Project Call for 2021 ERBE Cohort

MaREI Supervisor	Dr. Marcus Keane
Institution	National University of Ireland Galway
Co-Supervisor & Institution (if known – please note this is not a requirement at application stage):	Dr. Noel Finnerty (Director of Global Real Estate and Facilities Boston Scientific Corporation)
PhD Proposal Title:	Standards-based Modelling, Simulation and Measurement Framework to Support Environmental Design and Operational Decision Making in a Multinational Medical Devices Manufacturing Company

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Alignment with ERBE Themes: (200 words max – please specify if the project aligns with 1 or more of the ERBE Themes)	Proposal aligns with all 3 ERBE themes. The proposal aims to develop **a)** a novel Key Performance Indicator (KPI) capable of capturing the relationship between COVID 19 air quality requirements in a global medical device company and the associated energy and carbon impacts and **b)** an environmental modelling, simulation framework capable of quantifying the impact of operating Air Handling Units in "COVID 19" mode in 3 selected operational facilities that include clean rooms, offices and warehouses. **Flexibility and Resilience** Flexible spatial and occupant layouts, multi-mode operation of Air Handling Units (AHU's) energy systems, decarbonisation of HVAC energy systems, carbon neutrality 2030 **Technology and System Performance** Environmental and energy performance in clean rooms, offices and warehouses in a global medical device manufacturing company. Control of HVAC systems to optimise potential stringent COVID 19 related air quality requirements and energy/carbon impact Enhancement of BSC Global Energy Management System (GEMS) to account for COVID 19 related air quality requirements on the roadmap to carbon neutrality 2030 **Comfort, health and well being** Comfort and health requirements for occupants in spaces that include clean rooms, offices and warehouses

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PhD Proposal Abstract: (500 words max)	Multinational medical devices manufacturing companies typically comprise of multiple sites consisting of three major operational facilities - *clean rooms*, *offices* and *warehouses*. One of the primary environmental requirements in each of these facilities is air quality which in turn impacts the on-site and network energy and carbon profiles. Air handling units (AHU's) are the primary Heating Ventilating and Air Conditioning (HVAC) energy systems technologies used to provide the operational air quality conditions within each of these distinct facilities, specifically in relation to the mix of fresh and recirculated air contained in the supply air, resulting in varying energy and carbon footprints in each of the operational facilities. BSC in collaboration with NUI Galway has successfully developed (2013-2020) a Global Energy Management System (GEMS) consisting of 6 key performance indicators (KPI's) that are enabling BSC achieve its commitment to being carbon neutral by 2030. Two of these metrics are EM^3 and Green Real Estate. EM^3 quantifies the status of each site with respect to its energy maturity roadmap against the backdrop of energy management standards that include ISO50001. Green Real Estate quantifies how much of the office and clean Room real estate is compliant with environmental standards that include LEED and Energy Star. BSC now recognises that with the emergence of COVID 19, additional AHU modes of operation will be required within these facilities to allow for emerging COVID 19 air quality requirements. This proposal aims to research and develop a standards-based methodology and technology framework needed to create a novel KPI capable of measuring the impact (air quality, energy and carbon) of operating the on-site AHU's in each of the clean room, office and manufacturing facilities in "COVID 19 mode" and examining how this metric can be added/incorporated into the current set of GEMS key performance metrics in order to evaluate the overall impact of this KPI on BSC's roadmap to carbon neutrality by 2030. The proposal will aim to develop a standards-based environmental modelling, simulation and measurement framework comprising of validated and calibrated environmental and energy simulation models working alongside industrial grade building management and control systems servicing the BSC Global Energy Management System (GEMS). Selected clean rooms, offices and warehouses in the BSC network will be chosen to validate the novel KPI and the modelling, simulation and technology framework and its role in enhancing the BSC Global Energy Management System (GEMS).

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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)	Global Medical Device Technology Manufacturing companies are responding to the need for their facilities (clean rooms, offices and warehouses) to operate under varying air quality requirements provided by existing and emerging building energy technologies. In particular, there is a need to quantify the energy and carbon impact of servicing these facilities with varying air quality conditions. Boston Scientific Corporation has made significant advances in this respect by developing a Global Energy Management System (GEMS) that has enabled BSC to roadmap their commitment to carbon neutrality by 2030. This has been achieved by the development of 6 Key Performance Indicators (KPI's) within GEMS that allows each site and the overall corporation assess the status of their journey to achieving carbon neutrality by 2030. However, with the emergence of COVID 19, BSC has recognised that not all of their operation spaces (clean rooms, office and warehouses) have similar air quality requirements and therefore energy and carbon footprints, even when their energy systems (Air Handling Units – AHU's) are operating in "normal" modes. COVID 19 has resulted in the need to be able to quickly react to the spatial layouts of these spaces and understanding of the energy and carbon impacts of these changes at site level and across the entire BSC network. This proposal aims to develop an environmental modelling, simulation and measurement framework that can aid BSC in determining how these spaces can be made flexible both in terms of the occupants and the air quality requirement for various operational modes of the Air Handling Units servicing these spaces. This modelling and technology framework must also be integrated in the BSC Global Energy Management Systems so that concurrent decisions can be made with regards to occupant, spatial, energy and carbon vectors to BSC's overall pathway to carbon neutrality by 2030. Information and contact details for both supervisors can be found at (Dr. Marcus Keane, www.iruse.ie/people) and (Dr. Noel Finnerty, https://www.linkedin.com/in/noel-finnerty-53413614a/?originalSubdomain=ie)