and storage needs for fuelling pilot processes, to help clients plan hydrogen supply for future full-scale use.
Ammonia as fuel testing	Test combustion of ammonia (a hydrogen carrier) in a furnace or boiler setting to gauge its viability and by-product emissions for industrial heating.
Plastic waste to fuel or reductant	Investigate conversion of waste plastics into useful products: either pyrolysing to oils or using plastic as a reductant in metal furnaces.
Biomass waste to biochar for metallurgical use	Convert agricultural or forestry waste into biochar and test its use as a reducing agent or carbon additive in metallurgical processes.

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Leveraging facilities

Plasma-Assisted Microwave Technology	Enhanced material processing and activation, Conversion of industrial wastes to value-added products (e.g., carbon-rich materials, syngas), Advanced thermal and non-thermal plasma treatment for surface modification, Research and scale-up of novel low-carbon industrial processes, Faster reaction rates and improved product yields.
Electric rotary kiln for low-carbon processing	Use an electrically heated rotary kiln (with microwave enhancement) to process materials, demonstrating reduced energy use and emissions.
Microwave-assisted heating processes	Explore the use of microwave energy in high-temperature processes (e.g., ore reduction or material drying) to reduce energy consumption and processing time.
Hydrogen fuel combustion in furnace	Investigate how using hydrogen as a fuel in a reheating furnace impacts heating efficiency and material quality vs conventional fuels .
Food waste to chemical feedstock	Explore processes (e.g. pyrolysis) that turn food or biomass waste into useful chemicals or fuels (like ethanol or biogas), advancing circular use of organics.
Rubber tyre pyrolysis and reuse	Pyrolyse end-of-life tyres to recover oil, gas, and carbon black, and test the quality of recovered materials for reuse (fuel or filler).

Full Services Portfolio

Advanced Metals & Green Steelmaking
- Green Steel - Product Development - Process Improvement - Extra
Advanced Materials Development
- Custom Alloy Development - New Steel - Supporting R&D - Additive Manufacturing & Powder Metallurgy - Additional Services
Characterisation and Analysis
- Characterisation and Analysis
Critical Raw Materials
- By-product Valorisation - End of Life Process Development - Mine Tailing Valorisation - Piloting /Testbed Hosting - Process Scale-up - Process Optimisation
Sustainable Cement and Concrete
- Product Development - Process Improvement
Powder Analysis and Additive Manufacturing
- Powder Analysis - Additive Manufacturing - Powder Processing
Energy and Process Decarbonisation
- Feasibility Studies - Energy and Emission Optimisation - Process Optimisation - Leveraging Facilities
Facilities and Equipment

Full Services Portfolio

Training

Processes

- Ironmaking
- Desulphurisation or Iron
- Steel Plant Raw Material
- Primary Steelmaking
- Secondary Steelmaking
- Ladles
- Practical Steelmaking
- Stainless Steelmaking
- Electric Arc Furnace (EAF) Steelmaking
- Continuous Casting
- General

Supplementary

- Engineering
- Metallurgy
- Environmental Protection
- Management
- Research

Applications

- Circular Economy
- Digital Technology
- Analytical Techniques

Products

- Finished Goods

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