



Project Call for 2022 ERBE Cohort

MaREI Supervisor	Dr. Dominic O’ Sullivan, ERBE (MaREI) Vice Director, Director of IERG, School of Engineering
Institution	University College Cork
Co-Supervisor & Institution (if known – please note this is not a requirement at application stage):	TBC
PhD Proposal Title:	Carbon Neutral Planning for Industrial Manufacturing Sites
Alignment with ERBE Themes: (200 words max – please specify if the project aligns with 1 or more of the ERBE Themes)	<p>This project aligns with the ERBE themes (1) Flexibility and resilience and (2) Technology and system performance. In terms of flexibility and resilience, it is critical that industrial manufacturing sites better appreciate their role in the wider energy system and management of same. The challenges for sites to reduce their carbon emissions are wide and varied and must consider energy efficiency, electrification of heat, demand side management, intelligent efficiency, to name a few. Development of sensible, step wise carbon neutral plans are fundamental to meaningful change. Furthermore, with respect to technology and system performance sophisticated modelling will enable optimum solutions and technological innovations to be part of the onsite energy management philosophy leading to reduced carbon footprints for the products of those manufacturing sites.</p>

Project Call for 2022 ERBE Cohort

PhD Proposal Abstract: (500 words max)

In the International Energy Agency (IEA) energy efficiency indicators report 2020 [1] manufacturing was one of the largest end users of energy, accounting for 24% of the IEA member countries end use of energy in 2018. Global GHG emissions need to decrease by 7.6% annually from 2020 to 2030 to limit global warming to the desired target of 1.5 °C listed in the Paris Agreement [2]. Energy efficiency remains one of the most effective short to medium term mechanisms to reduce industry carbon footprint.

Numerous industries have goals of reducing their greenhouse gas emissions towards carbon neutrality. This is typically driven by a combination of corporate social responsibility and business strategy (marketing based on consumer awareness of environmental issues; profit; and future-proofing by mitigating risk regarding future emission regulations), where the contribution of each driver varies between organisations [3]. The main carbon neutral certification method used in the EU for greenhouse emission reduction in industry is PAS 2060: Specification for the demonstration of carbon neutrality. This is the primary globally recognised certification standard for carbon neutrality [4]. It requires reporting of all Scope 1 and 2 activities and all Scope 3 activities that contribute more than 1% of the total emissions. A typical roadmap to carbon neutrality following this guidance comprises the following steps:

- calculating current emissions,
- improving process efficiency,
- integrating processes,
- power purchase agreements,
- investing in renewable technologies, and
- offsetting unavoidable carbon emissions.

In reality however, there is a lack of effective and standardised planning in the initial stages of the carbon neutral planning process, while in the later stages, the use of power purchase agreements and carbon offsetting are not always effective strategies as many don't result in additional renewables on the grid.

The multifaceted nature of manufacturing systems makes the twin goals of carbon neutrality and digital transformation in the industrial sector a complex and challenging task. A holistic and cross-disciplinary approach is required to unlock previously unanalysed data that has the potential to influence the energy



Project Call for 2022 ERBE Cohort

performance of an industrial site. This strategy needs to cut across multiple disciplines in order to deliver successful and sustainable change. It must be a data driven, digitally integrated solution which underpins structured methods within a standardised framework for the delivery of carbon neutral industry.



Project Call for 2022 ERBE Cohort

PhD Proposal Summary for inclusion in Student Call Document:

(300 words max – please note the student will be indicating their order of preference for all submitted proposals; please ensure this summary includes a project overview & introduction to the supervisor & institution)

Corporate social responsibility and business strategy are drivers for industrial enterprises to reduce their greenhouse gas emissions to approach carbon neutrality [5]. This often entails the following steps:

- calculating carbon emissions,
- improving process efficiency,
- integrating processes,
- power purchase agreements,
- investing in renewable technologies,
- offsetting unavoidable carbon emissions.

Focussing on the early action steps of improving process efficiency and integrating processes reduces the financial investment of the later steps and the final emissions to be offset.

This project will develop new modelling tools to assist manufacturing companies in making the right decisions as to how to reduce their carbon emissions most economically. These should be data driven, digital twin type calibrated models which allow scenarios to be tested offline and thus not under the constraints of quality departments. These could be used to test out technology replacement choices prior to making decisions on investment

This project will be supervised by Dr. Dominic O’ Sullivan and Dr. Ken Bruton of the Intelligent Efficiency Research Group in UCC. UK co-supervisors will be appointed on success. The project will lean on existing industrial site’s and established contacts for trials and demonstrations. It will benefit from the expertise within the IERG group around data analytics, machine learning and energy efficiency.

References



Project Call for 2022 ERBE Cohort

1. IEA, "Energy efficiency indicators," Energy Effic. Indic., 2020.
2. U. E. Programme, Emissions Gap Report 2019. 2019.
3. C. Okereke, "An Exploration of Motivations, Drivers and Barriers to Carbon Management: The UK FTSE 100," Eur. Manag. J., vol. 25, no. 6, pp. 475–486, Dec. 2007.
4. BSI, "PAS 2060:2014 Specification for the demonstration of carbon neutrality," 2014.
5. Olatunji O.O., Akinlabi S.A., Ayo O.O., Madushele N., Adedeji P.A., Fatoba S.O., 2019, Drivers and barriers to competitive carbon footprint reduction in manufacturing supply chain: A brief review, Procedia Manufacturing, Elsevier B.V., 992–1000. DOI: 10.1016/j.promfg.2019.06.047