Results of Competition: ISCF Transforming Foundation Industries: Fast Start Projects

Competition Code: 1910_ISCF_TFI_FS

Total available funding is £5,000,000

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
GLASS TECHNOLOGY SERVICES LTD	Development new waste-derived raw materials for the Foundation Industries (EnviroAsh)	£115,302	£69,181
CASTLE CEMENT LIMITED		£16,194	£8,097
DRAX GROUP PLC		£2,263	£0
ENCIRC LIMITED		£81,471	£40,736
GLASS FUTURES LTD		£30,905	£30,905
GLASSWORKS SERVICES LIMITED		£19,083	£13,358
POWER MINERALS LIMITED		£36,000	£21,600
SAICA PAPER UK LIMITED		£3,842	£1,921

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Sheffield Hallam University		£153,243	£153,243
University of Sheffield		£14,728	£14,728
WIENERBERGER LIMITED		£20,006	£10,003

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 EnviroAsh project brings together partners from across the six Foundation Industries \[Glass (Glass Technology Services, Glassworks Services Ltd, Encirc, Glass Futures Ltd), Ceramics (Wienerberger), Steel (British Steel Ltd), Paper (Saica), Cement (Hanson, Breedon), Chemicals (Power Minerals Ltd. - through its Biolite division, which converts an ash-waste into a fertiliser product)\], the Energy sector (Drax) plus key academic partners (Sheffield Hallam University (SHU) and the University of Sheffield (UoS) and supply-chain partners experienced in handling and processing wastes and raw materials (PML, LKAB Minerals). The project will identify opportunities to take waste ashes, slags, mineral by-products and filter dusts from across the FIs and convert them into new raw materials for a range of products produced within the glass, ceramic and cement Foundation Industry sectors. In exploring an end-to-end approach this project aims to identify routes to convert waste streams into new raw materials transforming disposal costs into opportunities for income generation by creating lower cost raw materials with potential to reduce environmental impacts of Foundation Industry manufacturing processes. The project will also explore how these new feedstocks might create opportunities to improve product performance in a cost-effective manner. The project will deliver practical lab and commercial-scale demonstrations of how these new waste-derived materials can be incorporated into existing products and processes, establishing a consortium, supply chain and new business models which can be applied to other waste streams within the FI and other energy intensive sectors.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
LUCIDEON LIMITED	HYBRID SINTERING FOR DECARBONISATION AND PRODUCTIVITY IN MANUFACTURING	£127,760	£76,656
GLASS TECHNOLOGY SERVICES LTD		£29,856	£17,914
KNOWLES (UK) LIMITED		£34,124	£17,062
University of Sheffield		£132,824	£132,824
VESUVIUS UK LTD		£30,811	£15,406

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Project description - provided by applicants
Ceramic and glass bodies are manufactured widely in the UK and used by many foundation industries, from the production of ceramic electronic components used in all modern electronics, to glass and refractory kiln linings essential for glass and metal processing furnaces. All require sintering in their green state, at high temperature and over long timescales. With extended cycle times and high consumption of energy, the development of a sintering technology to significantly reduce the energy used, lower peak furnace temperature, and increase speed of sintering would provide a step change in resource efficiency for foundation industry users. This project will target benefits in resource and energy efficiency assessing the possibility of combining two novel and highly energy efficient sintering technologies to exploit the strengths of both systems, and provide sintering in seconds at temperatures as low as 100oC. Current state of the art sintering involves peak temperatures of 1200 oC -- 1800 oC +, applied for a number of hours. The project's objective is to develop a processing technology for use by the glass, ceramics (focused on electroceramics and refractories) sectors, each a foundation industry. The project builds on Lucideon' s expertise in the development of flash sintering technology, and the University of Sheffield's (UoS) development of cold sintering . Cold sintering is a pressure assisted densification technology that relies on the aqueous dissolution of ions from the constituent oxides followed by recrystallisation as the water evaporates above its the boiling point. Although many ceramic systems or ceramic composites cold sinter, the technique cannot yet be applied to all ceramics. Moreover parts are held under load for several minutes, which limits scaling the technique for manufacturing. Flash sintering has been successful in sintering a wide range of ceramic materials, but still requires relatively high furnace temperatures of 800 to 900oC. This project addresses these limitations by building a hybrid flash/cold system and providing densification within seconds at ultra-low temperatures compared to conventional sintering. This is a highly innovative world first that could usher in a new paradigm in materials processing. Technology route to market will be licencing via technology sales to manufacturers. The project will be industry led with a steering committee of project partners, represented by the foundation industries targeted .

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
I3D ROBOTICS LTD	Intelligent Robotic Inspection for Foundation Industry Optimisation - IRIFIO	£93,851	£65,696
GLASS TECHNOLOGY SERVICES LTD		£56,243	£33,746
LUCIDEON LIMITED		£21,660	£12,996

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 collaborative, industrial R&D project will utilise machine learning to enhance artificial intelligence, robotics and vision systems when applied to foundation industry production processes. This project builds on previous work inspecting defects in metals production through digitised inspection sensor technology to enhance industrial productivity and significantly reduce energy in both glass and ceramic manufacturing. This includes the integration into factory processes visual inspection with machine learning and AI-driven automated design for the non-destructive testing of fabricated parts. Current manufacturing methods are inflexible, often requiring the time-intensive pre-programming or manual intervention of production tasks responding to unexpected occurrences or production errors. This means that foundation industries are unable to respond to the demands of future environmental requirements, and can not make further improvements within the manufacturing process until the production methods are updated. This project aims to use vision sensors to feed information into machine learning and AI algorithms to monitor and improve the metals, glass and ceramic production process. To guarantee the repeatability and accuracy of measurement, automation through the flexibility offered by modern multi-axis robotic systems will be explored. The ultimate output of the system will result in foundation industry-wide benefits in glass, ceramics and metals production. This project will address specific needs in these foundation industries by offering an augmented, existing manufacturing process thorough digitised inspection & learning. It is anticipated that a reduction in energy costs and improved production yields associated with the manufacture of tempered glass & dense ceramic materials will be significantly and positively impacted, as is the case in the steel industry.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DROCHAID RESEARCH SERVICES LIMITED	LevWave	£98,295	£58,977
ADVANCED MICROWAVE TECHNOLOGIES LTD		£84,312	£59,018
BRITEST LIMITED		£46,573	£32,601
CRODA EUROPE LIMITED		£23,148	£0
Manchester Metropolitan University		£43,237	£43,237
SAICA PAPER UK LIMITED		£2,799	£1,400

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

Funders Panel Date: 16/03/2020

Project description - provided by applicants
Driven by a range of sustainability challenges such as climate change, resource depletion and an expanding population, a circular bioeconomy concept is emerging which envisages the use and re-use of sustainable resources to meet pressing societal needs. This will accelerate in the coming decades, with biorefineries and bio-based products as key cornerstones. This in turn demands the development of new technologies to replace fossil resources as the primary feedstocks; such technologies will only be adopted at suitable scale if the economics are right for all involved. Levwave seeks to explore an innovative and highly efficient technology to produce a key sustainable chemical, levulinic acid (LA) by using aqueous streams available in the paper industry. LA has been identified as one of the top-10 bio-based chemicals. Seen as a "platform" molecule it can displace the use of fossil resources in many applications including as a green solvent, precursor for the production of advanced polymers, pharmaceuticals, additives and other commodity chemicals we all rely on. However, there is no current production in the UK. A project team with outstanding and complementary expertise has been assembled, this contains all the necessary expertise in science, technology, process design, techno-economic and environmental impact assessment and spans the entire value chain. At the heart of this concept is the microwave assisted catalytic transformation of aqueous biomass containing streams into LA. The biochar also be produced will be assessed for energy generation. The basic concept has been demonstrated by the University partner. There are several innovative aspects of this project; the impact of advanced catalysts on process and product will be assessed, the scale up to a continuous process will be studied and the end uses of the products will be investigated. These combined activities will provide data that will inform techno-economic and environmental assessments that will determine the commercial viability of the process from the perspective of both the paper and chemical sectors. This critical new data will be a key output of the project and allow a follow on to be structured accordingly, focussing on the critical aspects. This project clearly responds to the ISCF call to bring together two foundation industry sectors to explore mutually beneficial technology developments that would not occur independently. Longer term the production of this key platform molecule will drive the national ambition to become leaders in low carbon, sustainable manufacturing and create regionally distributed, highly skilled manufacturing jobs.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Q-FLO LIMITED	Low cost catalytic conversion of methane to high purity hydrogen for use in the Foundation Industries	£137,403	£68,702
ACCELYO LIMITED		£45,516	£31,861
PILKINGTON TECHNOLOGY MANAGEMENT LIMITED		£12,491	£6,246
University of Cambridge		£145,575	£145,575

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 brings together different foundation industries, bulk chemical and glass production, to realize shared opportunities for use of hydrogen by-product from functional carbon production as a supply to float glass manufacturing. This high-impact feasibility study has potential to add value to key UK industry sectors. The project partners are two Foundation Industry companies, an start up and a knowledge centre (University of Cambridge). The companies leading this proposal are world experts in functional carbon materials manufacturing (Q Flo) and glass manufacturing (Pilkington, NGS) and have strong track records of commercializing innovative manufacturing processes. The project directly addresses issues of resource utilization by delivering an innovative and cost-effective route to simultaneously produce clean and usable hydrogen alongside high value and usable carbon products. This will result in symbiosis in processes and industries. The project will demonstrate and evaluate the commercial potential of using methane feedstock to generate quality hydrogen gas and high value carbon products. Success will enable the UK to take an important lead in this emerging sector of common resource utilization technologies. It will also embed technology in the UK and open the potential to exploit significant export opportunities. The project represents Industrial Research that builds on the success of both existing commercial activities, as well as unique UK academic knowledge. Having secured the ability to produce advanced materials the project, if funded, will accelerate development of exploitation of an unused co-product, hydrogen, as a source for glass manufacturing. IUK funding will allow rapid development and trialling of this new technology for hydrogen production. This will include evaluation by members of the Foundation Industry sector for use as a process chemical. The output will be a robust, environmentally acceptable and investment ready process design for a production demonstrator scale plant. Although based in the UK, the project is international in its application and builds on innovation and research from grant and commercially funded work at the University of Cambridge; its successful completion will anchor this globally important technology in the UK. The collaboration with NSG, global players in the glass market, will open a global route to market. Delivering this project will facilitate advancement of the UK's goal of achieving a carbon zero economy while offering first mover advantage to manufacturing and development companies seeking to utilise high performance carbon based materials.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MATERIALS PROCESSING INSTITUTE	Best practice and heat recovery in gas fired continuous furnaces	£23,771	£23,771
BRITISH STEEL LIMITED		£25,710	£0
HEATCATCHER LTD		£20,067	£14,047
WIENERBERGER LIMITED		£15,677	£7,838

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 bring together expertise from both the steel and brick making industries to share best practice in the operation of continuous gas fired furnaces and waste heat recovery. The potential for using new furnace technologies and waste heat recovery systems will be explored. The project aims to show where shared best practice, new technologies and improved waste heat use can reduce furnace fuel use and CO2 emissions, reducing operating cost and contributing to the National Energy and Climate plan requirements to reduce industrial CO2 emissions by 20% by 2030\. Results from the project will be disseminated to encourage the take up of improved technologies and waste heat recovery in more than 40 other brick kilns and 20 steel reheat furnaces in the UK. The results may also be applicable to other foundation industries.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CAMBOND LIMITED	Paper, Ash and Resin: Valorisation of Foundation Industry Waste Streams	£156,277	£109,394
Bangor University		£70,653	£70,653
SAPPI BIOTECH UK LTD		£27,842	£13,921

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
Making paper, manufacturing ceramics and metals, producing ethanol and generating energy produces millions of tonnes of by-products waste a year (some 12 Million Tonnes in total). Industry has worked hard to deal with these waste streams (e.g adding ash to cement, using distillers and sugar processing residues as animal feeds, or paper waste to burn in power stations) but a substantial portion of this material still goes to landfill. But what if we could use these wastes to make more expensive or better products? Better use of these wastes could replace the use of scarce or expensive virgin resources, reduce our carbon footprint and improve the environment of the UK. One of the biggest barriers to more effective use of waste resources is cost. The cost is often linked to the technology needed to transform waste streams into useful materials. High process and technology cost leads to a failure of innovative change and the maintenance of existing environmentally damaging and high carbon manufacturing processes. Sappi and Cambond have developed different approaches to dealing with waste streams and transforming them into valuable products at a sensible price. The Biocomposites Centre has expertise in measuring the environmental and sustainability advantages of different materials to ensure the most planet friendly approaches can be chosen. Our project brings together innovative UK technology and expertise to focus them in a robust plan to drive the commercial development of a new low carbon materials technology which up-cycles waste streams and could provide a significant development in materials manufacturing in the UK. Paper mill wastes, fly ash and resins can be combined to provide a range of materials for the construction and ceramics sectors in the UK. These materials offer commercially attractive opportunities to develop and manufacture _improved_, low carbon, sustainable, products: Fire resistant boards for construction Decorative panels and tiles with ceramic-type finishes Ceramic type materials which can be moulded into many types of product We will turn environmental problems into valuable commercial opportunities producing large reductions in the carbon footprint of UK manufacturing and a materials technology which embodies circular economy principles

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This project uses waste from several foundation industries to produce an innovative manufacturing platform to enhance UK productivity and competitiveness. Innovation in the use of multiple waste streams will be commercially competitive and help meet one of the Grand Challenges -- Clean Growth.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ENVIRONMENTAL RESOURCES MANAGEMENT LIMITED	South Wales With Both Eyes Open: A Fast Start Project	£69,330	£34,665
CAPITAL LAW LIMITED		£30,000	£18,000
CELSA MANUFACTURING (UK) LIMITED		£28,103	£14,052
CONFEDERATION OF PAPER INDUSTRIES LIMITED		£3,017	£0
COSTAIN LIMITED		£7,504	£3,752
CR PLUS LIMITED		£98,410	£68,887
ROCKWOOL LIMITED		£0	£0
SECTOR DEVELOPMENT WALES PARTNERSHIP LIMITED		£0	£0

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SEXTON MATERIALS RESEARCH LIMITED		£69,035	£48,324
Swansea University		£10,000	£8,000
TARMAC TRADING LIMITED		£0	£0
VALE EUROPE LIMITED		£60,793	£30,396
VALERO ENERGY LTD		£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
The proposed is a research and development project that aims to bring multiple stakeholders within the Foundation Industry South Wales Region together to analyze material and energy flows and identify potential opportunities for collaboration. Funding will support an industrial circular economy vision that will open new opportunities for improved energy and resource efficiency. Currently there are information silos among companies operating within the region, which prevents the realization of operational synergies that could be possible through the co-location of industrial facilities. ERM will act as an intermediary organisation to facilitate information transfer and research partners will contribute innovative ideas, which will be used to develop an action plan for cooperation between facilities. Funding will support the first phase of the project, which will involve relationship building, co-mapping material and energy flows, exploring the application of existing literature, and developing an action plan of future commercial opportunities. **"Value for money"** is to Foundation Industry partners involved, the South Wales economy and the National/Global economy (contributing to the development of circular economies more broadly). Wales has the lowest productivity of any region of the UK. WRAP suggests cost savings of up to £2.0bn a year could be achieved by transitioning to a circular economy. A circular economy model could move South Wales towards less dependency on raw materials and achieving global-sustainable-development-goals, specifically related to reduction of raw materials and associated impacts on biodiversity/ emissions, contributing towards climate change. There are clearly many unidentified market opportunities, which the region has yet to explore, which this project will help identify. This includes: 1. Precious metals recovery 2. Plastics recycling 3. Food/oils/agricultural/bio-wastes recycling and energy recovery 4. Water abstraction reduction, reuse/recycling amongst sectors/local-communities 5. Waste heat networks/heat recovery 6. Local energy networks/community projects 7. Meeting the need for energy storage and peak demands 8. Shared facilities - to benefit both industries and communities. 9. Shared services (accounting/legal/etc) 10. New supply chains Wales is second best in the world at Recycling rates, this project will help to build off that attribute to support the Foundation Industries in the region. With this funding, industry would be able to provide a forum for companies to come together to explore these opportunities - getting the right people around the table to explore the potential projects. This initiative also perfectly aligns to the Welsh and UK Government circular economy objectives and sustainability, to be 'zero waste' by 2050\.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MATERIALS PROCESSING INSTITUTE	Upgrading the value of BOS slag by addition of difficult to recycle glass or slags	£41,408	£41,408
BRITISH STEEL LIMITED		£37,464	£0
Frederick Peter Wheeldon T/A PWS road building services		£4,724	£3,307
GLASS FUTURES LTD		£13,556	£13,556
TARMAC TRADING LIMITED		£21,212	£10,606

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
Steelmaking slag from the integrated route, ie made from blast furnace hot metal, is demetalled, crushed and screened, and used to create tarmac for the top surface of roads. Its rate of arising in the UK is around 500ktpa. However, it's skid resistance is not high enough for the top grade of road surface. For these locations, virgin aggregate has to be imported with its associated quarrying and transport environmental impact. Modifying the slag to increase the silica content after it is tapped from the steelmaking vessel should improve its skid resistance to the level required for the top grade of road surface. The slag modifier could be slags arising elsewhere in the process route, such as desulphurisation slag, for which there is no ready use. Other likely sources of modifier are certain streams arising from the glass industry, including waste streams contaminated by aggregates, mixed colours, and fines, which cannot be returned to the process, and high silica arising refractory waste. Thus this project objective is to use slag arising within the steel industry, and streams of waste glass and refractory from the glass industry, all of which have no ready recycling route, to modify the slag from the steelmaking process. This will then produce an aggregate replacement of higher value. The project will make a number of new slags, at the kg scale, by taking existing steelmaking slag and modifying with a number of alternative high silica sources. Thermodynamic modelling will be used to define the mixtures to achieve the aim mineralogy. The slags will be tested to assess the improvement in skid resistance and abrasion resistance. The most promising blend will be produced in a full scale plant trial and will then be further tested. Any field trial of the new slag, ie a trial road surface, must fall outside the project due to the cost and timescale. The second activity of the project is to undertake a detailed assessment of the volumes and values of waste, or difficult-to-reuse, streams of appropriate material from within the glass industry and the steel works to determine the potential for use as a slag modifier.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ALSITEK LIMITED	"SAFERII": Non-combustible Cladding Systems	£143,283	£100,298
TATA STEEL UK LIMITED		£79,129	£39,564

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
Recent tragic events, such as the London's Grenfell Tower fire in 2017, has led UK authorities to ban combustible materials in cladding systems on new high-rise residential buildings. This project seeks to deliver a completely inorganic insulative product with an insulation performance akin to PIR foam, with the significant benefits inorganic materials bring for safety in fire both from non-combustibility and a complete absence of toxic smoke emissions. There has been limited development of inorganic non-combustible insulation materials since the invention of mineral wool in the 1870s. Mineral wool remains the main viable solution to the use of Polyisocyanurate (PIR) and other carbon-based products. However, there is a significant performance divide between the insulative properties provided by mineral wool and PIR foams. This project aims to build on the Alsitek patented inorganic insulative panel core "FIRETEK" to develop an insulation material that is completely safe in fire and has physical properties and thermal performance equivalent to PIR insulation foams.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MACE LIMITED	Re-usable net-zero carbon structures	£70,633	£17,658
AKT II LIMITED		£55,142	£13,786
DB GROUP (HOLDINGS) LIMITED		£54,544	£13,636
OCTAGON I/O LTD		£54,676	£24,604
ORANMORE PRECAST LIMITED		£134,780	£47,173
University College London		£73,532	£73,532
WILLIAM HARE LIMITED		£44,079	£11,020

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Funders Panel Date: 16/03/2020

Project description - provided by applicants

Around the world, construction designers have been exploring ways to deliver highly efficient "net zero" buildings with a reduced energy demand. A key motivation for this is because around 40% of man-made global carbon emissions come from the construction and operation of buildings. Although significant advances in reducing building's operational energy have been made, the energy use within the construction process remains high.

One of the biggest opportunities for concrete and steel energy-efficiency lies in the volume and energy-intensive production of a building's structure. Because despite advances in manufactured approaches to construction, the vast majority of buildings are still delivered through a traditional approach to steel-framed construction.

We propose a prefabricated offsite alternative: a reusable, net-zero carbon structure made from recycled steel and cement-free concrete. Targeting commercial offices and infrastructure applications, the components will be manufactured offsite and delivered to the project site as sub-assemblies and installed as a single operation.

Compared with conventional construction this will reduce:

* Weight of the structural frame by 10%
* Structural steel content by 15-20%
* Deliveries to site by 40%
* Labour resources for steel frame erection and following trades by 60%
* Reduced embodied energy (and therefore carbon reduction of 80%)
* Cement content in floors by 100%

Through the application of digital engineering and sensor technology, the project will interrogate design and construction elements to optimise the design-life of the product, and create an end-of-life deconstruction strategy for the building, making it reusable. Key aims include ease of manufacture, ease of assembly on site, reduction in complexity, improved safety, logistics and long-term performance.

We will deliver a full factory trial of a two-storey, 9mx12m demountable mock-up assembly. The output will be energy efficient, reusable and scalable.

The solution supports both the cement and steel industry to be more energy efficient and competitive:

* The full-scale mock-up and performance testing of a clinker-free concrete in a structural module will demonstrate the material's capabilities in structural applications and offer a route to market - increasing trust and catalysing the uptake of low-energy (and carbon) concrete products
* The development of a reusable product and an 80% offsite construction methodology will significantly increase the ease of reuse and rework of steel, helping future-proof the steel industry.

We viewed this competition as an opportunity for the construction, concrete and steel industries to work collaboratively to develop an impactful low-energy

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solution suited to widespread adoption, accelerating all three industries simultaneously.

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Total available funding is £5,000,000

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
CELSA MANUFACTURING (UK) LIMITED	Power Generation and Heat Recovery from Industrial Waste Heat with Advanced CO2 Thermodynamic Power Cycles (PowerCO2)	£158,432	£79,216
GLASS FUTURES LTD		£18,855	£18,855
GLASS TECHNOLOGY SERVICES LTD		£29,496	£17,698
University of South Wales		£230,505	£230,505
VENTURI JET PUMPS LIMITED		£62,531	£43,772

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
Each year in the UK, approximately there are 48 TWh/yr industrial waste heat sources which is equivalent to one sixth of overall industrial energy use. Of this amount of industrial waste heat, technically 11TWh/yr (2.2 MtCO2/yr) could be potentially recovered for useful purposes such as Combined Heat and Power (CHP) through specially designed energy conversion technologies. Globally one third of energy consumption is attributable to the industrial sector, with up to 50% ultimately wasted as heat. The market of power generation with industrial waste heat is thus enormous. The project will create an innovative CO2 transcritical power cycle (iT-CO2) for energy conversion systems with industrial waste heat. Instead of using an inapplicable CO2 liquid pump, a combined CO2 transcritical compressor and vapour-liquid ejector will be developed and installed in the system to create thermal-to-electrical efficiency of a target 30% (i.e. double state-of-the-art). The project outcomes will target heat-intensive industries such as steel, glass and other heat-intensive planets that require CHP solutions on sites or grid connections.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Results of Competition: ISCF Transforming Foundation Industries: Fast Start Projects

Competition Code: 1910_ISCF_TFI_FS

Total available funding is £5,000,000

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
TETRONICS (INTERNATIONAL) LIMITED	Meeting the Industries Specific Heat Needs Through Plasma (SUNFISH)	£399,988	£279,992
GLASS FUTURES LTD		£24,829	£24,829
PLATINUM RECOVERIES LIMITED		£15,000	£10,500
UNIVERSITY OF LEEDS		£59,816	£59,816

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
By scaling and modularising the physics of the SUN, i.e. plasma, and applying it to meet the Foundation Industry Specific Heat demands (i.e. the amount of heat energy required to melt a material (in-flight melting) or maintain a gas at a set temperature (Gas space heating), as well as other resultant influences on system design), Specific Heat being the fundamental characteristic that drives the energy requirements of the Glass sector. Project 'SUNFISH' is targeted to future-proof sectors currently utilising large quantities of fossil-fuels as a source of thermal energy. This is achieved by maximising the efficiency of heat utilisation at the point of use whilst minimising emissions; both delivered by moving to a source of electrical energy delivery (plasma) with wider capabilities and functional benefits. Tetronics International Limited is a well-established UK business, renowned for developing and installing industrial high temperature Direct Current (DC) Plasma Arc technology. This project tailors and characterise the technology for application to the Glass Sector with the support and guidance of Glass-Futures and the University of Leeds. However, there is wider applicability to the metal (Platinum Recoveries Limited), cement and/or ceramic sectors, enhancing processes in terms of gas-space heating and direct thermal treatment of raw materials. The scale of the opportunity to the UK glass industry is significant (float and container glass, from a government sponsored WSP report and estimated to be worth £3 billion), with its' annual production of 3 million tonnes of glass, consuming 4.5 TWh of energy and emitting 2.2 million tonnes of CO2\. Globally the equates to 400 million tonnes of glass product per annum. Adoption of plasma could reduce the energy consumption by 50% and CO2 emissions by 38%, estimated to provide UK operators alone with an annual saving of £105 million on operational costs, which is also projected to increase with time. The working complement of project partners provides essential technology, facilities, engineering and application knowledge to expedite progress to improve Technology Readiness Levels (TRLs) and maximise the Economic and Environmental benefits in preparation for subsequent industrial deployment.

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