

Enhancing collaboration

UKRI expects that projects of this nature will require the integration of multiple stakeholders and broad transdisciplinary teams. Therefore, in order to maximise the value of this activity to the wider community, the text from the 'summary' TFS section for the successful outlines, along with the Project Lead name and lead institution can be found in this document.

This aims to support potential additional partners to identify, approach and join programmes. Any investigators involved in outlines that are not invited to proceed are encouraged to engage with those that are, where appropriate, as the full stage proposal transdisciplinary consortia are scoped and developed.

Outline proposals invited to full application stage (listed in alphabetical order of lead institution)

Title	(STEP) Systems Transition Engineering Programme
Project Lead name	Susan Krumdieck
Lead institution	Heriot-Watt University
TFS summary text	<p>Since Watt's steam engine, new technologies have built enterprises, end user benefits, economic growth and prosperity, but at the cost of man-made disasters and environmental damage.⁵ Safety Engineering, Risk Management and numerous <i>corrective transdisciplines</i> emerged in response to unacceptable damage from technological enterprise.³ Systems Transition Engineering⁴ corrective transdiscipline is emerging to shift away from unsustainable fossil fuel systems and prevent climate change disasters. The UK and Scottish Governments, and 75% of local authorities have "Declared Climate Emergency", but only 2% have a delivery plan (2021)²⁰.</p> <p>The first Systems Transition Engineering Programme (STEP) will be established. STEP will spearhead transformative shifts in business and civil practices by developing a new corrective transdiscipline for shift away from fossil energy, infrastructure, and end use systems across sectors. Hindsight review of corrective transitions will provide a framework for convergence of existing knowledge into the new discipline. A series of national cross-sector expert summits will institute the fundamentals, methods, and processes, and codify the application of systems approaches at every step. We will co-create a transdisciplinary education and research mission, a national transition engineering laboratory, and standard playbook with stakeholders within the first three years. Research into novel applications for</p>

modern digital capabilities will underpin a centre of excellence for digital infrastructure.

The STEP team have expertise in transdisciplinary research themes, co-developed with more than 150 industry, community and government partners. Cross-cutting research will devise measurements of adaptive capacity, develop design and ethics principles for new digital infrastructures, processes for transition pathfinding in complex systems, and tactical disruption of incumbent systems for strategic re-invention. Our transdisciplinary team brings the requisite expertise in key areas: equity and just transition, complex whole systems approaches, economics & investments, policies & incentives, transition engineering, engineering, computer science, data and modelling.

The research is organised into six energy activity ecosystems, with the intersecting energy, infrastructure, end-use, finance, and regulation systems. Test cases are place-based, with specific stakeholders experiencing unsustainable pressures. Energy transition can present a re-invention opportunity to achieve systemic sustainability. The initial test cases, demonstrating shift projects and digital infrastructures in the Islands, will provide the foundations for growing future STEP services.

Housing across the UK is in crisis, exacerbated by costs of energy and transport. Orkney housing is the first test case, including council, builders, digital partners and a range of stakeholders.

Personal Transport will start with the school run in rural towns and cities. We have worked with primary school teachers on a curriculum and digital mapping platform that empowers children to find their own ways to achieve net zero and safer, healthier communities.

Freight stakeholders are ferries, truck transport, and Islands NHS hospital food services, aiming to transition whole food chain systems including procurement and nutrition, developing the digital infrastructure for re-invention and adaptation of the regional system including waste circularity.

Public Buildings and Urban Form initial test case involves HWU campuses, focusing on a novel digital infrastructure that maps adaptation to gas or oil downshift through co-creating ingenuity and adaptive capacity with occupants.

Primary production works with Islands fishers and grass farmers, exemplifying traditional values, efficiency, market innovation,

	<p>measurements, and co-designing shifts and digital projects for transition to regenerative practices.</p> <p>Manufacturing and product design involves design for flexibility in a wind-dominated grid, with wool, textile, clothing, and interior design partners.</p>
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Title	STANZA
Project Lead name	Neil Strachan
Lead institution	University College London
TFS summary text	<p>Net zero emissions transitions pathways in the UK are at a critical juncture. Achieving net zero is a systems problem requiring transdisciplinary thinking for an equitable, prosperous, sustainable, and resilient transformation. If we do not take a system-of-systems approach we risk delivering “<i>the right answers to the wrong questions</i>”. We risk missing insights into critical feedbacks that could either sow inertia into already fragile pathways to net zero by 2050, or that could accelerate the net zero transformation beyond any historical precedent.</p> <p>Siloed and fragmented approaches focused on a single system (e.g. energy) are insufficient because they ignore how each system depends on others (e.g. transport) to achieve net zero targets. A system-of-systems perspective provides greater coherence, coordination and connectivity across interdependent systems and facilitates cross-system learning, sharing of good practice and innovation.</p> <p>The STANZA consortium will address the net zero challenge by taking a full system-of-systems approach to distil the widest set of transdisciplinary insights into stakeholder co-created test cases and legacy tools. STANZA members are a blend of systems scholars and net zero specialists. We are a geographically diverse and gender balanced team. Our interdisciplinary expertise encompasses: economics, engineering, environmental science, political science, organisational & institutional studies, project & infrastructure management, systems sociology, complexity theory, system dynamics and engineering systems. The consortium will be guided by a Strategic Advisory Board consisting of policy, industry, and lived practice professionals.</p>

STANZA is a “*Think and Do Tank*”. The thinking part supports transdisciplinary action by synthesizing systems and transitions conceptual approaches, and the doing part co-creates transdisciplinary test cases with key stakeholders for actionable insights and provision of legacy tools. We recognize the interplay between doing and thinking in that co-creating solutions will provide valuable insights updating our conceptual approaches.

STANZA will work through four inter-linked and iterative workstreams:

1. Combine a set of conceptual systems and transitions approaches to bridge techno-economic, environmental and socio-political understandings of net zero pathways as comprising complex, dynamic, interacting and path-dependent systems. This will redefine the goals, constraints, and opportunities of these interacting systems.
2. Build the foundations for transdisciplinary action by integrating critical disciplinary insights with stakeholders into a shared vision and actionable system-of-systems framework. The latter includes the actors, their framings and resources, institutions, decision criteria for risks and learning, and enablers of change.
3. Work with stakeholders to co-create, co-develop and co-apply systems-transitions approaches for new insights to net zero pathways through a set of novel test cases
 1. For each test case we will work with an array of stakeholders but will have an anchor stakeholder with the agency to enact findings and apply tools
 2. We have identified an initial set of systems test cases, that focus on key uncertainties in achieving net zero pathways: reimagining energy demand; delivering major infrastructure investments; enabling key actors; integrating wider systems implications
4. Create a legacy of co-created systems tools for understanding and triggering transformation – adapting existing frameworks and developing new tools – to be applied by stakeholders for future decision making
 1. Qualitative tools for co-framing and understanding net zero challenges such as co-created processes, systems maps, causal loop diagrams
 2. Quantitative tools to simulate change pathways such as system dynamics or simulation models, robust metrics to monitor progress
 3. Mixed method approaches combining both, and including spatial and artificial intelligence elements

Title	Integrated Systems Approaches for Accelerating a Just Transition (JUST-Systems)
Project Lead name	Tavis Potts
Lead institution	University of Aberdeen
TFS summary text	<p>Achieving Net Zero presents fundamental challenges for society, the economy, environment and politics. While often viewed as a technological challenge, transitioning to a decarbonized energy system involves a complex interplay between ‘systems’ of technology, governance, regulation, societal norms and finance. Simply put, achieving Net Zero is not just about replacing fossil fuels for renewables, it's about transforming our social and economic lives and embedding new ways of living and development.</p> <p>JUST-Systems aims to bridge the gap between systems approaches and a just transition, supporting initiatives that place people and communities at the centre of this change and accelerating action on decarbonisation, fuel poverty, sustainable local economies, wellbeing and social justice. JUST-Systems recognises that in the drive to achieve our UK Net Zero targets, communities must be active participants and beneficiaries, not passive bystanders where change is imposed. The transition to date has failed to galvanise widespread social acceptability or action, with increasing evidence of deteriorating local infrastructure, cost of living pressures, fuel poverty and social conflict. The ‘system’ as perceived by the public, is not working, and not delivering for communities, and in many instances is creating counter currents against Net Zero. Progress is also hindered by conflicting pathways, multiple technical approaches and ‘solutions’ that do not work for people and are mired in inertia or actively deepen poverty and social conflict. New modes of development must be people-centred and respond to the need for fairness, co-creation of wealth and create new forms of decision making on the journey to Net Zero. We recognise that changes must come at scale – linking ‘bottom-up’, place-based and grassroots-led approaches to sustainable development with ‘top-down’ approaches that enable action and channel resources, delivering change at scale and coordinating ‘systems thinking’ solutions across geographies and sectors.</p> <p>The objectives of JUST-Systems is to identify systems-based networks and interventions for facilitating Net Zero transitions; to accelerate local transitions in an inclusive and participatory manner</p>

	<p>and to derive lessons, strategies, and business models from systems approaches that can transform local and national action. JUST-Systems will employ a systems approach that co-designs technical evaluations of local energy systems into practical pathways and accelerated action that builds upon community aspirations for sustainable, liveable and resilient places. A feature of the research will be the integration of interdisciplinary systems science with community action and understanding of place that can provide solutions and pathways for achieving objectives in decentralised renewable energy, decarbonised heat, sustainable homes and transport. JUST-Systems key principle is to <i>accelerate</i> action - drawing out from a series of local and regional test cases that can inform national approaches to Net Zero and embracing whole-system perspectives that prioritize empowerment, equity, capacity building and local sustainable development.</p> <p>JUST-Systems will focus on five unique test cases. This includes working with the Torry Retrofit Project (Aberdeen) a new community initiative born out of a citizen assembly; the Community Renewable Energy Project (CoRE) (East Ayrshire Council) that will develop new local energy distribution networks, storage and community-based generation; developing an energy transition strategy with Clackmannanshire Council; decarbonisation of heat using geothermal energy in SE England; and examining the implications for Net Zero in the Welsh social care sector. JUST-Systems will facilitate learning and capacity building across the test cases, connecting 'bottom-up' grassroots action with 'top-down' systems-thinking and coordination to achieve Net Zero.</p>
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Title	People-Led Net Zero: accelerating our transition
Project Lead name	Linda Newnes
Lead institution	University of Bath
TFS summary text	Imagine you are responsible for ensuring your business transitions in a timely and just way to meet its net zero pledge. You know the UK needs to be 11 times faster in its net zero transition than it has been over the last 20 years. You have no idea why the transition is so slow. When you meet with other business leaders, who have pledged net zero targets, it is clear there are five critical barriers slowing down the transition to net zero:

1. Overcoming people and cultural barriers, everyone highlighted that engaged, informed, and motivated people are key to achieving a rapid transition.
2. Identifying which decisions to make to optimise decarbonisation.
3. Current system models which show the impact of proposed actions are often unwieldy.
4. Defining how one measures carbon in a consistent and fair manner across businesses, and where the carbon should be accounted for. Industry stated that for carbon accounting, six significantly different methods were identified across 15 commonly used regulations, policies and frameworks used for carbon reporting and trading. It was perplexing!
5. Applying policy, regulation and standards that are inconsistent and labour intensive.

Everyone wanted to achieve a just transition to net zero and identified three themes, to overcome these barriers:

- The importance of people as a core enabler in driving a successful and just transition.
- Creation of transparent and consistent approaches to measure Net Zero.
- The need for fit-for-purpose, easy to adopt and sustainable in-use system models.

These barriers cannot be tackled by one discipline/stakeholder working in isolation. Central to achieving success everyone highlighted the need for a **people-led approach** by a Flagship team that can work in a transdisciplinary manner. The assembled team for this flagship meets these criteria. The team are leaders in transdisciplinary working and in ensuring people and culture of the workforce are core to any solution. They have expertise in creating people-led solutions for transformative business change.

To realise this transformation, our stakeholders co-created ONE VISION: A people-led, practical, systems-based approach which enables business and industry to decarbonise quickly, efficiently, and productively, in a fair and just manner.

This vision will be achieved through using action-based research, with four test cases and delivering on five specific objectives. The four test cases, which have people at their core, were co-created with the whole flagship team, including non-academic partners and build on

	<p>existing research/industry needs, encompassing the whole value-chain. They are:</p> <ol style="list-style-type: none"> 1. Nuclear Decommissioning Authority – Dounreay. 2. Bath and North East Somerset - Decarbonisation of office buildings. 3. Bath and North East Somerset – Mobility as a Service (MaaS) 4. Cellular Agriculture Manufacturing Hub - Novel food production <p>For the test cases the following objectives will be used to deliver actionable insights and impact from year 1 of the Flagship:</p> <ol style="list-style-type: none"> 1. Co-create people-led current state system models for four test cases. 2. Select future state scenarios for an accelerated transition to net zero. 3. Identify rules and create minimal viable system model for a rapid and just transition. 4. Evaluate minimal viable system model and disseminate outputs. 5. Embed people-led systems-based approach within our initial partners then beyond. <p>The outputs from this flagship will enable our stakeholders to deliver a just transition to net zero, an order of magnitude faster.</p>
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Title	PACT - Production and Consumption Transformations
Project Lead name	John Barrett
Lead institution	University of Leeds
TFS summary text	<p>To meet the UK's 2030 Greenhouse Gas (GHG) emission target, we will need to reduce GHG emissions by nearly 5% each year. This is a significant increase from the 1.5% annual reduction rate we have achieved since 1990. Climate policy to date has mainly focused on the power sector but whilst the carbon intensity of the economy remains high (with fossil fuels currently accounting for 79% of UK energy demand), there is a significant role for energy and material productivity measures that critically consider the UK's production and consumption patterns. If we can align low carbon production and consumption, we can deliver the step change needed to meet our 2030 targets and set a path towards a fair and just net zero transition.</p>

Our comprehensive approach encompasses the economic, political, and social systems within which production value chains and consumption patterns evolve, and will support the development of a just, prosperous, sustainable, and resilient transition pathway to net zero. We plan to work with stakeholders to develop co-created pathways of alternative consumption and production futures that are climate compatible. We will develop new transferable analytical frameworks for the inclusion of consumption and production measures in energy and climate policy, and we will provide much needed tools for UK industry to understand their production value chains.

Our dynamic research programme will focus on actionable insights and ensure real-world impact, working with government departments and the private sector to develop impactful test cases and demonstrate the effectiveness of systems approaches. We will develop practical business models which are fit for a net zero transition, including metrics and toolkits to measure business performance and reductions in material consumption. We will explore how changes to consumption could feasibly be implemented at each level of government, from national to local, including developing a new analytical framework for policy and political change to ensure that policies are fair, effective, and inclusive. Finally, we will evaluate the societal, political, and economic systems upon which the delivery of the UK's transition to net zero depends.

Our research programme will create a series of benefits; it will equip Government with the necessary knowledge and approaches to address unsustainable consumption patterns and carbon intensive supply chains; it will equip organisations with the evidence and knowledge to understand the carbon implications of their supply chains; and it will evaluate societal, political, and economic systems in order to cement systems approaches which can realise the UK's transition to net zero.

Our strong existing networks will ensure the successful delivery of this ambitious programme of work within the grant's lifetime, whilst also bringing in new collaborators to ensure the additionality of the research. Our long-established relationships mean that we have a direct route to ensure the methodological advances associated with this project will feed into decision making processes in businesses and government departments from day one.