

Engineering X Frontiers symposium

22 to 24 April 2024

**Systems approaches in a just energy
transition for equitable access**

**All questions to be sent to
Frontiers@raeng.org.uk**

#EngineeringX #FrontiersDev



About the Royal Academy of Engineering and the Symposium partners

The UK's [Royal Academy of Engineering](#) is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone. In collaboration with its Fellows and partners, the Academy is growing talent and diversity, developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public. Together we are working to tackle the greatest challenges of our age. Scan the QR code to find out who we are.

[Frontiers](#) connects and empowers enthusiastic and proactive researchers, innovators, and practitioners from the UK and around the world to work together on new ways to solve complex global challenges. By putting collaboration and interdisciplinary thinking at the heart of development, it aims to catalyse creative solutions that deliver impact and build a global lasting community with integrity at its heart, equipped to achieve a sustainable and inclusive society.

Frontiers Symposia

These highly interactive and curated symposia bring together academics, industry professionals, NGO staff, and policymakers around a topic related to the Sustainable Development Goals (SDG) in a welcoming and inspiring format. Attendees are encouraged to participate and network with others during these interactive events and build partnerships that are diverse and collaborative.

Frontiers seed funding

After each Frontiers symposium, we award [grants of up to £20,000](#) to successful collaboration bids from the symposia. These are led by applicants based in the UK or Jordan and designed to strengthen collaborations developed at the event. These projects must address specific challenges based on community needs.

Frontiers follow-on funding

Funding of up to £300,000 over three years is available to scale up seed funded projects into fully formed collaborative research projects.

Frontiers Champions

Previous participants can apply for additional grants of up to £10,000 over one year through Frontiers Champions to help build a network around a challenge, made up of those who will benefit from the solution to that challenge.

Symposium Partnership

"Systems approaches in a just energy transition and for equitable access" symposium is being held in partnership with the [Engineering X](#) and [Universidad De Antioquia](#).



Engineering X

[Engineering X](#) is an international collaboration founded by the Royal Academy of Engineering and [Lloyd's Register Foundation](#) that promotes the contribution of engineering to solve global sustainability challenges related to the climate crisis, pollution of the environment and inequality. We bring engineers together with researchers, businesses, innovators, and policy makers to identify and work on specific challenges. We use the reputation and global networks of our founders to connect and give a platform to people working on these challenges across disciplines, countries, and systems.

We take an evidence-based approach, listen to unheard voices to inform our programmes, and champion local leadership of solutions and encourage new skills that can improve the safety and sustainability of future infrastructure, products and systems in a way that benefits everyone equally.

We have 4 programmes which we are currently working on with ambitions to grow. These are:

- [Safer End of Engineered Life](#)
- [Skills for Safety](#)
- [Transforming Systems through Partnership](#)
- [Safer Complex Systems](#)

Themes from across these programmes, such as circularity and end of life, will be drawn out throughout the symposium, particularly from our Safer Complex Systems programme.

Safer Complex systems programme

All around the world people rely on critical infrastructures to survive, stay safe, and maintain a good quality of life. Much of this infrastructure, for example food and water supply, healthcare, education, housing, transportation, and communications, is made up of complex systems that are highly interconnected and interdependent on one another. When one system fails, many other complex systems are also affected, which can have catastrophic consequences for people's lives and the environment.

The Engineering X [Safer Complex Systems](#) programme builds evidence and convenes multidisciplinary networks to educate, advocate, and govern safer complex systems.

We identify and partner with international **systems convenors, systems experts, and systems innovators** to better understand complex challenges and to embed systems approaches in the way that local solutions are designed, implemented, managed, communicated, and evaluated.

We also champion the development of a systems mindset by co-creating [resources](#) that illustrate complex systems in real-world issues, provoke meaningful conversations, and create collaborative learning spaces so that we can better tackle complex global challenges together in a systemic way.

Through this Frontiers symposium, we aspire to put systems approaches into practice with a multidisciplinary global group and specifically look at energy access and just transition. We hope to inspire participants to take up these tools and consider how we deal with complex challenges.

In the coming months, Engineering X is exploring setting up a systems hub in Colombia and are currently co-developing this idea with stakeholders in the region. We hope to gather more inputs during this symposium and will report back to participants soon.

To receive updates on the Safer Complex Systems programme and connect with the community, [click here to join the LinkedIn group](#).

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Welcome from the Event Chairs

As Chairs, we are delighted to welcome you to the Royal Academy of Engineering Frontiers Symposium *“Systems approaches in a just energy transition and for equitable access”* in partnership with Engineering X and Universidad De Antioquia.

You have been invited to this event because you are among the future leaders in your field. Participation in this symposium will open doors to a global network of talented researchers, innovators, and practitioners. You are also joining a broader network of people who aim to make a real difference. We encourage you to seize this opportunity to engage in discussions, exchange ideas, and discover collaborative, interdisciplinary and systems approaches to tackle the significant challenges our planet is facing.

Contributions to addressing the world’s most pressing development challenges related to equitable, secure, and accessible energy system are increased manifold by combining the varied skills of engineers, systems thinkers, social scientists, and natural scientists, from provision of essential resources and services, to enhancing resilience to natural and artificial hazards and the protection of the planet we live on while managing to grow sustainably. This symposium aims to promote international development, encourage collaborative work, and facilitate cross-disciplinary and systems thinking among the upcoming generation of leaders.

Challenge-led research at the frontiers of traditional disciplines is particularly likely to lead to real environmental, economic, and social impacts. If we want to resolve these challenges, we need to connect the future leaders across all disciplines by building strong links between academia, industry, civil society, and government across the world.

We aim for the symposium to be both enjoyable and productive, offering an exciting platform for collaboration. We extend our best wishes for your success during the event.

Yasmin Merali

Emeritus Professor - The University of Hull, UK

Franklin Jaramillo Isaza

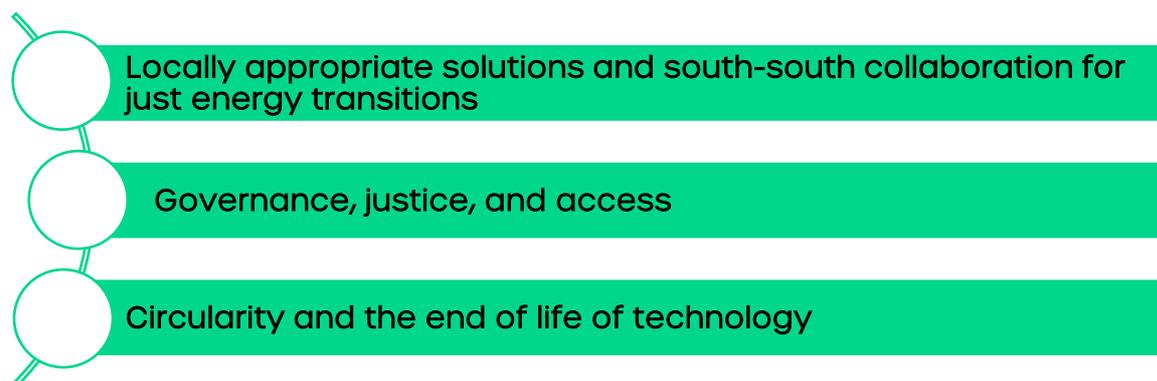
Professor, Universidad de Antioquia, Colombia

Structure and themes of the symposium

The event theme will explore challenges in transitioning to an energy system that is fair, safe, and accessible. By analysing this complex issue using systems approaches, the event aims to identify innovative proposals and practices that ensure access to reliable and clean energy in low- and middle-income countries and consider how engineering clean energy intersects with a variety of disciplines, sectors and actors, including the role of governance.

The symposium will include an introductory session that will enable participants to cultivate a systems mindset and prepare them for the subsequent sessions where they will be able to exercise their capacity for systems thinking in addressing the challenges posed. Different methodologies and techniques will then be used across the following days of the symposium which will consist of three interactive sessions. The days will be interspersed with networking opportunities, receptions, and dinners.

Themes



Funding opportunity

Participants are invited to apply for the Engineering X Frontiers seed funding of up to £20,000 to help kick-start a new interdisciplinary collaboration. Please go to page 47 to check further details on the seed funding or visit [the Academy website](#).

If you think you will apply for the funding, it is worth forewarning the relevant authorities before the event, as the timeline for gaining institutional approval for your application will be very tight.

Networking opportunities

- Participant countdown
- Interactive activities during each session
- Networking meals including welcome dinner
- External activities
- Frontiers insights
- Linking-up session

Participant countdown

The participant countdown offers participants an opportunity to introduce themselves and express their goals for the symposium. The participants will be divided into four groups. Each member of Group A will have 1 minute to introduce themselves to the entire symposium. Following Group A's presentations, there will be a 15-minute period for delegates to approach Group A with additional questions. This pattern of 15-minute presentations and 15-minute discussions will continue for the remaining groups.



It is worth planning what you would like to say in your 1-minute presentation, so that you come prepared. We recommend you cover your expertise, interest in the symposium topic, and what you hope to gain from the event.

Funding opportunities and opportunities for initial pitches

This session offers volunteers the chance to pitch their ideas for seed funding proposals, find potential co-applicants, and receive valuable feedback. Only 10 slots are available by sign-up during the event. It is a unique chance to develop ideas and gain support from other symposium participants.

Frontiers insights

This session captures key messages and discussions from the event, contributing to the post-event outputs. We encourage an open and collaborative debate, where all points of view are respected and listened to. This session will be led by the event Chairs.

Linking up/proposal planning

The linking up session equips delegates with the building blocks for interdisciplinary collaboration for a seed funding project application. Here, delegates will work with each other to sketch out project ideas, outlining clearer ideas, goals, and early plans. There will be an opportunity to gather input from

your fellow delegates or join forces with others working on something similar. It's a valuable opportunity to forge connections and strengthen your project.

Logistics

For all logistical details, please refer to the **“Welcome to Colombia Travel Guide and Logistics”** logistical guidance document sent to you via e-mail.

Schedule

Sunday 21 April		
From 15.00	Arrival of participants to check in	Faranda Collection Hotel
18.30	Welcome reception and dinner	
Monday 22 April		
6.30	Breakfast served	Faranda Collection Hotel
8.00	Departure from hotel to venue	
9.15	Introduction from RAEng and Event Chairs	Universidad de Antioquia
9.35	Welcome remark: <ul style="list-style-type: none"> Professor Luz Fernanda Jiménez Segura - Vice-Rector for Research, Universidad de Antioquia 	
9.45	Introductory session: Participant countdown	
11.15	Coffee break	
11.45	Introduction to systems approaches session (part 1)	
12.45	Lunch	
13.45	Introduction to systems approaches session (part 2)	
15.30	Coffee break	
16.00	Session 1: Locally appropriate solutions and south-south collaboration for just energy transitions	
18.00	Group photo/departure	
19.00	Dinner	Herbario restaurant
20.30	Depart for hotel	
Tuesday 23 April		
6.30	Breakfast served	Faranda Collection Hotel
8.15	Departure from hotel to the venue	
9.15	Keynote: Professor Alexander Gómez Mejía	Universidad de Antioquia
10.00	Coffee break	
10.30	Session 2: Governance, justice, and access	
12.30	Lunch	
13.30	External activity	Comuna 13

18.00	The British Embassy reception/dinner	Ruta N
20.00	Depart for hotel	
Wednesday 24 April		
6.30	Breakfast served	Faranda Collection Hotel
8.15	Departure from hotel to venue	
9.15	Session 3: Circularity and the end of life of technology	Universidad de Antioquia
11.15	Coffee break	
11.45	Funding opportunities and initial pitches	
12.45	Lunch	
13.45	Linking up/Proposal planning	
14.45	Keynote: Carlos Enrique Vélez Restrepo	
15.30	Frontiers insights	
17.00	Event Chairs & Academy wrap up	
20.00	Departure: return flights and travel	Faranda Collection Hotel

Introduction to systems approaches: cultivating a systems mindset

The event will begin with a 2.45 – hour introductory session to systems which will be chaired by Professor Yasmin Merali.

This session will articulate the fundamental value proposition of systems approaches appreciating there is a range of methods and tools for addressing different aspects of the systems they will engage with in the future. This will set the tone for how delegates will analyse the energy challenge.

This session will enable participants to cultivate a systems mindset and prepare them to use systems thinking principles for the sessions to come. It will use the co-creation of a rich picture to explore the diversity of perspectives, issues and opportunities that they need to be aware of when positioning themselves in the energy transition and access challenge. Through this exercise, participants will gain a deeper understanding of the systemic nature of these challenges and explore potential solutions from a holistic perspective.

Session Structure:

- **Introduction to Systems Thinking:** The session will begin by introducing the concept of systems thinking and its importance in addressing complex issues such as the energy transition and access challenge.
- **Rich Picture Creation:** Participants will be divided into small groups and provided with materials (such as markers, sticky notes, and a large poster board) to create a rich picture depicting the energy transition and access challenge. They will be encouraged to identify key stakeholders, drivers, barriers, feedback loops, and potential interventions.
- **Facilitated Discussion:** Participants will engage in facilitated discussions centred around the rich pictures created by each group. They will be encouraged to explain their illustrations and articulate the underlying systemic dynamics depicted.
- **Reflection and Synthesis:** A reflective session will be led where participants will share their observations and insights gained from the activity.
- **Key Takeaways and Next Steps:** The session will conclude with a summary of the key takeaways, emphasising the value of adopting a systems mindset in addressing complex societal issues.



Many of our participants are well versed in the use of systems approaches. If that is your case, we encourage you to share your experiences and practices in the reflections section so that others can benefit from listening applications of these methods in real world scenarios.

Resources: [Complexity Network Ecosystems](#) & [Foundations](#)

Session 1:

The session is led by session co-chairs as follows:

- **Hannah Härtwich & Gianne Tillema** – Systems Innovation Amsterdam Hub
- **Professor Jairo Espinosa** – Universidad Nacional de Colombia
- **Andres Bustamante** - EcoSwell

Session abstract:

To reach a future where everyone has access to clean energy (SDG 7), engineering innovation is critical. This includes the development, installation, and maintenance of clean energy infrastructure, including renewable, such as wind, solar, hydro, and geothermal, along with efficient energy storage. However, the current landscape is marked by inequalities in technology design, production, and implementation, particularly between high- income and low- income nations. Renewable technologies are often tailored to richer nations in the Global North and are therefore not designed for tropical climates or different wind speeds which can lead to unequal outcomes in other regions. Researchers and innovators in the Global South need the right resources to develop context-appropriate solutions. We also see systems developed in the Global North often setting a precedence for future system management in the South. This trend is visible historically within the oil and gas industry and is now seen emerging within offshore wind. It is key to understand the context and complexities of energy systems in the Global South, especially in the management of relationships between stakeholders and their roles in ensuring project sustainability.

Questions:

- What are all the aspects we should consider when setting up an energy system and how are they interconnected?
- What role do stakeholders (local & external) play within energy system implementation and how can these be managed to ensure a sustainable project?
- What makes a solution locally appropriate?
- Why can duplicating solutions from the Global North in the Global South lead to issues?

Keywords/concepts: energy system, locally appropriate solutions, stakeholder management

Session plan:

- Introduction from Event Chairs and Session Chairs (5 minutes)
- Presentations (20 minutes)

1. Complex Cases of Energy System implementations in Peru - **Andres Bustamante**

Every project and energy system implementation poses a unique set of challenges that must be addressed to ensure a sustainable outcome. In Peru, like in many other developing countries, the social approach of working with vulnerable communities and the proper management of relationships between stakeholders are perhaps the most vital aspects that influence success. This short presentation will provide detail on a case study of a Hybrid Microgrid implementation in a remote settlement in Nazca, Peru that gained access to energy for the first time. It will focus on the complexity of the context and key stakeholders involved, and how throughout the project implementation difficult and delicate decisions had to be made which would determine the end result.

Resources:

- [Empowering rural areas: Microgrid initiatives in developing countries](#)
- [How Microgrids can facilitate energy access and electrify rural Africa](#)
- [Energy communities in sustainable transitions: The South American case](#)

2. **Professor Jairo Espinosa**

- Exercise presentation (10 minutes)

3. 3D Mapping the energy system - **Hannah Härtwich & Gianne Tillema**

During the workshop part of this session, we will work with 3D mapping in order to deepen our understanding of what is needed to make an energy system locally appropriate. We will use a collection of small items to build a visual representation of all the aspects we need to consider when setting up an energy system and how they are connected to and influence each other. Based on this visualisation, we will think about where there are significant differences in requirements comparing energy systems in the Global North to energy systems in the Global South and discuss why South-South collaboration is needed.

Resources:

- [3D mapping demonstration](#)

- **Exercise: 3D mapping**
 1. Group mapping (50 min)
 - Round of introductions
 - Groups build an answer to the question with physical elements
 - Groups add labels and key insights
 2. Group sharing (20 min)
 - One or two people per group remain at their table to explain, the other participants walk through the room to explore the other maps
 - Participants write their reflections down on sticky notes and post them on a central wall

- **Closing circle (10 minutes)**

Session 2:

The session will explore the theme, led by session co-chairs as follows:

- Dr Pedro Pablo Cardoso Castro – University of Exeter
- Stella Leona Deppe - Development Cooperation Agency Germany, GIZ
- Professor Andrés Felipe Colorado – Universidad de Antioquia

Session abstract:

Governments and decision-makers face a wicked challenge as they seek to move to clean energy and electrify their countries in a sustainable way. This requires them to identify levers to intervene, acknowledging local practices and informal institutions, limits to regulation, and opportunities to innovate with a wide array of stakeholders. The session will explore various angles from a) both governance approaches for sustainable systems transformation (Mission-Oriented Innovation), to b) more holistic frameworks for exploration of boundaries of systems (Critical Systems Heuristics) to c). case-studies regarding the inclusion of indigenous rights for a just energy transition.

Questions:

- How the deep understanding of stakeholders and boundaries provides the conditions for justice, inclusion and (participative) governance in projects that involve socio/economic transformations?
- What are transformative approaches for governance of complex systems that are part of the current academic and practitioners' debate? What role can and should development cooperation play?

Keywords/concepts: Inclusive Governance and Stakeholder Mapping, Agency of transformative approaches, Critical Systems Heuristics, Capability Approach, Indigenous Rights

Session plan:

- Introduction from Event Chairs and Session Chairs (5 minutes)
 - Briefing: SCCs presentations (30 minutes)
1. Mission-Oriented Innovation Policy as a transformative governance approach for complex systems? Hype or hope and what current exploration can help us learn for the role of both innovators, governments, and donors? - Stella Leona Deppe

Mission Oriented Innovation (MOI) is transformative approach for policy makers to govern complex systems mission. The short input will explore what sort of “missions” are out there, what this could mean for a just energy transition and to what extent the inclusiveness and agency are considered. There will be a short detour to a new management framework of social impact the includes Amartya Sen’s lenses of impact (capabilities and agency). Participants get the opportunity to include their thoughts on the introduced approaches to the following case studies plus the CSH interactive session (3. on the agenda).

Resources:

- [Mission Oriented Innovation: A New Approach for Development Cooperation?](#)
- [MOI for net zero transition](#)
- [OECDs Mission Action Lab](#)
- [13 reasons why missions fail](#)
- [Examining proto-missions](#)

2. Renewable Energy and Indigenous Rights: The Colombian Case of Balancing Sustainability and Social Justice - **Professor Andrés Felipe Colorado**

Colombia, situated at the nexus of renewable energy advancement, harbours significant potential for solar and wind power initiatives, notably in La Guajira, which offers optimal wind speeds and abundant solar resources. However, this potential is intertwined with a multifaceted interplay of environmental, cultural, and socio-political dynamics. Focusing on La Guajira, this presentation examines Colombia's endeavours in implementing new renewable energy projects. Despite being home to diverse indigenous communities like the Wayúu, the region faces a delicate balance between environmental preservation and energy expansion. Historical injustices and corruption have tainted previous projects, fostering disillusionment among indigenous groups who see little benefit from these ventures, exacerbating socio-economic disparities. Consequently, despite its vast potential, La Guajira struggles to attract new investments, with many projects stalled or redirected elsewhere. As Colombia seeks to bolster its renewable energy capacity, addressing these complexities is paramount. Aiming for inclusive governance frameworks prioritizing indigenous rights and community empowerment is crucial, learning from past successes and failures to forge a path that reconciles renewable energy development with indigenous aspirations, ensuring a fair and sustainable energy transition for all stakeholders.

Resources:

- [Wind resistance: can Colombia overcome opposition to get its green energy plan back on track?](#)
- [Wind energy and Wayuu Indigenous communities: challenges in La Guajira. José Vega Araújo, Miquel Muñoz Cabré, Yismary Ramirez, Reinaldo Lerma / Published on 13 July 2023 / La Guajira, Colombia](#)

- [La Guajira: The renewable centre tearing itself apart over wind. Alex Donaldson.](#)

3. Exploring the use of Critical Systems Heuristics in community-based projects - **Dr Pedro Pablo Cardoso Castro**

This presentation (and workshop) delves into the complexities of stakeholder ecosystems using Critical Systems Heuristics (CSH). Moving beyond simple stakeholder mapping, we will critically examine the boundaries that define who and what matters within the system. Through facilitated exploration of these boundaries from various stakeholder perspectives, participants will uncover underlying values, potential power imbalances, and opportunities for collaboration and (social) innovation. This collaborative process empowers participants to co-create sustainable solutions aligned with their project's goals.

Resources:

- [A Brief Introduction to Critical Systems Heuristics \(CSH\)](#)
 - [Evaluation Based on Critical Systems Heuristics.](#)
 - [Chapter 6 Critical Systems Heuristics: The Idea and Practice of Boundary Critique](#)
- **Let the game begin (role-play - 50 minutes) - apply the CSH method in your project**
 - Once organised in groups in the different tables, each group will select a table project led by one of the members who will act as the project/problem owner. The other members of the group will act as consultants/advisors.
 - Each group will start to question the project and its purpose "as-it-is" through answering the CSH 12 questions, taking note of their findings (and discussions) that emerged in the process.
 - Once you questioned the project and took record of your answers, question the project again. This time, from the perspective of what could be ideal for the project/problem situation, the "Ought-to-be" perspective. As in the previous round, take note of your answers, finding and discussions, making sure you are revisiting the same questions from the previous round
 - Now, compare the answers from both rounds. (10')
 - Pay attention to the lists of stakeholders in each case (as-it-is and ought-to-be in your answers.
 - Collect the findings and records of the previous stages in your group and prepare a presentation to share your learnings and reflection of the session with the room.

- Sharing Findings and learnings: Groups feedback what they have learned/built/discussed (25 minutes)
- Debriefing: SCs reflection on the session (10 minutes)

SCS: Safer governance of complex systems project.

As part of our work understanding challenges in the governance of complex systems, our partners in [Strathmore University, UNESCO Climate Change Resilience and Sustainability centre](#) hosted multi-stakeholder roundtable discussions which informed a report that takes a systems approach to analyse electricity systems issues in Kenya. This [report](#) presents a holistic view on how socio-economic systems and technical engineered systems interact regarding access, maintenance, and regulation.

It was concluded that electricity access is an emergent feature resulting from interactions between technologies, governance, and economic considerations in a complex ecosystem.



Are you interested in this topic and want to learn more about how to better govern complex systems? Explore more resources [here](#).

Session 3:

The session will explore the theme, led by session co-chairs as follows:

- **Aída Luz Villa Holguin** - Universidad de Antioquia
- **Annabel Membrillo** - Universidad del Medio Ambiente
- **Alejandra Tabares Pozos** - Universidad de Los Andes

Session Abstract:

This session underscores the critical role of the circular economy in managing the rising demand for minerals in clean energy technologies, emphasizing the need for sustainable end-of-life management and lifecycle planning. Strategies proposed include embedding circular economy principles such as durability, repairability, reuse, and recycling into renewable energy expansion, alongside effective waste management systems and sustainable procurement criteria. The presentations advocate for cross-sector cooperation, industrial symbiosis, and innovative business models to promote circularity, supported by policy measures and financing mechanisms. Moreover, the presentations highlight the importance of considering full lifecycle impacts and utilising collaborative tools like the iceberg model to explore underlying thinking patterns and drive interventions for sustainable energy solutions. Collectively, a systemic approach is needed to address sustainability challenges in the energy transition, advocating for collaboration, innovation, and the adoption of circular practices for a more inclusive and sustainable future.

Questions:

1. What are some examples of successful collaborations between different sectors that have resulted in promoting circular practices within the renewable energy sector?
2. How can the use of collaborative tools like the iceberg model underpin the arguments to weigh alternatives that enhance decision-making processes and encourage stakeholders to adopt more sustainable energy solutions, particularly in addressing complex systemic challenges?
3. What are the main sources of minerals used in the production of green energy technologies and which minerals could be recovered for their reuse?
4. How could the clean energy technologies be disposed to comply with circular economy principles?

Keywords/concepts: circular economy, sustainable end-of-life management, lifecycle planning, cross-sector cooperation, critical factors for circular solutions, critical minerals

Session plan:

- **Introduction from Event Chairs and Session Chairs (5 minutes)**
 - **Presentations from session chairs (30 minutes)**
1. **The circular economy as strategy in the use of critical minerals for clean energy transition – [Aída Luz Villa Holguin](#)**

In the production of green energy technologies, a large amount and diverse range of minerals are required. The demand of photovoltaic panels and lithium-ion batteries for energy storage have considerably increased as part of decarbonization measures. This increase has resulted in the enhanced consumption of critical materials; critical materials such as gallium, indium, and the rare earth elements are mostly obtained from primary metal mining and refining. Improper disposal of materials that contain metals would cause waste of resources and have adverse environmental effects; recirculation of materials would prevent future extraction of raw materials from nature. This presentation will show information about classification, use and demand of critical minerals, as well as some strategies for using critical minerals under circular economy criteria.

Resources:

- [Critical minerals](#)
- [The Role of Critical Minerals in Clean Energy Transitions](#)
- [New Report: Scale-up of critical materials and resources required for energy transition](#)
- [The Circular Economy and Critical Minerals for the Green Transition](#)
- [A circular economy for critical minerals is fundamental for our future](#)

2. **Circularity in renewable energy planning - [Alejandra Tabares Pozos](#)**

The global shift towards low-carbon energy underscores the necessity of sustainable end-of-life management for renewable energy infrastructure. Key technologies like solar panels, wind turbines, and batteries are pivotal in addressing climate change and ensuring equitable energy access. Yet, their deployment risks significant environmental impacts without thoughtful lifecycle planning.

This presentation delves into strategies for embedding circular economy principles into renewable energy expansion, emphasising durability, repairability, reuse, and recycling to reduce waste and pollution. The establishment of effective waste management and reverse logistics systems is crucial for material recirculation at the end-of-life stage. The discussion extends to the need for lifecycle assessments and sustainable procurement criteria, along with the benefits of cross-sector cooperation and industrial symbiosis in utilising waste and byproducts. Highlighting the role of policy, innovative business models, and financing, the presentation advocates for circular practices across the renewable energy sector.

Emphasising a systems approach that considers full lifecycle impacts, the presentation aims to foster a collaborative dialogue on circularity challenges and solutions, concluding with a call for cross-sector innovation towards a sustainable, inclusive energy future.

Resources

- [Circular economy principles in the context of energy transition](#)
- [Renewable energy for sustainable development in India: current status, future prospects, challenges, employment, and investment opportunities](#)
- [Sustainable energy management in a circular economy framework](#)
- [End-of-life management of photovoltaic panels: Trends in PV module recycling technologies](#)

3. The iceberg tool as a systemic lens to circular challenges - **Annabel Membrillo**

Sustainability challenges call for creative exploration of solutions. It asks us to have the ability to dance between seeing the forest and seeing the tree and, above all, integrate these visions. To approach these challenges there is a growing need of using collaborative tools that can enhance our vision and thinking to support solutions design. One popular tool is the iceberg model due to its accessibility and fast application.

The iceberg model offers a structure of 4 levels of thinking: events, patterns, structures and mental models. Each one of these levels gives a layer of the systems from which we can analyse a specific situation, and from there identify different levels of possible interventions.

The presentation looks to provide an adapted iceberg framework to embark on a rich exploration that will draw from the other two presentations. Working in small groups we will explore the underlying thinking that decision makers usually go through to think about sustainable energy solutions, and why some of the times decision makers create wicked solutions that can perpetuate the problem or create new problems, for example promote and economy based on renewable technologies without transitioning processes to reuse materials perpetuate the same problem that we have created with no renewable solutions.

Resources:

- [Systems Thinking Tools](#) - Applying the iceberg model
- [Iceberg Model - Ecochallenge.org](#)
- [Systemic Thinking in the Circular Economy | by Alice Casiraghi](#)
- [Circular Economy Seminar II // CDW management - IAAC Blog](#)

- **Scoping opportunities to strength circular strategies for technology (50 minutes)**

The group will be divided into 6 groups of 10 people. Groups will be assigned a region/subsector to analyse what is needed to transition from non-renewable energies to an economy of green energy and low carbon energy technologies. Using the 4 levels of the iceberg model the group will explore the following:

- **Current state:** the current state and the thinking behind the non-renewable energy and non-circular economy within the region assigned.
- **Desired state:** what will need to happen to transition to green energy technologies with circularity processes, the potential new entry points to crack the system.
- **Criteria for possible solutions:** create a set of criteria to suggest for the design of prototypes or solutions to be more collaborative, inclusive and considering a circular mindset for implementation for the challenge.

- **Tables feedback (using the iceberg template) to the room & discussion (30 minutes - 4 minutes each)**

While participants are presenting, the rest of the groups will underline commonalities they discover between them and the other groups.

- **Conclusions and Wrap Up (5 minutes)**

Event Chairs

Professor Yasmin Merali - Emeritus Professor of Systems Thinking at the University of Hull

Professor Yasmin leads pioneering research in Complex Systems Science. Her work transcends traditional boundaries between the natural and human sciences, drawing on Complex Systems Science to study the resilience of socio-economic systems in the networked world. She has published widely in peer-reviewed journals and produced numerous reports for government and industry.



Professor Yasmin was Co-Director of the ESRC Doctoral Training Centre on Complex Systems Science at Warwick University and Director of the Information Systems Research Unit at Warwick Business School. Her work extends internationally, with roles such as EU Expert Evaluator and membership on key committees including the European Complex Systems Society and UNESCO.

Professor Franklin Jaramillo - Professor at the School of Engineering, Universidad de Antioquia

Professor Jaramillo is a leading expert in renewable energy and sustainability. His expertise includes nanotechnology, nanostructured and flexible solar cells, semiconductor solution processing, building-integrated photovoltaics, precision agriculture and energy, materials for energy, green hydrogen, and energy sustainability. With over 100 publications, 11 book chapters, and 2 patents, he has supervised over 30 theses and led numerous research projects.



Professor Jaramillo holds degrees in Chemical Engineering from Universidad de Antioquia and a PhD in Chemistry from the University of Manchester. Currently, he leads the "Program for the Development and Establishment of an Intelligent Network Enabling the Management, Utilization, and Storage of Unconventional Renewable Energies and Green Hydrogen in Residential and Industrial Sectors – Perseo" (2024-2027).

Keynote speakers

Professor Alexander Gómez Mejía - School of Engineering, Universidad Nacional de Colombia

Professor Alexander holds a PhD in engineering and serves as a full professor in the Department of Mechanics and Mechatronic Engineering at Universidad Nacional de Colombia. His expertise lies in research and development within energy systems, bioenergy and hydrogen. Additionally, he provides consulting services on energy transition for both the Ministry of Mines and Energy and the Ministry of Science, Technology, and Innovation in Colombia.



Carlos Enrique Vélez Restrepo - Empresas Públicas de Medellín EPM

Carlos is a senior professional within EPM's New Solutions department, with over 18 years of experience in the innovation department within the EPM Group. Carlos has a Mechanical Engineering degree from EAFIT University and an MBA from Southern New Hampshire University. He spearheaded the Corporate Venture Capital initiative, investing in over 12 startups. Formerly the General Manager at Aguas de Urabá, a subsidiary of EPM, Carlos also served on the board of directors for startups funded through the CVC fund, showcasing his adeptness in driving innovation and fostering growth.



Participant biographies

LinkedIn profiles are linked to the names in this section, please use PDF document to access and navigate these

[Adam Cooper](#), UCL Department of Science, Technology, Engineering & Public Policy

I'm an interdisciplinary/transdisciplinary social scientist academic and ex-civil servant who studies engineering policy - both policy for engineering and engineering for policy. I have a background in energy policy having been the Head of Social Science Engagement at the UK's then energy ministry the Department of Energy and Climate Change.



[Aída Luz Villa](#), Universidad de Antioquia

I am an academic and an interdisciplinary researcher. My areas of expertise include the development of new materials for energy applications, custom electronic design for humanitarian technologies for water monitoring and energy conversion, and thinking on the intuitive, and integrated integral practices and experiences/interfaces with the end-users of technologies.



[Alba Avila](#), Universidad de los Andes

I am an academic and an interdisciplinary researcher. My areas of expertise include the development of new materials for energy applications, custom electronic design for humanitarian technologies for water monitoring and energy conversion, and thinking on the intuitive, and integrated integral practices and experiences/interfaces with the end-users of technologies.



[Alejandra Tabares](#), Universidad de los Andes

I am an Industrial Engineer with a Ph.D. in Electrical Engineering, adept in energy systems optimization. My expertise includes renewable generation, energy storage, and electricity market restructuring, employing AI. I'm actively involved in research, with a passion for applying mathematical models to real-world energy challenges.



[Alessandro Bezerra Trindade](#), Federal University of Amazonas

I am a professor and researcher at Federal University of Amazonas. Research areas: rural electrification, renewable energy, model checking, formal verification, formal synthesis, optimization. With skills in: business models, planning, management, competitive intelligence, strategic planning.



[Alvaro Jaramillo Duque](#), Universidad de Antioquia

I earned my Bachelor's degree in Electrical Engineering from Universidad de Antioquia in Medellín, Colombia, Master's degree and a Ph.D. from Universidad Carlos III de Madrid in Spain. Currently, I hold professorship in the Department of Electrical Engineering at Universidad de Antioquia. My research interests lie in data analytics, renewable energy, smart grids, optimization, power systems, and software development.



[Amy Deeprise](#), Allianz

I'm at the early stages of my career as a Systems Thinking Consultant within Allianz. I've worked with various levels of stakeholders on interventions across the UK, India and Germany. Having recently completed a Masters Level Apprenticeship as a Systems Thinking Practitioner, I am keen to broaden my experiences further.



[Ana Escudero](#), Universidad Pontificia Bolivariana

I am a researcher and consultant in the fields of energy efficiency, power generation, regulation and energy markets. Member of the Energy and Thermodynamics Group at Universidad Pontificia Bolivariana for more than 20 years. Responsible for the design, planning and executing research projects applied to the industry sector. With teaching experience in graduate and undergraduate programs and tutoring master and PhD students.



[Andres Bustamante](#), EcoSwell

I am a passionate and value driven social entrepreneur with over 15 years of professional experience in marketing, sales and international development. I co-founded EcoSwell in 2013 and lead all of our renewable energy projects and also the organizations marketing systems and strategy.



Andres Colorado, Universidad de Antioquia

Professor of mechanical engineering



[Angus Kerr](#), Social Finance

I am a systems thinking practitioner, working with UK local and central government on social issues. Recently, I have specialised in information management, with a specific focus on access to and understanding of data to make impact.



[Annabel Membrillo](#), Universidad del Medio Ambiente

I am a co-conspirator for systemic change, systems transformation and collaborative strategies processes with a wide variety of organizations (business, not-for-profit, government, networks, communities). My focus and passions are exploring new ways of agreements, organizational and networks structures, co-host deep collective change processes, integrating systemic and strategic tools and methodologies.



[Camilla Perotto](#), Scipopulis

I'm a Civil Engineer pursuing a Master degree in Public Policy. Because of strong analytical skills, my interests intersect big data analysis and urban planning. At Scipopulis, I work as data scientist proposing innovative solutions to problems such as GHG emissions and developing data products to support decision making.



[Camilo Ramirez](#), KTH Royal Institute of Technology

I am a PhD candidate and researcher at the division of Energy System (KTH-dES) at KTH Royal Institute of technology Sweden. I use GIS-based tools to model energy systems interactions with sustainability. My research focuses on providing data-driven insights to support universal electricity and clean cooking access.



[Carlos Martínez-Smit](#), Universidad de La Guajira

I am a Civil Engineer with a Master's degree in Renewable and Clean Energy Engineering and a Ph.D. in Engineering, specializing in Energy Systems. My expertise is in thermochemical processes of biomass, porous carbon material synthesis, and catalysis. I am also an experienced professor at the University of La Guajira, focusing on renewable energy resources, wind, and hydro energy.



[Cephas Samende](#), University of Strathclyde

I am a co-founder of ERAC Energy Limited and a Research and Development Engineer in the whole energy systems team at PNDC. My research at PNDC aims to facilitate a cost-effective energy transition through real-time power simulations and, the development of mathematical and AI-based optimisation models and tools.



[Chabelly Medina](#), British Embassy in Colombia



[Claire-Elise Orleach](#), Taka Tech

I am an environmental engineer with 12+ years experience in utilities. I started my career with Engineers Without Borders in West Africa and have since worked in corporates (Veolia) and start-ups. Today I am a freelance consultant providing ClimateTech organizations strategic, innovation and commercial leadership and am working on new ventures.



[Claudia Berenice Muciño García](#), Tecnológico de Monterrey

I am an architect with an MSc in Advanced Sustainable Design. In recent years I specialized in Latin American cities, energy transition, urban politics, and social impact. I've worked in private practice, municipal government, and NGOs. I am currently the Director of the architecture program at Tec de Monterrey, Puebla.



[Conrado García Madrid](#), SC Group

I am a consultant with extensive experience, designing and applying strategic tools and methodologies to facilitate the development and testing of corporate strategies and business transformation initiatives, with clients such as: LEGO Foundation, Kellogg Foundation, Rainforest Alliance, Universidad del Medio Ambiente, Social Impact Exchange, Prudential Insurance, Garfield Foundation, Bell Canada.



[Cristian Gil-Sánchez](#), Instituto para la Acción Pública

I am a Colombian economist, researcher and designer with more than 10 years of relevant mixed experience (public, private and international cooperation) launching innovative interventions. I am the co-founder and creative director of a community-engaged research center with the purpose to test and launch a new generation of regenerative interventions.



[Daniel Hefft](#), Puraffinity Ltd

Dr Daniel Hefft is the Senior Process Development Engineer at Puraffinity (PFAS removal). With degrees in food and chemical engineering, he is known for expertise in process design. Daniel chairs the IAgRE Engineering for Food & Drinks SIG. He has over 90 publications. He's honoured with scientific awards and holds patents.



[Danny Ibarra Vega](#), Universidad de Antioquia

I have a doctorate in engineering, with a postdoctoral stay in sustainability, and modelling of socio-ecological systems. I completed a master's degree in environmental management, I am environmental engineer and biotechnology engineer. Currently, my research is: circular bioeconomy, waste management, and sustainable territories, applying a modelling approach with Systems Dynamics.



[Dhiraj Kumar Mahajan](#), Indian Institute of Technology Ropar

I am an academic, working as Associate Professor in the Department of Mechanical Engineering at Indian Institute of Technology Ropar, Punjab, India. My research focuses on the interface of materials, mechanics and design towards novel technologies development in the field of hydrogen based clean energy and biomedical devices.



[Dipesh Joshi](#), Eco Earth Foundation Nepal

I am a conservation practitioner where I work with communities to enhance their climate resilience through assessments and planning, mainstreaming and implementation of climate and conservation interventions. I support to build capacity of the most marginalized and climate vulnerable communities, governments and the civil society around climate change.



[Emiliano Diaz del Valle](#), Busara Center for Behavioral Economics

As an Applied Behavioral Scientist with a BSc in Economics and an MSc in Experimental Economics, I specialize in financial inclusion, gender-based violence, and consumer choices. Founder of IMEC, Latin America's pioneering non-profit Behavioral Science firm, I now contribute to Busara, the world's leading applied behavioral science non-profit.



[Gianne Tillema](#), Systems Innovation Network (Amsterdam Hub)

I am a Systems Thinker with a background in Human Centered Design. Together with Hannah Härtwich I run the Amsterdam Hub of a Systems Innovation Network, a global community of Systems Innovators. My personal drive is to make systems visible to the people that are part of it.



[Hannah Härtwich](#), Systems Innovation Amsterdam Hub

I support people with complex systemic challenges by visualising complex systems in the form of systems maps, making it easier to find places to intervene. My foundation in systems thinking comes from studying geo-ecology. I like to combine systems mapping with other methods, like for example storytelling, Deep Democracy or Lego Serious Play.



Ivona Bravic, Si Energy Hub

I'm an energy consultant in Berlin, Germany, specialising in infrastructure projects, renewables integration, and strategic guidance, empowering companies manage the energy transition. Additionally, I am a partner of the Si Energy Hub. Our purpose is to contribute to shaping our future energy system towards a cleaner, more resilient, and accessible paradigm through systems thinking.



Jairo Espinosa, Universidad Nacional de Colombia

Jason Joannou, UK Atomic Energy Authority

I am a chartered engineer and systems thinker, motivated by the potential for disruptive technologies to impact global challenges. As systems engineering group leader at the UK Atomic Energy Authority, I facilitate a systems approach to delivery of commercial fusion in the context of the wider energy system.



Jeannie Carolina Sanchez Mendoza, Universidad Del Magdalena

I am an anthropologist from the University of Magdalena, I am currently studying a master's degree in sustainable territorial development from the same university. I am passionate about artistic and cultural issues about the energy transition, which is why I am the coordinator of the territorial science and arts laboratory for the fair energy transition (LabTeca) and from there I direct the El Solar Podcast where we discuss issues related to research and communities affected by extractivism in general.



Jorge Andrés Calderón Gutiérrez, Universidad de Antioquia

I am Metallurgical Engineering. I am a professor and researcher at UdeA (Medellín, Colombia). My research activities focus on several areas of electrochemistry and materials science, currently I perform several projects on electroactive materials and its use in energy storage devices for mobility application.



Jose David Meisel Donoso, Universidad de Ibagué

I am Associate Professor at the Department of Industrial Engineering - Universidad de Ibagué. I am an Industrial Engineer at Universidad de Ibagué, and Master's in Sciences, and a Doctor of Engineering from Universidad de los Andes. My research interests include the simulation of complex systems in areas like transport, logistics, and public health.



Jose Ignacio Marulanda Bernal, Universidad EAFIT

I am physicist with doctorate in electrical engineering and an enthusiast for applied research. I work as professor at EAFIT University (Medellín, Colombia). I have worked for more than 10 years in the area of renewable energies and currently direct the research program "Energy Efficiency 2030: Transition towards sustainable construction.



Juan Felipe Botero, Universidad de Antioquia

He is currently an Associate Professor with the Electronics and Telecommunications Engineering Department, Universidad de Antioquia (UdeA), Colombia, where he joined the GITA Laboratory, a research group, in 2013. His main research interests include quality of service, software defined networks, NFV, cybersecurity, network management, and resource allocation.



Joseph Obbo, Strathmore University

I work in the field of sustainable energy transition as a professional and scholar. Using energy modelling and taking into account the current state of affairs and competing issues like affordability, climate, water consumption, and land use, my primary task is creating a roadmap for the just transition to energy.



Julia Díaz, Universidad de los Andes

I am an academic and researcher with interest and experience in systems approach, learning communities and cross social sector partnerships. In consulting I have participated in processes of organizational design and re-design employing systems approach mainly in public organizations.



Kadija SIMBORO, Practical Action West Africa

I am Kadija Simboro, a Burkinabe with over 8 years of experience in the renewable energy sector. My passion lies in championing energy access and women's empowerment. I work on several initiatives and programs that focus on providing access to productive energy use as a means to empower vulnerable individuals, especially women.



Katharina Burger, UCL

I am an Associate Professor in Major Infrastructure Delivery at UCL's The Bartlett School of Sustainable Construction. My research focuses on the intersection of behavioural aspects and socio-technical transitions, for instance, in the context of smart and sustainable city development.



Kirthi Chetty, Hydrogen Energy Applications (HYENA) Pty Ltd.

I am an engineer at a clean energy start-up in Cape Town, South Africa. I have a background in Chemical Engineering and am passionate about leveraging my skills for social impact. My interests include sustainable development, systems thinking and collaborative problem solving.



[Liliane Vanessa Kamga Samen](#), MIPROMALO

I am a researcher in energy field studying and experimenting with new matrices based on tropical raw materials and biomass. The aim is to make infrastructure greener by minimising the energy demand in the life cycle of the materials used.



[Lina Maria Gómez Cortés](#), Universidad de La Sabana

I am a university engineering professor. I use technical elements such as systems thinking tools and information systems, among others; My objective is to understand socio-environmental problems of society and carry out interventions together with the community.



[Luis Chiza](#), National Polytechnic School

I am currently a doctoral student and Part-time Professor at the National Polytechnic School. I worked as Research Engineer at National Operator of Electricity and Inter-American Development Bank.



[Luis Gerardo Carvajal](#), Siemens Energy

Sustainability Operations Specialist for Mexico, Central America and the Caribbean and Venture Building Architect at Siemens Energy. Mentor on innovation and entrepreneurship topics for climate tech startups. Climate activist, conference speaker, entrepreneur, engineer and digital artist. YLAI Fellow 2024. Involved in environmental education and sustainable technological innovation.



Margaret Yainkain Mansaray, Women in Energy Sierra Leone Limited

Margaret Yainkain Mansaray is the CEO/Founder of Women in Energy Sierra Leone Limited, dedicated to advancing gender equality in the energy sector. With a passion for renewable energy and empowering women, she leads transformative initiatives. Margaret's visionary leadership and commitment to social inclusion drive positive change in Sierra Leone's energy landscape.



Michelle Garbán, British Embassy Caracas

I am an economist leading on bilateral cooperation on energy and climate focused on promoting British expertise and values in Venezuela, including transitioning to greener economies. In addition, for the past 3 years I have authored regular analyses and reporting on Venezuela's complex context for key national and international stakeholders.



Monica Zamora Zapata, Universidad de Chile

I'm an engineer and a community leader representing a prospective South African party in parliament on energy security and mineral resources. I have years of experience in academia, government policy writing, innovation commercialization, and worked in the local and European energy sectors.



Mpho Madisha, ActionSA

I'm an engineer and a community leader representing a prospective South African party in parliament on energy security and mineral resources. I have years of experience in academia, government policy writing, innovation commercialization, and worked in the local and European energy sectors.



[Mumbe Mwangangi](#), Nyansapo AI

I am a passionate and driven social innovator who believes in the power of collective action to create positive change. I co-founded Nyansapo AI, a social enterprise that uses Artificial Intelligence to assess and improve the literacy and numeracy skills of primary school children in underserved communities in Africa.



[Nelly Cantillo](#), Universidad del Rosario

I am a professor and researcher at Universidad del Rosario with a Ph.D. in Chemical and Biomolecular Engineering from the University of Tennessee. My postdoctoral research at the Universidad de la Sabana and the University of Tennessee focused on flow batteries and fuel cells.



Nicolas Melendez Alvarez, Foreign Commonwealth and Development Office

I'm a professional in Urban Management and Development and hold a MSc in Environment and Sustainable Development at UCL. I consider myself curious, innovative and perseverant.



[Pablo Medina](#), Universidad de los Andes

I am a young academic mainly working on complex systems, modelling and data analysis. My background is Physics, and my PhD studies are related to using mathematical, computational and statistical tools to understand complex systems. In particular, I work on transportation on complex networks (data analysis and simulations).



[Pedro Eusse](#), EPM

I am an Electrical Engineer with a Specialization in Management and a Master's Degree in Energy Management and its Renewable Sources. I have 31 years of experience working at EPM in the areas of Energy Generation and Innovation and New Businesses.



[Pedro Pablo Cardoso Castro](#), University of Exeter

I am a Marine Biologist with a Master's in International Commerce, Environmental Industrial Planning and Auditing, and a PhD in Management focusing on Complexity Management. With 20 years as an academic across various countries, I specialise applications of systems thinking and complexity management, offering consultancy and executive training services.



[Pepe Salazar-Vela](#), BRE Group

I'm a sustainability consultant who collaborates with academia. My holistic perspective of the built environment leverages social impact as a driver for change. My current role focuses on embedding social impact into BREEAM. In my PhD, I developed a Social Value framework for digital construction through a sociotechnical lens.



[Prabina Shrestha](#), Utopia Kathmandu

I'm an Architect & Urban Designer with 8 years specializing in Human-centered Design and Systems Thinking. I integrate user perspectives throughout projects, fostering collaboration for user-centric solutions. Additionally, with Utopia, we co-found urban tech startups with innovative entrepreneur.



[Rafael Alberto Méndez-Romero](#), Universidad del Rosario

Educated in Mathematics and specialized in Applied Mathematics, with further studies in Mathematical Modelling and a Ph.D. in Didactics, I've progressed from professorship in Colombia to Distinguished Professor at Universidad del Rosario, Vice Provost for Academic Affairs, and now Dean of Engineering, Science, and Technology, acquiring significant honours.



[Ramón Fernando Colmenares-Quintero](#), Universidad Cooperativa de Colombia / BERTIC Network

I am a mechanical and aeronautical engineer from Warsaw University of Technology (Poland). I have a PhD in engineering focusing on energy systems and optimization from Cranfield University (UK), with postdoctoral research in aerospace engineering. Currently, I am CEO and Founder of the BERTIC LATAM and Europe Network, and CEO of the Engineering Research Institute at Universidad Cooperativa de Colombia.



[Raúl Montiel-Calderón](#), Universidad del Medio Ambiente

I am an academic and consultant working at the intersection of regenerative development, alternative economics and systemic strategy, looking forward to develop local capacities to enhance life quality and human potential through business in harmony with nature. I am the cofounder of GreenPretzel, social innovation consultancy, focused in Latin America.



[Richard Arwa](#), CIST Africa Ltd

I am an entrepreneur with seven years' experience of working in household renewable energy technologies in Kenya. I am the C.E.O and founder of CIST Africa Industries Ltd, a biotech manufacturing company, producing ethanol fuel, based in Kenya. I hold a Bachelor of Education Science and Masters in Chemistry.



[Rohan Agrawal](#), University of Oxford

I am a researcher working on understanding the feasibility and scalability of electrifying gas-based heating sources in the UK. I am passionate about addressing broader energy and environmental sustainability issues through the use of data-driven methods. As a young researcher interested in making a direct impact in the world through driving policy decisions.



Rosanna Zimdahl, Linköping University

I am a researcher within System-of-Systems Engineering and come from Energy and Environmental Engineering. I am making initial assessments of complex operations and coupling diverse interests to operational outcomes. I am also interested in systems change practices in support of human and nature health.



Rukevwe Siakpere, Teesside University

I am a social development specialist with expertise in policy development management. I am particular about discussions/programmes around promoting sustainable policies that concern green development. While assessing the quality and implementation processes of international policies established on the transitioning of vulnerable/poor states from fossil fuel to clean and renewable energy.



Sam Stones

As a People and Culture Change Leader, I specialise in enhancing human processes and systems to drive organizational transformation. I leverage Systems Thinking methodologies to facilitate collaborative efforts within teams, ensuring that change initiatives are strategically aligned and effectively implemented.



Shani Pandya, Imagine Powertree Private Limited

Born in rural Gujarat, India, I'm an entrepreneur dedicated to renewable energy accessibility. Founder of Imagine Powertree Pvt. Ltd, known for innovative solar solutions like Solar Trees and Balconies. Committed to fostering innovation, I've spearheaded a Tech Business Incubator, propelling numerous startups. My vision: decentralized energy and a cleaner future for all.



[Sheila Brenda Chepkorir](#), Strathmore University

I am a Project Engineer at the office of the Deputy Vice Chancellor Research and Innovation (DVC R&I) at Strathmore University with a background in BSc Mechatronic Engineering and 2+ years of experience in the energy sector. My main focus is on renewable energy technologies and energy access.



[Simon Önnared](#), Si Energy Hub

I am a PhD candidate in Innovation Management for Resilient Energy Systems, focusing on long-term and holistic solutions to energy transitions, in the same vein, I am a partner in the Si Energy Hub where we exercise systems thinking in the energy sector.



[Stella Deppe](#), Development Cooperation Agency Germany, GIZ

I am passionate about systems innovations in the field of international development and entrepreneurial ecosystem building and have more than 8 years of professional experience in both the private sector (start-up) and development cooperation (GIZ & KfW in Nicaragua, Ecuador and Germany).



[Tara Thornton](#), DrDoctor

As a Systems Thinking Practitioner, I specialise in NHS digital transformation at DrDoctor, transforming hospital pathways. With a diverse background, I have been tackling complex problems during my Systems Thinking apprenticeship with Cranfield University, driving healthcare innovation and improving patient care through holistic solutions.



Xinfang Wang, University of Birmingham

I am an Assistant Professor at Birmingham Energy Institute in University of Birmingham. My background includes energy and sustainability, behaviour and social practice, finance and economics, policy and whole systems research. My PhD was at Tyndall Centre for Climate Change Research and Sustainable Consumption Institute in the University of Manchester.



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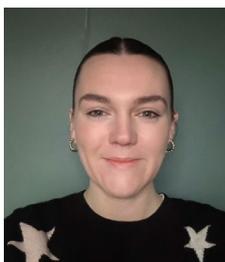
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Dima Rajjo
Monitoring
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Manager



Lauren Clarke
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Practitioner



Code of Conduct

To achieve a successful, professional event without any participant, awardee, staff member or involved party feeling uncomfortable, threatened, demeaned, or excluded, the Academy will not tolerate behaviours that do not treat all persons fairly and with respect.

For the avoidance of doubt, the following behaviours will not be tolerated:

- The use, possession or attempt to purchase drugs that are illegal.
- Illegally downloading or viewing objectionable internet material.
- Statements about the attractiveness or otherwise of others.
- Statements that draw attention to disability, skin colour, sexual orientation, gender, ethnicity, nationality, age, religion or other characteristics in a way that could cause offence or exclusion.
- Aggressive, threatening or disruptive behaviour.
- Uninvited physical contact.

This list is not exhaustive, and other behaviours may also lead to action if judged inappropriate or unprofessional. The Engineering Council's [Guidance for Institution Codes of Conduct](#) provides a framework for assessing unprofessional behaviour.



In the first instance, if participants are concerned about unprofessional behaviour, they should report it to Royal Academy of Engineering staff member who will act quickly to ensure an appropriate response. Please be assured that these reports are encouraged and will be treated confidentially.

The Academy reserves the right to exclude people from further participation in its activities, and pass evidence to the appropriate authorities for serious and/or repeated unprofessional behaviour.

Key contact information

Symposium venue

Address: Universidad de Antioquia, SIU - Sede de Investigación Universitaria, Cl. 62 #52-59, La Candelaria, Medellín, La Candelaria, Medellín, Antioquia, Colombia

Phone: +57 421 96402

Webpage:

<https://www.udea.edu.co/wps/portal/udea/web/inicio/investigacion/sede-investigacion-universitaria>

Accommodation

Address: Hotel Faranda Collection, Cl. 11B Sur #44 - 29, El Poblado, Medellín, El Poblado, Medellín, Antioquia, Colombia

Phone: +57 604 5012443

Webpage: <https://www.farandahotels.com/hotel/hotel-faranda-collection-medellin>

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In case of an emergency: please call 123 free of charge.

Engineering X Frontiers Seed funding Application Guidance Notes

Deadline:
9 May 2024, 4.00pm (UK time)

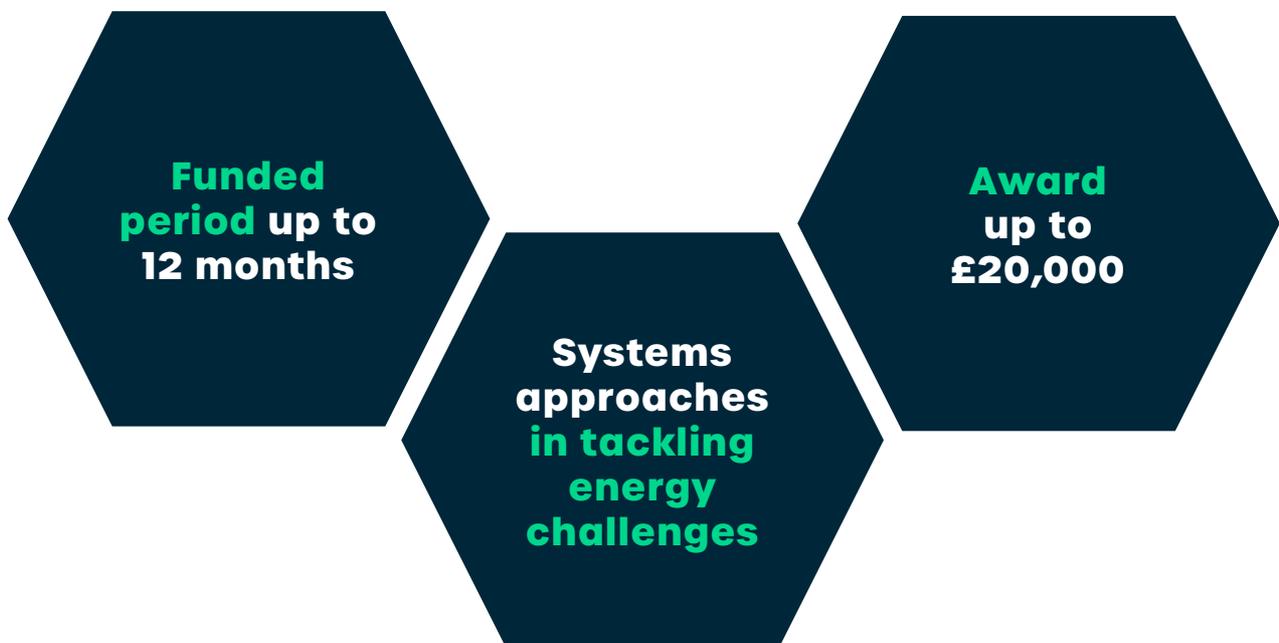
Send any questions to
frontiers@raeng.org.uk



Seed funding overview

Following the Frontiers symposium, Engineering X is offering seed funding to support collaborative projects by systems innovators, experts, and practitioners who put **systems approaches** into practice **whilst tackling the energy access and/or just energy transition challenges**. We hope to see projects that will have impact on this critical challenge whilst also testing and furthering the skills developed during the symposium on systems approaches.

The funding is ring-fenced for newly formed teams from the April 2024 Symposium participants and external collaborators.



Funding may cover the following activities (but is not limited to):

- Bringing together a consortium of symposium participants to implement projects using systems approaches on energy transition pathways.
- Using systems approaches to gain preliminary data to form the basis for a new project, intervention, product, or service related to circularity and technology's end-of-life.
- Creating prototypes for products or services supporting energy transition decisions, such as energy-efficient cooling systems that integrate systems approaches in the project design and implementation.
- Developing workshops for stakeholders to envision future energy transition scenarios, co-create solutions, and inform policymakers.
- Convening stakeholders and organising discussions to understand different perspectives on energy access and identify opportunities for collective action.
- Using systems approaches to create communities of interest around specific energy transition and energy access challenges.

This award scheme is funded by [Engineering X](#), an international collaboration founded by [the Royal Academy of Engineering](#) and [Lloyd's Register Foundation](#).

Application and award process

Funding opens for applications: 24 April

Applicants work in collaboration with partners and their institutions to agree details



Deadline for submissions: 9 May, 4.00pm (UK time)

Applications must be submitted via <https://grants.raeng.org.uk>



Eligibility checks: 9-13 May

Please reserve some time on these dates in case we need to clarify eligibility questions



Applications reviewed and panel decides which will move forward



Applicants notified on the results: 7 June

Contracts sent to successful applicants. Unsuccessful applicants notified



Deadline for contract signature: 1 July

Deadline for due diligence forms if applicable

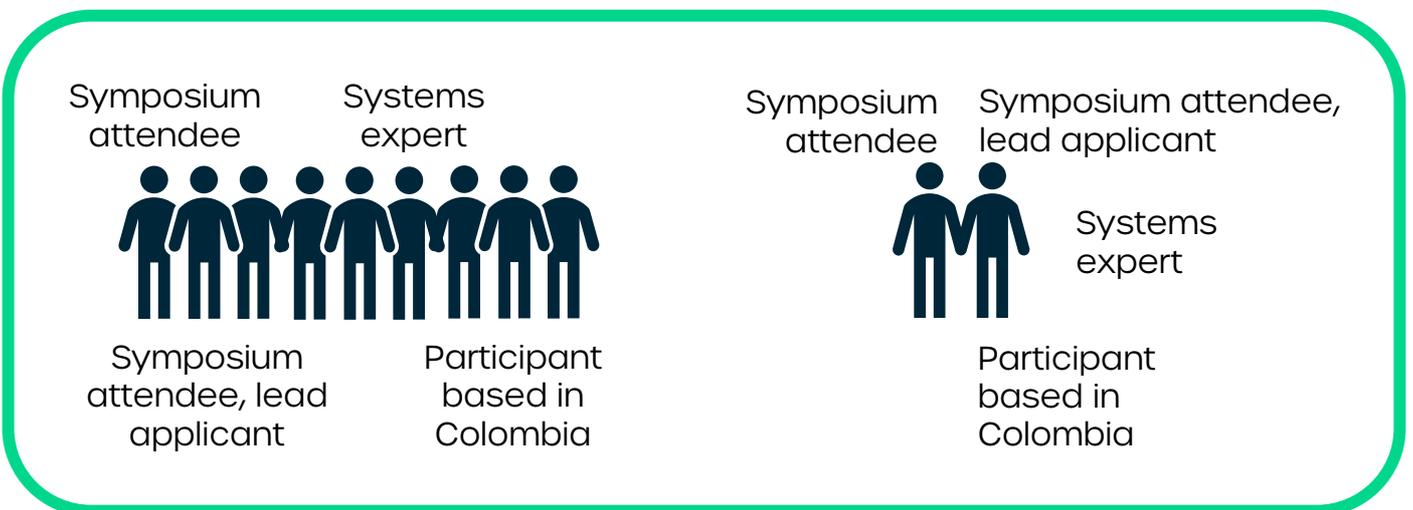


Project begins and initiation report submitted by 5 July

Eligibility criteria – who can apply for funding?

This funding is to promote new collaborations between Frontiers symposium participants. Teams must meet the following criteria:

- The project team should have at least two team members (including the lead applicant) who attended the Symposium in April 2024.
- The team must include at least one member with systems expertise¹.
- The project team should include at least one team member based in Colombia.
- The team is a newly formed partnership. Its' members should not have worked on the proposed project together before.
- The project should center on addressing a challenge related to access to reliable and clean energy.
- The project must be framed using systems approaches. It must be interdisciplinary, pilot-stage and challenge-focused, aligning with the required approaches outlined below.
- The lead applicant must be affiliated with an organisation that can administer the funding on their behalf.



Please note the team composition criteria may overlap. For example, one team member could be a lead applicant and Symposium attendee, have systems expertise, and be from Colombia. The team could also be comprised of three different participants, meeting one criterion each. Teams are encouraged to engage other co-applicants and collaborators who will enrich the project.

Co-applicant = a team member who attended the most recent Frontiers event.

Collaborator = an external expert, a team member who did not attend the Frontiers event.

¹ The participant must have both theoretical understanding and practical application of systems thinking principles, tools and methods. For example, have studied systems approaches, conducted research using systems approaches, implemented systems approaches in the project cycle.

The lead applicant

The lead applicant is the person who will do and coordinate most of the project work. This person is typically at the early to mid-career stage, usually up to 20 years postdoc/equivalent level of training. However, this is not a hard rule and non-standard career paths and career breaks are welcome. Where those who are more established in their career are included in the project team, they will usually take an advisory position as a co-applicant or collaborator.

The lead applicant must be affiliated with an organisation that will receive and administer the funding on their behalf. We expect the lead organisation to be based in the focus country. However, if the lead applicant is not based in the focus country, they will need to demonstrate partnership with actors in the focus country, city or region. The eligible organisations include:

- Public bodies, institutions, and research organisations
- Professional bodies or institutions
- Charities and Non-Governmental Organisations
- Private sector businesses and social enterprises of any size
- Research institutes and universities.

Required approaches

The projects proposed must apply **systems approaches** in the project cycle.

There is no single way to take a 'systems approach'. A systems approach involves using a range of techniques to determine how different components of a system interact and what is needed to deliver a system that is fit to fulfil its intended purpose. A true systems approach does not deliver solely technical solutions. It ensures appropriate technology, processes, interactions, and policy alignment to provide innovative responses to today's most complex and pressing challenges.² In our pursuit of sustainable energy solutions, it's essential to adopt a systems approach - a holistic way of thinking that considers the interconnectedness of various factors shaping energy transition and access. Unlike traditional approaches that focus on isolated components, systems thinking allows us to understand the complex web of interactions and dynamics at play in the energy sector.

This is an example on how systems experts have applied systems approaches in a project cycle (Go-science systems thinking toolkit). See figure below for reference.

² Engineering better care, RAEng, 2017



Notice that this is an example and you can approach the task in other ways.

For further reference on what we mean by taking a systems approach, please visit the below documents which you may find useful:

- [Royal Academy of Engineering Net Zero: A systems perspective on climate change](#)
- [Engineering X Safer Complex Systems Case Studies](#)
- [Royal Academy of Engineering: Managing complexity, how systems approaches can drive better policy](#)
- [Go-Science systems thinking toolkit](#)

In taking a systems approach, we anticipate projects will apply systems tools and methodologies to increase understanding and gain actionable insights into tackling energy access and the just transition. We expect projects to collaborate with stakeholders to consider and support the implementation of a systems approach.

In addition to systems approaches, all projects must be **interdisciplinary, pilot-stage and challenge-focused**. Interdisciplinary research is defined as “a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialised knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice”³. Participants will have the chance to meet potential collaborators via the formal and informal networking opportunities at the event and using the profiles in their welcome packs.

³ Committee on Facilitating Interdisciplinary Research, Committee on Science, Engineering, and Public Policy (2004). Facilitating interdisciplinary research. National Academies. Washington: National Academy Press, p. 2

How to apply

The application has **six sections**. It takes about an hour to complete the form if you write answers offline and copy them in rather than writing as you go. We recommend this approach to avoid accidental data loss.



All applications must be submitted via the Academy's online application system at <https://grants.raeng.org.uk>. The lead applicant must register first. They must provide basic log-in details to create a profile.



Once logged in to the grant management system, select 'Frontiers – seed funding'. There will be general instructions, and the application form



The **lead applicant** must provide a letter from an organisation confirming approvals. Details on page 11. You should request the letter **as soon as possible to avoid delays**.



At any stage in the process you can save and return to the application later. You can answer questions in any order, skip sections and return to them later. **Make sure you save every page as you go, to avoid losing work.**



Submit the application before the deadline (**9 May, 4.00pm UK time**)

Project budget

Projects may be awarded up to £20,000 per award.

The total project budget may exceed the maximum funding participants can request under this scheme. The participating institutions or other sources must meet additional costs. If this is the case, the contribution of each institution/source should be stated.

Eligible expenses include the following:

- Staff costs for lead applicants, co-applicants and collaborators, and experts.
- Small stipends to cover expenses that enable people to engage in the project.
- Travel and subsistence.
- Consumables, including project-specific costs of small equipment, computer software licenses or publication costs.
- Necessary service provisions related to the project, such as conferences and seminar fees, translation or IT services.
- The host institution(s) can include up to 10% of the grant as a contribution to project management, administrative and other running costs. The award funds can be dispersed to different project partners as appropriate for the project activities.

The following costs are not eligible:

- Funding activities outside of the project objectives and scope.
- Funding activities contrary to the values of the Royal Academy of Engineering and [Lloyd's Register Foundation](#).
- Loans, further grants or revolving funds.
- Infrastructure, buildings, large physical assets and vehicles.
- Facilities, such as air conditioning units, office buildings, furniture, etc.
- The funding cannot cover any indirect costs or overheads related to staff costs.

Things to consider

Diversity policy and monitoring

The Royal Academy of Engineering and Engineering X are committed to diversity and inclusion and welcomes applications from all underrepresented groups. It is our policy to ensure that no applicant is disadvantaged or receives different treatment because of age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, gender and sexual orientation.

Before completing the application form, applicants are asked to complete a Diversity Monitoring Form to help the Academy monitor and assess its [diversity and inclusion policy](#). It will only be used for statistical purposes with access restricted to staff involved in processing and monitoring the data. No information will be published or used in any way that identifies individuals. The Academy will retain personal information as per our [Data Retention Policy](#) in line with the General Data Protection Regulations 2018. The information is strictly confidential, nonattributable and is not seen by anyone involved in any selection processes. You must complete the diversity monitoring section before you see the grant application form and can always choose “prefer not to say” in responses.

Equitable partnerships

The Academy and Engineering X are committed to promoting equitable practices in the design, delivery and dissemination of research and innovation projects. Some things to consider when designing and collaborating on your project:

- Ensure transparency by establishing a partnership agreement within the initial three months of your project.
- Account for the time required to build strong partnerships, especially remotely, by including a generous timeline within your project.
- Think about whether your project includes a diverse set of perspectives.
- Think about how to embed equality into the division of labour in the project.

For further resources on equitable partnerships please visit the [UKCDR Equitable partnerships resource hub](#) and refer to the [Global Code of Conduct for Research in Resource Poor Settings](#).

Using Artificial Intelligence to draft your application

The use of AI to draft your application is permitted, but you must use caution, and acknowledge it's use. Please follow these guidelines:

- You are responsible for all content in your grant application, so make sure that the application represents your own voice and ideas. While AI tools may assist you, the application must primarily represent your own original work.
- Be rigorous in checking content generated by AI to avoid any ‘hallucinated’ references or factual errors. Reviewers may perceive these as a lack of rigour.

- Plagiarism is never acceptable: AI tools may use ideas from human authors without proper referencing. Make sure you check sources are appropriately attributed.
- If AI tools are used to draft your application, you **must** acknowledge the name of the tool and how you used it. For example:
 - “We acknowledge the use of [AI system/version number/link] to generate materials for background research/styling/proofreading.”
 - “[AI system/version number/link] was used to generate materials within [section title], in modified form.”

Application form

This section lays out all the questions you can expect to find in the application form.

1. Applicants and Institution Details

Question	Information
1.1. Please provide contact details of the lead, co-applicant(s)⁴ and collaborators⁵	We will use these details to contact the lead applicant and collaborators. Make sure that you have permission to share these details.
1.2. Team members (lead, co-applicant, collaborators) details	Provide details of all team members participating in the project, highlighting their expertise, discipline and project role or contribution (maximum 100 words per person).
1.3. Systems expertise	The team must include at least one team member with systems expertise. Please articulate how your team meets this criterion and specify systemic tradition, perspective, or methodologies to be used (maximum 150 words).
1.4. CVs of the applicants and collaborators	Upload a CV for all named project team members. Each CV should be a maximum of three pages long and submitted as a pdf.
1.5. Lead organisation/ institution/ university declaration	<p>The declaration confirms that the application is acceptable in principle to the lead organisation/research institution/university and has received all internal authorisations. It must be on headed paper, signed by an authorised signatory (for example, from the Research Grants Office or equivalent team) from the lead applicant's organisation. Digital signatures are allowed. We do not require a hard copy. Upload the letter via the online form.</p> <p>The required terms are listed below. You may select organisation, research institution, or university. The rest of the statement must use the exact phrasing as stated.</p>

⁴ Co-applicant – attended the most recent Frontiers event

⁵ Collaborator – did not attend the Frontiers event

Please copy this text directly into the declaration:
*The applicant will be employed by the [organisation/ research institution/ university] for the duration of the award. **OR** The [organisation/research institution/university] commits to maintain a relationship with the lead awardee such that it will administer the grant funds on their behalf.*

The applicant and any co-applicant(s) will be given full access to the facilities, equipment, personnel, and funding as required by the application.

The costs submitted in the application are correct and sufficient to complete the award as envisaged. Any shortfall in funding will be met by the [organisation/ research institution/ university].

2. Project summary

Question	Information
2.1. Project title	The essence of the research should be captured in the title and should be as informative as possible. Ensure it is understandable to a non-specialist (maximum 10 words).
2.2. Project abstract	Include the problem statement, project purpose and expected results. It should provide an overview of how the team will apply systems approaches and work in a collaborative and interdisciplinary way. Ensure it is understandable to a non-specialist (maximum 300 words).
2.3. Total project cost	This is the total value that is requested from the Academy and may be up to £20,000.
2.4. Project keywords	Please provide several keywords (1-5 keywords or phrases) that encapsulate the essence of your project. These keywords should convey important aspects such as the project's focus, key themes, and relevant areas of interest. Examples could include terms like 'end of life', 'governance', 'sustainability'.
2.5. Start and end date	Enter the start and end date of the proposed project. It must start on 5 July 2024 and finish on/before 5 July 2025.

- 2.6. Is this a new collaboration?** Please confirm this is a new collaboration, as pre-existing collaborations are not eligible.
- 2.7. Sustainable Development Goal(s)** Select the primary Sustainable Development Goal that your project will address. If applicable, you may select a second and third goal. Explain how your project will address the Sustainable Development Goal(s) you have chosen, and why it is needed (maximum 400 words).
- 2.8. Identify the primarily focus country (where the main impacts will accrue)** You must identify one country to be the focus of the project. This should be where the impacts of your project will mainly accrue.
- 2.9. Please list any other countries or regions your project will focus on** This should be a list, not an explanation. You can also indicate a region, or, in rare cases, the project may aim at global impacts (maximum 10 words).

3. Project details

Question	Information
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3.1. The project objectives	Please describe your project’s objective/objectives: the changes the project hopes to achieve or contribute to within its lifetime (maximum 200 words). For more information on setting objectives, please use this resource .
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3.2. The project activities, outputs, outcome, and impact	This section outlines the logic of planned activities and their impacts. For more information, please refer to this resource .
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Activity	Output	Outcome	Impact
Activities of the project	The tangible products or services the project will produce. Please keep in mind that each activity might have one or several outputs.	The short-term and medium-term effects of outputs. The changes the project achieves within its lifetime. Please remember that several activities and outputs can contribute to one significant outcome, and outputs can also contribute to several outcomes.	The long-term effect or change the project aims to create. The project might have one or several impacts.

3.3. Timeline of activities	Please indicate when each activity will occur (maximum 800 words).
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3.4. Measuring success	Describe how you will monitor the project and measure success (maximum 400 words).
3.5. Application of systems approaches	<p>Describe at what stages of the project cycle you will integrate systems approaches (see guidance and figure on page 5 as a reference).</p> <p>Additionally, outline any specific diversity and inclusion considerations and implications for your proposed project (any measures you have put in place to ensure equal opportunities, any expected impacts on people of different backgrounds).</p> <p>See more in: https://www.gov.uk/government/publications/systems-thinking-for-civil-servants/journey</p> <p>As a guide, this question should be between 300 - 600 words.</p>
3.6. Stakeholders	Describe the primary stakeholders (i.e. those who are influenced by your project or could influence it). Include which key stakeholders are already engaged, the status of the relationship, and how you will engage other stakeholders (maximum 400 words).
3.7. Safety consideration	How will the project anticipate and address potential safety risks in the long term, specifically concerning the transition to cleaner energy sources and improving energy access? (maximum 150 words)
3.8. Project's scalability and sustainability beyond the funding period	Describe how the sustainability and scalability of the project/initiative will be ensured beyond the initial funding period. This may include resource management, stakeholder engagement, and expanding to other regions or communities (maximum 300 words).
3.9. Pictures and diagrams (optional)	Upload any pictures and/or diagrams related to your project as a single file.

4. Budget

4.1. Provide a breakdown of the funding requested using the table in the application form. Give a narrative description of what resources are requested and why.

Category	Cost	Description/Further details
Travel, subsistence, accommodation and visa fees	£	
Staff costs	£	
Consumables and equipment	£	
Administrative fees charged by the lead organisation	£	
Other costs	£	
Total	£	

Please note that the funding provided by this scheme is not calculated based on full economic costs. Please refer to the eligible cost guidance on page 8.

The totals may exceed the maximum funding you can request under this scheme. If so, the participating institutions or other sources must meet the additional costs. Please state the contribution each institution/source will make.

At the end of the project, any unspent funding awarded will be repayable to the Academy.

4.2. Is there anything else you would like to tell us about your budget? This may include expected in-kind support, additional funding, projected costs per goal/milestone, etc.

5. Applicant declaration

At the end of the application form, you will be asked to confirm, via a simple tick-box declaration, that the information is accurate, the ideas are your own, that you have credited/cited any sources, including AI tools you may have used, and that you understand the application will be shared with reviewers as part of the process.

6. Academy Marketing

You will be asked to select, from a list, how you heard about this scheme. In this context please answer based on how you heard about the Engineering X Frontiers Symposium and the Seed funding.

Submission

Once you have completed all sections and pressed save on all the pages, a "submit" button will appear on the summary page. This button is greyed out until all sections are complete. If you have completed and saved all sections but the button is still greyed out, please ask all your collaborators to save and complete all sections and sign out of the system. Contact the Frontiers team with any issues or questions about the form.

Assessment of applications

Applications will be checked for eligibility before being assessed by a minimum of two panel members. The panel will include Academy Fellows and experts from relevant disciplines. All applications will be assessed against the following criteria:

The project's quality

- Reviewers will assess the proposed project's quality and its objectives' feasibility, applicants' approach to monitoring and evaluation.

Professional track record and team complementarity

- Reviewers will assess the team members' experience, capacity to deploy systems approaches and implement the project, and the partnerships' robustness.

Application of systems approaches

- Reviewers will assess how clearly application of systems approaches is demonstrated in the project cycle outlined in the proposal. This includes diversity and inclusion of multiple perspectives, considerations on sustainability and end of life and on long-term impact.

The outcome and impact

- Reviewers will assess the extent to which outcomes and impact are reasonable, tangible, feasible, and sufficiently ambitious.

Budget suitability

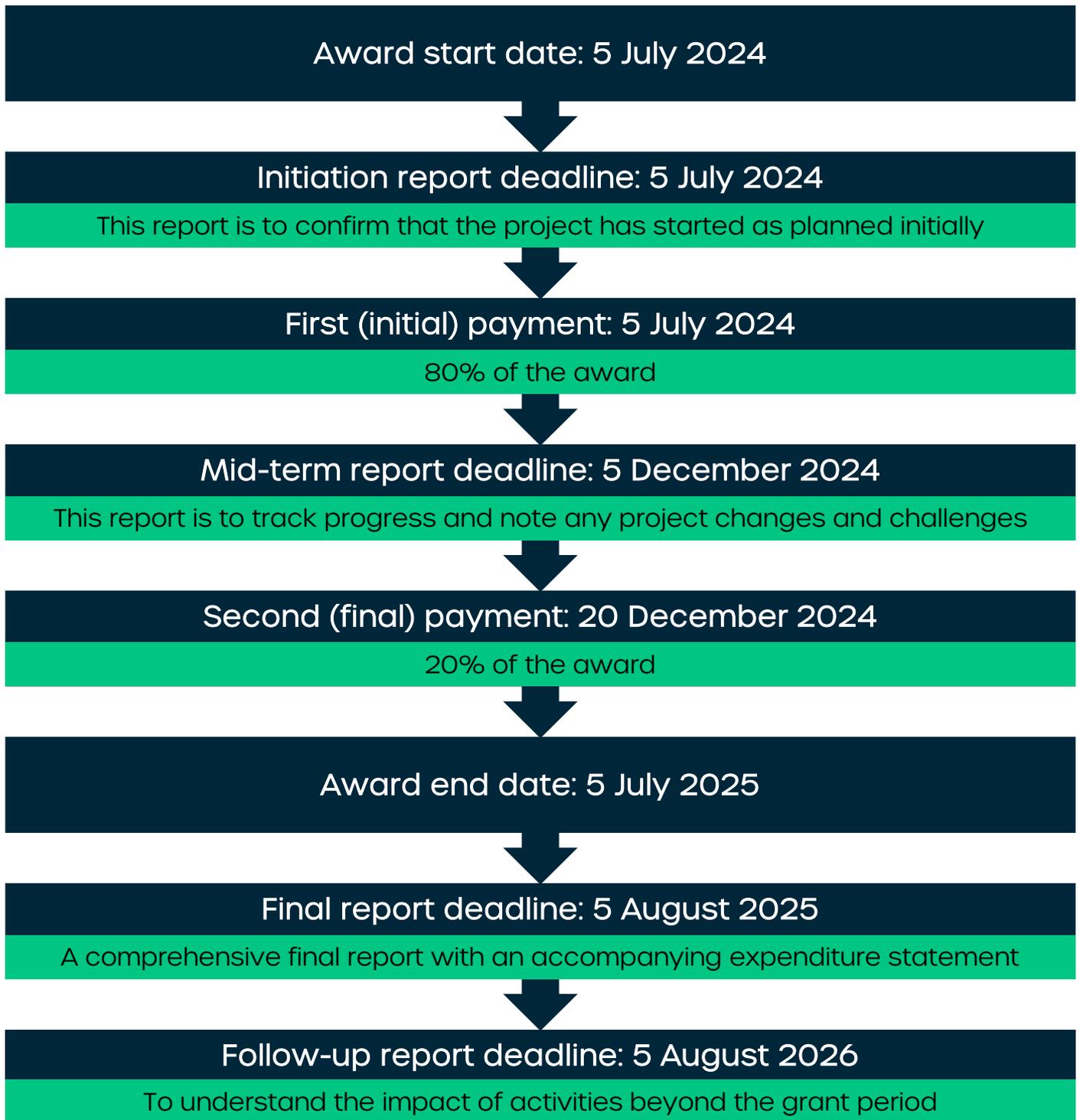
- Reviewers will assess how suitable, realistic and clear the budget is. Whether the project demonstrates value for money

The project's sustainability

- Reviewers will assess project's scalability and sustainability beyond the funding period

The final outcome is decided by a Sift Panel made up of reviewers and Academy Fellows. Expect notification of the outcome by 6 June.

Project implementation and monitoring



FAQs and further questions

If you have questions about the application or assessment process, please email Frontiers@raeng.org.uk.

Visit our [FAQs page](#) to check answers for the frequently asked questions on Frontiers seed funding.

Notes

iGracias!

Stay in touch!