Results of Competition: ISCF Transforming Foundation Industries: Building a Resilient Recovery

Competition Code: 2008_ISCF_TFI_RECOVERY

Total available funding is £8 million

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
MANNOK BUILD LIMITED	Study of the feasibility of producing artificial pozzolana at existing cement facility for use as an alternative raw material in Portland Cement	£475,468	£237,734

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The larger share of CO2 emissions in cement production is due to the calcination of limestone. This share can be mitigated through a process that reduces the clinker-cement ratio, using supplementary cementitious materials (SCM) such as natural pozzolans, blast furnace slags, fly ash and limestone filler. Natural pozzolans are plentiful in some countries due to volcanic formation, but not in the UK or Ireland. Blast furnace residue and fly ash are becoming increasingly scarce following the mandatory closure of coal-fired power stations by 2025\. This project will complete an in-depth feasibility study into the possibility of using abundant clay deposits in N.Ireland to produce an artificial SCM in the form of Natural Calcined Pozzolans (NCPs) for use in cement production. This will be aimed at replacing by-products such as Pulverised Fuel Ash (PFA) and Granulated Ground Blastfurnace Slag (GGBS) which are currently used as SCMs but are in decreasing availability in the UK. It will also examine the commercial viability of processing the product in an existing standard rotary kiln used previously for clinker production.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
GLOBAL COMBUSTION SYSTEMS LIMITED	EcoLowNOx: Auxiliary Combustion System for Efficient Combustion with Low-NOx emissions for Foundation Industries	£310,066	£217,046
GLASS FUTURES LTD		£359,570	£359,570
SPECIALITY STEEL UK LIMITED		£70,226	£35,113
TATA STEEL UK LIMITED		£119,708	£59,854
University of South Wales		£139,331	£139,331

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Project description - provided by applicants
Glass and Steel manufacturing furnaces frequently operate at temperatures above 1400'C, creating a pressing need for new, cost-effective technologies to reduce NOx emissions and increase furnace efficiency to meet ever tightening regulatory requirements. Global Combustion Systems (GCS) have previously demonstrated (at lab and commercial-scale) an 'Auxiliary Injection' combustion technology for end-fired glass furnaces that has the potential to reduce NOx by more than 80% and increase furnace efficiency by as much as 3%. This project, supported by Tata Steel and Liberty Speciality Steels, will assess the performance of the GCS Auxiliary Injection technology for a range of new glass and steel furnace scenarios, using the Glass Futures 350kW combustion-test-bed furnace. A team from the University of South Wales will screen and select existing computer models to understand how to transfer the GCS technology into steel applications as well as to quantify potential benefits. A techno-economic review will be undertaken to assess the feasibility of the GCS technology for these furnace applications, which will be used to identify the further work required to de-risk the technology to the point at which it can be trialled on commercial furnaces.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ALUSID LIMITED	The World's first ceramic glazed tiles – made from 100% recycled materials	£76,859	£53,801
ORIGINAL STYLE LIMITED		£27,506	£16,504

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
"OUR STORY STARTS WHERE OTHERS FINISH" ALUSID, a spin-out company from the University of Central Lancashire, has been making architectural surfacing products at its Lancashire-based plant, since starting operations in 2016\. Our patented, award-winning technology utilises recycled industrial ceramic, glass and mineral waste, diverting them from landfill or low-value applications, to create unique surfacing products, including tiles and solid surfaces such as tables and bar-tops. To date we have undertaken numerous projects for major brands, such as Harrods, Nandos, Pret-a-Manger, Hilton, H&M, Amazon and Coya Restaurants. ALUSID's current glazed tile range comprise of around 95% recycled content. Our vision for this project is to develop the world's first mass-produced, commercially available tile range made from 100% recycled waste - eliminating any reliance on virgin raw materials. Producing the world's first and only truly sustainable tile, would offer a paradigm shift in ceramic tile manufacturing, whilst providing ALUSID and the UK tile industry a significant commercial advantage over global competitors. In order to achieve market penetration, ALUSID is currently moving towards high-volume manufacturing from a hand-made batch process, aiming to increase production capacity of 95% recycled content tiles, from 4000m2 per annum to 1000m2 per day. COVID-19 permitting, we hope to launch our first mass-produced range early next year through Topps Tiles, the UK's largest tile retailer. Our intention is to centre production in the UK, through collaboration with our project partner Original Style. As one of the UK's few remaining tile manufacturers, Original Style has the kiln capacity and volume manufacturing know-how, to enable the increases in production volumes required by a commercial retailer. This Innovation Award will allow us the opportunity to develop glazes appropriate for fast-fire high-volume manufacturing in collaboration with our project partner, where recycled waste will be utilised to replace virgin raw materials currently used in the preparation of ceramic glazes. A dramatic increase in production capacity, utilising fast-fire kiln technology would mean significant increases in the amount of glaze used. In turn, higher volumes of glaze, offer exponentially greater cost and environmental benefits. Developing glazes made from recycled waste and producing the world's first 100% recycled mass-produced, commercially available tile range would offer significant economic, social and environmental impacts; reduction of excessive landfill practices, reduction of environmental impacts associated with the extraction and transportation of virgin raw materials, a unique and timely eco-tile to the global tile market, and the safeguarding of UK jobs.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SPECIALITY STEEL UK LIMITED	EMSTROW	£290,000	£145,000
BRITISH STEEL LIMITED		£118,712	£59,356
PRIMETALS TECHNOLOGIES, LIMITED		£217,312	£108,656
The University of Manchester		£119,681	£119,681
University of Warwick		£117,860	£117,860

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Project description - provided by applicants
The aim of the project is to aid recovery from the effects of Covid-19 for Liberty Steel, British Steel and Primetals Technology Limited through the design and development of a robust on-line electromagnetic sensor array capable of online microstructural measurement of cooling steel. The sensor system will allow the companies to differentiate their product portfolios with more advanced, more tightly controlled products demanded by their customer markets. The project will build upon fundamental sensor research completed by the Universities of Manchester and Warwick, which has shown that EM sensors are sensitive to changes in steel phase fraction. Phase fraction changes as steel cools from high temperatures, analysis and measurement of phase balance in steel is essential for production of high-quality steels. On-line sensing allows phase fraction to be measured in real time, increasing the percentage of steel produced to specification and allowing the production of newer higher strength steels. Liberty Steel and British Steel recognised the need to improve their narrow strip and wire/rod facilities before Covid-19, the need to improve their processes has become more prescient since the pandemic took hold. Narrow strip product is produced from slabs that are heated and rolled down into thin, narrow strips before coiling, the width of the strip changes with each product cycle. In a rod mill, hot rod is looped into waps as it is laid on the run-out table, the waps move over a series of rollers until they reach the end of the table where they are coiled. In both cases the steel passes along a run-out table where phase transformation takes place which is detectable using an electromagnetic sensor array. Significant innovation in electromagnetic sensor development is required to make sure that the engineering and scientific challenges of deploying a sensor in full scale narrow strip and rod mills are overcome. These challenges include: varying product cooling rates; miniaturisation of the sensor to fit into the run-out table without affecting cooling processes; varying material thicknesses and geometry above the sensor. Industrialising the sensor design requires specialist knowledge and expertise. Primetals Technology Limited is a specialist in the design and manufacture of sensors for the steel industry. The consortium for the project: Universities of Manchester and Warwick, Liberty Steel, British Steel and Primetals Technology Limited has all the expertise and knowledge required for a succesful project, from the fundamental science of the sensors through to sensor industrialisation and installation.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SENSEYE LIMITED	SCI-FI: SCalable, Intelligent condition monitoring for Foundation Industries	£250,912	£150,547
MALONE ENGINEERING UK LIMITED		£100,163	£70,114
SMURFIT KAPPA CORRUGATED UK LTD		£91,448	£45,724
TATA STEEL UK LIMITED		£0	£0

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Proper maintenance in domestic Foundation Industries is crucial for everything that matters: productivity, product quality, reliable deliveries and safe working environments. However, in responding to the demands of global competitions, and more recently the effects of COVID-19, management teams have been forced to make difficult decisions to reduce costs. This has resulted in significant cuts to maintenance budgets, which are often seen purely as costs rather than investments. This has resulted in staff reductions, cancellation of third-party maintenance contracts and under-maintained machines with the inevitable consequences for productivity and energy and resource efficiency. There is a pressing need for automated condition monitoring systems that help maintenance teams sustain their effectiveness with fewer resources. Such systems should scale the expertise of the maintenance team, allowing them to manage more machines with fewer people. They should help them optimise machine performance, avoid unplanned downtime and understand the root causes of failures. The SCI-FI project is about adapting a cost-effective approach to automated condition monitoring (CM) and prognostics (PdM), that has been proven in the automotive sector, developed specifically for the needs of metal (Tata) and paper (Smurfit-Kappa) manufacturing. It involves taking techniques, algorithms and user interfaces that were developed for the kinds of discrete, standalone machines common in automotive and adapting them for the coupled machines and processes that predominate in Foundation Industries. This system would help manufacturers in domestic Foundation Industries become more competitive by reducing both CAPEX and OPEX expenditure through more efficient and more effective maintenance strategies.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CORNISH LITHIUM LTD	Co-production of Lithium and China Clay in Cornwall - CLiCCC	£540,383	£378,268
HSSMI LIMITED		£220,191	£220,191
IMERYS MINERALS LIMITED		£235,274	£117,637

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The China Clay (or kaolin) industry in Cornwall has been in operation for nearly 275 years since its discovery and was once a mainstay of UK industry, producing raw materials for Britain's potteries and paper industry. English China Clays was once a household name in Britain and was formerly the world's largest producer of china clay, before being sold to French company Imerys in 1999\. The industry still forms a significant part of UK primary industry, employing over 750 people in mid-Cornwall and contributing £92m/year into the Cornish economy (Imerys statistics July 2020). Unfortunately, the china clay industry has long been in decline due to reducing demand for printing and writing papers and the emergence of competing kaolin sources and other minerals overseas. China clay in Cornwall is largely sourced from decomposed granite, a rock that also contains lithium minerals in the form of lithium mica. The lithium potential of the china clay region in Cornwall was outlined in a British Geological Survey (BGS) report of 1987 and the possibility of lithium extraction from this source is currently being evaluated by Cornish Lithium Ltd -- the lead partner in this grant application. The project consortium will include Imerys, Cornish Lithium and HSSMI and aims to enhance resilience of the Cornish china clay industry by evaluating the economic viability of extracting lithium from minerals that occur in the same rock as china clay -- thus increasing the resource efficiency of the mined rock, making this vital Cornish industry more internationally competitive and securing a domestic supply of lithium that is vital to the transition to renewable energy and a zero-carbon economy. This project takes an innovative approach to evaluating cutting-edge lithium extraction techniques and developing new processes to align co-production of lithium with Imerys' current kaolin production, demonstrating the commercial possibility to produce a vital new metal for the UK whilst making the Foundation Industry more resilient. Lithium is critical due to its vital importance in the transition to renewable energy/zero-carbon economy. The UK aspires to be a leader in battery and electric vehicle (EV) production and technology but faces a major hurdle given that there is no secure domestic supply of lithium for battery manufacture: an issue noted recently by the Prime Minister. Co-production of lithium from minerals found in china clay waste (current and historic material) will increase resource efficiency by reducing waste and generating additional revenue sources.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
IS-INSTRUMENTS LIMITED	hot Gas Raman Identification and measurement For Foundation INdustries (GRIFFIN)	£276,658	£193,661
BREEDON CEMENT LIMITED		£9,601	£0
GLASS TECHNOLOGY SERVICES LTD		£40,054	£28,038
Sheffield Hallam University		£242,062	£242,062
University of Southampton		£93,552	£93,552
WIENERBERGER LIMITED		£9,585	£0

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The UK Government is committed to moving to a zero-carbon economy, including within the most energy-intensive sectors. These sectors consume a considerable amount of energy, but also play an essential role in delivering the UK's transition to a sustainable, low-carbon economy, as well as in contributing to economic growth and rebalancing the economy. UK Foundation Industries generate 10% of the UK's entire CO2 emissions and for three of these industries, glass, cement and ceramics, manufacture is energy and capital intensive. Future environmental regulations create challenges in competing with new plants from the developing world but also offer new opportunities. COVID-19 impact resulted in near total suspension of foundation industry production. Subsequent recovery is further challenged by new, UK policies and plummeting raw material values which are compounding negative impact to decimated sectors. This energy efficiency industrial research project aims to deliver a transformative new instrument for the glass, cement and ceramics industries, utilising analytical Raman gas measurement instrumentation, originally developed for nuclear decommissioning by project lead IS-Instruments. The data provided by the instrument will enable these Foundation Industries and others, to make a step-change in process control, energy consumption and environmental emissions monitoring. Significant energy savings will be directly enabled through accurate, near-to-real-time hot gas measurement, realising the future potential of mixing natural gas with cleaner energy sources such as hydrogen, when combined with more accurate and near-to-real-time burner in-process control. The optimised environmental monitoring capability of this instrument will enable greater understanding and the value added by additional in-process monitoring technologies will deliver a new technology enabling step changes to prcessing within the foundation industries. To deliver this collaborative, innovative project, IS-Instruments will be supported by UK Foundation Industry partners Glass Technology Services (Glass), Breedon Group (Cement) and Wienerberger (Ceramics) with world class University expertise from Southampton's Optoelectronics Research Centre and Sheffield Hallam's Materials Engineering Research Institute.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
KEEN LIMITED	BACpack	£125,087	£87,561
INNOVAL TECHNOLOGY LIMITED		£79,986	£39,993

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Project description - provided by applicants
The BACpack feasibility study examines the potential to recycle low carbon scrap for the manufacture of aluminium sheet for packaging and other large-scale applications within the UK. This is an essential development for the aluminium industry as a key part of UK's foundation metals industry for both its future productivity and sustainability. The study will provide the technical and economic verification of the route for the UK's aluminium industry to re-shore the manufacturing of aluminium sheet packaging products that are all presently imported into the UK. This will be based on efficient manufacturing processes and the use of UK based recycled low carbon aluminium as its feedstock. This will make the manufacturing of aluminium sheet packaging products in the UK both globally competitive and at the same time environmentally friendly particularly as the UK decarbonises its electricity generation capacity. The feasibility study proposed is firmly based on both resource and energy efficiency as it will make use of a low carbon recycled aluminium feedstock that is mainly lost to export today. The proposed closed loop recycling entity would take a significant proportion of the up to 800 kt UK based end-of-life aluminium scrap which is currently exported each year and convert this in the UK using the most efficient casting and rolling technology, to provide high added value aluminium sheet for both closure sheet stock and for can body sheet stock for supply to UK manufacturers of both cans and closures at advantageous cost, based on the maximum use of ultra-low embedded carbon recycled aluminium which has a low carbon intensity of 0.5 tonnes of CO2/tonne compared to the world average for primary aluminium of 17.0 tonnes of CO2/tonne; thus securing the existing UK canning and food industry but also enabling this to grow, as it must, in moving food and beverage packaging away from plastic. The study will be led by Keen Ltd as part of its longer-term plan to establish capacity for sustainable aluminium sheet manufacture in the UK for supply to the packaging, construction and automotive sectors. Keen has partnered with Innoval a world-leading aluminium technical consultancy for aluminium processing and product development.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
RECYCL8 LIMITED	Low Carbon Concrete Manufacturing Process	£238,003	£166,602

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Project description - provided by applicants
Recycl8 has developed a low carbon (footprint) concrete manufacturing solution which utilises a waste material otherwise destined for landfill. This solution will make a significant contribution to improving carbon reduction in the UK, Europe and worldwide and assist towards satisfying the requirements of the Paris Agreement for Carbon Reduction. The development of this solution involves the transformation of Incinerator Bottom Ash (IBA), a waste material from the waste to energy plants, into a cost effective additive in the manufacture of concrete and will partially replace high CO2 emitting cement and reduce the use of virgin quarried materials. This will utilise this waste material and prevent large quantities of IBA being sent to landfill and contribute significantly towards the Circular Economy. Activities undertaken during the project include the testing of materials and optimising material mixes to ensure our solution provides a construction industry attractive solution that is both cost effective and environmentally friendly to assist this industry with its carbon reduction ambitions. Cement is the most widely used man-made material in existence. If cement were a country it would be the third largest emitter of C02 in the world, its use is set to rise as global urbanisation and economic development increases demand for new buildings and infrastructure. The World Cement Association recently held its first ever Global Climate Change Forum, where industry leaders and experts focus was on how to reduce the industry's carbon foot print. Cemex and Costain have recently announced an ambitious climate strategy, including a new global target for CO2 emissions by 2030: a reduction of 35% to ensure alignment with the Paris Agreement commitments. Recycl8 has a tangible, easily accessible, cost efficient, low carbon concrete manufacturing solution, which has a game changing effect on the worldwide concrete industry, and will significantly contribute to its global Paris Agreement Targets.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CAT INTERNATIONAL LTD	Continuous production process for 3D printed ceramic foundry filters, suiting all applications	£405,460	£283,822

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Metal components are required across many sectors including aerospace, automotive, manufacturing and construction. As such, cast metals in the UK generated sales of £1.89bn in 2017 (Cast Metals Foundation, Industry Census) with a global market of £123Bn in 2019 (Grandview Research, 2020). Liquid metal is cast into different and often specific shapes and it is important these components do not have defects which could lead to catastrophic failure. Filtration of the metal can reduce imperfections/defects which in turn minimises the number of failures that are unusable. Reducing the number of components manufactured to obtain high quality usable products consequently reduces the energy inputs and carbon dioxide emissions associated with this high energy consumption sector. Metal filters are often made from ceramic materials formed around polyurethane foam, however, when fired to remove the foam and create the filter pores, toxic fumes can be emitted and there is no guarantee of pore size and reproducibility. Additionally, shrinkage when materials are fired can be problematic adversely impacting the pore size. CAT International Ltd, a leading manufacturer of foundry filters and consumables, have developed a novel ceramic formulation (covered by a patent) and process that ensure high quality, reproducible filters for use in the metal casting foundry sector (foundation industry). We will develop an Additive Manufacturing (3D printing) process and proprietary ceramic formulation (ceramic materials combined with organic resin) that can be used to fabricate the filters. We have undertaken initial work and seek to carry our further industrial research to optimise our manufacturing process and formulation and test our materials in terms of properties and user needs. By using our new innovative process, we seek to enhance performance throughout the supply chain which will minimise materials wastage associated with defective parts. This will then minimise energy usage where the same inputs can create more usable parts as a result of better liquid metal pre-processing. Our project will improve the environmental performance of a sector that uses high volumes of raw material and increasing amounts of energy. Changes to the sector as a result of the Covid-19 pandemic provide us with a chance to build back a more environmentally sustainable industry in response to UK and global priorities to reduce waste and work towards net zero emissions by 2050\.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
HSSMI LIMITED	Through the Looping Glass	£73,840	£73,840
PILKINGTON TECHNOLOGY MANAGEMENT LIMITED		£90,824	£45,412

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The Through the Looping Glass project, by HSSMI and NSG Pilkington (NSG), aims to harness support from a wide range of industry partners to explore new sources of post-consumer cullet in the UK. The goal of this project is to deliver a feasibility study which challenges the UK glass industry's ability to incorporate 30-41% use of cullet (recycled glass) in new flat glass production. While some facilities worldwide are able to produce glass with up to 70% cullet, most UK facilities struggle to surpass 30%. The challenge the UK glass industry has in achieving this is rooted in the quality of available feedstock. Flat glass manufacture is extremely sensitive to any impurity, and so the cullet used in new glass production is often sourced from material offcuts from the manufacturing process itself (i.e. a closed loop within the manufacturing facilities). The UK glass industry has therefore not widely experimented with concepts such as cullet return schemes or the using post-consumer cullet. However, the use of cullet to reduce environmental impact is now becoming increasingly important. The application of cullet represents a great opportunity in energy reduction as it is easier to melt than raw material. Additionally, it has no intrinsic carbon. What is innovative about this study is that it explores new sources of post-consumer cullet that have not previously been explored due to concerns about contamination. It aims to provide a solution for the UK glass manufacturing industry without necessitating expensive retrofits to existing facilities. It also aims to combine the most appropriate supply chain actors with the glass manufacturers and improved sorting, processing, and detection technologies. The study will also make recommendations regarding whether improved segregation, processing equipment, detection equipment, or a mix of multiple improvements are required in order to upscale the circular process. It will conclude with a techno-economic assessment and a life cycle analysis evaluating the potential of a new circular model of flat glass production with post-consumer cullet and with existing available technologies, with recommendations for upscaling.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
FABRICNANO LIMITED	A novel biocatalyst platform for biobased-synthesis of 1,3-propanediol	£585,093	£409,565

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Biomanufacturing has emerged as a promising alternative to chemocatalysis for green, renewable, complex synthesis of biofuels, medicines, and fine chemicals. Cell-free chemical biosynthesis offers additional advantages over in vivo fermentation methods, by enabling plug-and-play assembly of separately produced enzymes into an optimal cascade, versatile reaction conditions, and direct access to the reaction environment. FabricNano have developed a synthetic biology, DNA-based nanoreactor platform technology with the potential to transform the UK's chemical synthesis industry. Their approach vastly improves reaction kinetics of multi-enzyme cascade kinetics to yield product quickly, and can contribute to the greening and sustainability of chemical production. FabricNano have identified a multi-enzyme cascade that converts waste glycerine into 1,3-Propanediol (PDO). Bioethanol/biodiesel production creates waste glycerine, valued at 20p/kg; PDO is valued at £9/kg, due to it utility across many applications (plastics, cosmetics, personal care, cleaning products) There is significant demand for PDO, but just four leading manufacturers have an annual output c. 142.5 kilotons/year. PDO chemical processing techniques are energy intensive, consume metal catalysts, and create dangerous working conditions. State-of-the-art approaches convert sugars and polyols to PDO via fermentation. However, fermentation relies on lengthy yeast culture, and consumes significant energy and fresh water. Because the Covid crisis is restricting the market for the UK's biodiesel/bioethanol producers (less leisure travel and freight services has lowered demand), FabricNano have identified an opportunity to: 1. Help bioethanol/biodiesel producers to remain profitable/viable operators during the Covid crisis by creating added-value for a low-value waste stream. 2. Create a domestic supply chain for PDO (currently no producers in the UK). The project will help to demonstrate the viability of FabricNano's biocatalyst at an industrial scale. It will also prove utility of FabricNano technology for coupling cascading enzyme reactions for the conversion of low value renewable feedstocks into high value products, which represents a keystone of renewable green chemistry.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
JJEnergy Limited	A digital platform for industrial heat recovery in terms of supply chain management	£240,000	£168,000
OUTOKUMPU STAINLESS LIMITED		£20,034	£10,017

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Project description - provided by applicants
JJ Energy Limited, together with partner Outokumper, propose to develop a digital supply chain platform to improve industrial heat recovery/utilisation for foundation industries. The platform includes a search/recommendation modular for the industrial customers to find appropriate suppliers and their reference records; a heat aggregating/sales portal to help sell their excessive heat by aggregating industrial heat sources to satisfy the external district heating networks; and an e-commerce and project collaborative module. In ten years, the digital platform aims to involve in 10.5TWh/year of industrial heat recovery/reuse in the UK.

Results of Competition: ISCF Transforming Foundation Industries: Building a Resilient Recovery

Competition Code: 2008_ISCF_TFI_RECOVERY

Total available funding is £8 million

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
LUCIDEON LIMITED	Foundation Industry Wastes for Cement Encapsulants	£152,657	£91,594
NUVIA LIMITED		£51,083	£25,542

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Foundation Industry (FI) wastes such as coal fly ash and ground granulated blast furnace slag can potentially be used in geopolymer cements to give more effective encapsulation of hazardous wastes compared with Portland Cement, which is extensively used at present. Activities will evaluate sources and types of FI wastes in the UK to select FI wastes for encapsulation trials and their business potential, namely: * develop geopolymer formulations and process methods to encapsulate simulants wastes using FI wastes as a key cement component. * maximise the amount encapsulated within the geopolymers * characterise properties of the composites to indicate compliance with disposal requirements This 12-month project is the first step of a timely opportunity to produce disruptive cement technology using FI wastes, creating internationally attractive products with low CO2 footprints.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
REGEN WASTE LIMITED	Glass cUllet conversIon To wAteRglass and used, with cement bypass flue dust, for cementless concrete building products (GUITAR)	£141,493	£84,896
ECOCEM GB LIMITED		£31,232	£9,098
MANNOK BUILD LIMITED		£111,333	£55,666
Queen's University of Belfast		£252,636	£252,636
T & J RECYCLING LTD		£104,356	£73,049

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Waterglass (sodium silicate) is a commodity industrial chemical, sold as a powder or water solution, and used in compound formulations, for processing textiles and lumber, and in the manufacture of ceramics, silica gel and other materials. Waterglass is prepared by melting together soda (Na2CO3) and quartz/silica sand (SiO2), in an energy-demanding process (1100-1200 °C) to produce an amorphous material known as cullet. The cullet is then mixed with water and pressurised steam to produce an aqueous solution. The development of a robust technology for making waterglass from waste glass is highly desired by the bulk industrial chemical industry. GUITAR will demonstrate a manufacturing process for waterglass suitable for producing "cementless" concrete products when used together with cement bypass flue dust (a waste stream from the manufacture of cement) and/or Ground Granulated Blast Furnace Slag (GGBS, a by-product from steel production). The end products will be autoclaved aerated concrete building blocks, normal density blocks, and a pre-bagged one part binder (GGBS with waterglass) that do not use any Portland cement, instead using waste materials to replace it. These products will have a significantly lower environmental impact those currently on the market. The project will explore the preparation and purification strategies required to deliver waterglass equivalent to that produced as a commodity bulk chemical for use in detergents (the largest single market for waterglass) and paper production. The 2016 global market size of sodium silicate was estimated at $8.6 billion and is projected to reach $11.0 billion by 2022, with the EU sharing approximately 20% of the market. EU production capacity exceeds 2 million tonnes per annum. The competitive advantage of the new waterglass production process arises from its lower environmental impact and its lower cost of production. There are two-fold environmental benefits: lower process temperature (around 150 °C instead of \>1100°C) and use of waste glass cullet rather than virgin material (pure quartz/silica sand). The production cost for waterglass from the waste glass cullet is estimated at £100 £/tonne (about 95% cost being NaOH). In comparison, the market price of commercially available sodium silicate solution is of the order $500-$1000/tonne, and it is expected to further increase with increasing penalties for C02 emissions and consequent energy input costs.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
INCOREZ LIMITED	Bio-based solvent identification and evaluation for use in polyurethane resin binders for the roofing industry	£67,421	£33,710
GREEN ROSE CHEMISTRY LTD		£21,000	£14,700
MilliporeSigma - the life science business of Merck KGaA, Darmstadt, Germany		£24,076	£0

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The after-effects of the COVID-19 pandemic will be felt through all industries for many years, if not decades, yet following a crisis there is always an opportunity for innovation that can change the way businesses operate and make them more competitive. COVID-19 has brought sustainability to the forefront of the conversation. With increasing interest from climate experts, activists, governments and the next generation, it is industry's responsibility to respond by developing products that are not only functional, but genuinely sustainable, whilst remaining competitive in the global marketplace. Incorez is a key supplier of construction intermediates to the global Sika Group, and therefore well-positioned to develop the next generation of sustainable, bio-based building materials that will be used well into the future. With this project, Incorez seeks to identify and adopt high-performance bio-based solvents for use in its liquid applied membrane (LAM) roofing products. Solvents serve a critical role in resin manufacture and product formulation by facilitating chemical reactions, dissolving and stabilising formulations, controlling viscosity, and enabling rapid and smooth film formation. The solvents used in LAM products throughout industry are currently petroleum based and must be replaced with bio-based options as the UK transitions to a bio-economy. Incorez has partnered with Merck, a world leader in chemical manufacturing and distribution, and Green Rose Chemistry, the UK's leading green solvents consultancy, to lead an innovative project seeking bio-based solvents for the roofing industry. While the traditional industrial approach is to source and test existing available raw materials, incurring high lab testing costs and long product development times, this project aims to take a new approach that will accelerate and de-risk solvent research. Green Rose Chemistry will apply specialist solvent lead identification software based on the Hansen solubility parameters to mine an extensive database of bio-based solvents, identifying potential greener alternatives that have a much higher probability of successful commercialisation. Merck will assess the economics and available supply chain for the selected solvents, identifying the candidates that are commercially viable. Incorez will test the best prospects in its product development labs and oversee life cycle analysis to evaluate their long-term sustainability, laying the groundwork for incorporation of truly sustainable bio-based solvents in its next-generation roofing products.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
BINDING SOLUTIONS LTD	Novel EAF Composite Feedstock	£451,044	£315,731
MATERIALS PROCESSING INSTITUTE		£443,533	£443,533

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Binding Solutions Limited ("BSL") and the Materials Processing Institute ("MPI") are developing a novel, composite feedstock for Electric Arc Furnaces. These composite pellets are designed to feed fresh iron units into the EAF without the need for capital and energy intensive induration. The pellets are produced using a cold process and will be used to create clean, high-quality steel. BSL and MPI are targeting 30% cost savings vs DRI, HBI and scrap metal. The process will significantly reduce energy usage and CO2 emissions in the steel making process. The technology provides a sustainable solution to help the UK remain competitive in a constantly evolving market place, incentivising investment whilst safeguarding and creating new jobs. We estimate a quick ROI for EAF steel producers and further benefits across the supply chain including increased demand from chemical producers in the North East. We believe investment in EAF technology is critical to the UK's long term growth. Our technology supports this growth and we aim to have a commercially available product on successful completion of a 12-month Innovate-backed project.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
JAMES CROPPER PUBLIC LIMITED COMPANY	Recovering cotton fibre from UK post-consumer, mixed composition textile waste for use in paper manufacturing	£125,131	£50,052

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
James Cropper plc is a world-class advanced materials and paper products group, with an operational reach in over 50 countries. Using materials from cotton and wood to carbon fibre we support industries from packaging to digital imaging and aerospace with products that are at the cutting edge of performance. At James Cropper plc we would like to work on a unique innovation project that studies the use of alternative natural fibres (sourced from a UK post consumer waste stream) for the papermaking process. We recognise that the UK is the fourth largest producer of textile waste in Europe with only 10% currently being recycled - More than 200,000 tonnes of UK textile waste is sent to landfill or burnt every year. The project will study the use of UK post consumer textile waste used as a raw material in papermaking and moulded pulp process. The COVID-19 pandemic has exposed vulnerabilities in our current global supply chain and this project will reduce the risk of future supply chain interruptions through the identification of a viable, UK based alternative fibre to our current, globally sourced virgin wood pulp.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
FUTRAHEAT LIMITED	Breakthrough High Temperature Heat Pump Technology for Foundation Industry Decarbonisation	£393,264	£275,285
PROJECTIVE LIMITED		£351,078	£245,755

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Climate change has been described by the UN as the defining crisis of our time, which is happening even more quickly than previously feared. Human-induced warming reached approximately 1°C above pre-industrial levels in 2017 and is continuing to increase at 0.2°C per decade. To keep the temperature increase compared to pre-industrial levels below an increase of 2°C, global reduction in greenhouse gas emissions is required. The industrial sector (of which Chemical Manufacturing is a significant part) is responsible for around 46% of global greenhouse gas emissions. Thus, improving industrial energy efficiency has a significant role to play in reducing greenhouse gas emissions. Industrial waste heat recovery is recognised as a vital technology to reduce greenhouse gas emissions. Currently, most heat below 100°C is lost to the ambient environment, even though it could theoretically be captured using high-efficiency heat-pump technology. Heat pumps use electrically activated compressors in a reverse Carnot cycle to raise the low-temperature waste industrial heat source to valuable high-temperature heat, usually in the form of steam or pressurised water. In particular, high-temperature heat pumps (HTHPs) are defined by the International Energy Agency as those which convert heat source temperatures of 40-60°C to heat sink temperatures of 80-100°C (the current market offer), while very HTHPs operate at heat sink and source temperatures of above 100°C and 60°C, respectively. Although the environmental benefits and potential of HTHPs are well understood, they have not yet gained widespread commercial acceptance because of technological challenges and their higher cost (at c£500 - 900/kW) compared to conventional boilers and fossil fuels (c£200/kW). Yet, it has been estimated that 2.85% of the world's primary energy consumption is lost as industrial waste heat below 100°C. If all the industrial waste heat in the EU could be captured, then we estimate that this would be equivalent to a reduction of approximately 15 million tonnes/year of carbon dioxide emissions (roughly equivalent to taking 20 million petrol cars off the road). With Innovate UK support, Nthalpy (lead SME) will partner with Projective (partner SME; leading UK provider of technical consulting and engineering services) to develop the world's first sub-1MW high-temperature heat-pump that can compete commercially with burning fossil fuels. By overcoming the existing technological and commercial barriers, this project will unlock the ability to capture waste low-temperature heat at scale. Mitigating climate change and supporting the UK's net zero ambition.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CLOUD CYCLE LTD. HS2 LTD	Cloud Cycle & HS2: Transforming Cement & its Supply Chain with IoT, Machine Learning & Big Data.	£835,241 £0	£584,669 £0

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The UK cement industry is facing increasing pressure to reduce its emissions profile in line with government targets (net zero 2050) and end-users that a looking for 'low-carbon' concrete solutions. Furthermore, there is a shortage of supply versus demand for cement throughout the UK, whereby 5% of concrete goes to waste on construction projects and Covid19 has exacerbated supply constraints. Cloud Cycle's innovation looks to address these issues through redistributing surplus concrete onsite, linking into BIM to allow for improved design, procurement and quality control. This project will also allow for the integration of LCA/emissions reporting functionality, improving oversight of full supply-chain emissions from cement production to end-use. Access to this data and capabilities will make the UK cement industry more sustainable and competitive in the face of extreme production challenges caused by Covid19\.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
NATIONWIDE ENGINEERING GROUP LTD	Graphene Enhanced Concrete for a Resilient Recovery	£350,157	£245,110
The University of Manchester		£133,528	£133,528

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
This project will develop an enhanced concrete using a graphene additive that will result in a revolutionary construction material capable of vastly streamlining virtually all construction projects whilst halving their carbon footprints. This will be achieved through proven strength enhancements of at least 50%, reduced concrete quantities, improved early age crack resistance, and the elimination of large quantities of steel reinforcement. Successfully rolling out these breakthroughs on an industrial scale has the potential to transform the UK construction industry. From extensive successful testing already completed by Nationwide Engineering Group, the relevant technology for optimally dispersing graphene within concrete to maximise end performance has been achieved and we now need to progress with the next steps of scaling up these laboratory results onto a live site test. Concrete is the world's most widely used material, the production and use of which contributes towards 8-10% of the global carbon footprint, with global cement production projected to increase by more than 5 billion tonnes per annum. Major clients such as Network Rail and Government Departments are under significant pressure to reduce their energy consumption and carbon emissions, with Network Rail committing to an 11% CO2 output reduction within 5 years. This is a huge challenge and can only be met by the rapid commercialisation of new and innovative products such as graphene enhanced concrete. At present, the construction industry relies on concrete designs that have not evolved for decades which has stifled innovation. With an annual UK concrete consumption of 40 million tonnes pa alone, the potential for GEC to facilitate a step change reduction in quantities of material required is substantial. Nationwide Engineering Group have formed Concretene Ltd as a specialist company to develop and bring graphene enhanced concrete to the global market. Working together with world leading centres of expertise in graphene production and structural engineering research, our vision is to exploit the full potential of GEC, revolutionise current practice, and place the UK at the global forefront of construction technology for many years to come. Please visit [www.concretene.co.uk][0] to discover more. [0]: http://www.concretene.co.uk/