



Royal Academy of Engineering | Policy Fellowships

Programme Annual Report 2022

Engineering better policy

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Foreword

by Dr David Cleevely CBE FREng
Chair of the Policy Fellowships’ Working Group



Engineering better policy since 2019

This is our first annual report. It celebrates some amazing achievements as we continue to build on a proven model for engineering better policy.

In 2022, we welcomed 19 new Policy Fellows and connected them with 181 leading engineering experts from industry and academia.

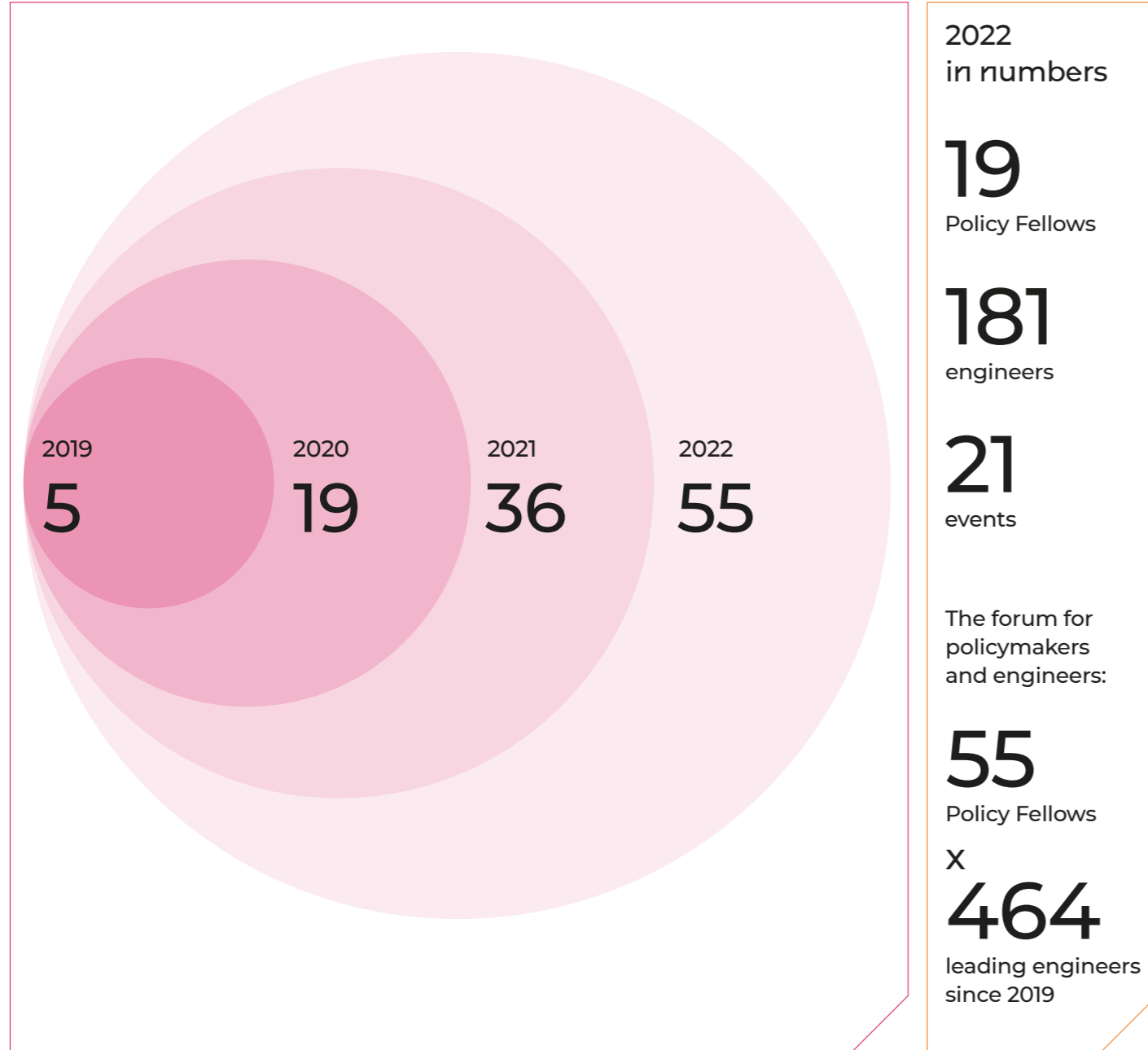
Our alumni community has now grown to 55 members. In 2022, they championed ‘Systems thinking in policy’ for 800 policy professionals in partnership with the government’s Policy Profession Unit and have been piloting peer-to-peer groups to explore topics of interest, such as resilient supply chains and value-led public infrastructure.

We build connections between policymakers and the technical community and encourage the role of engineering thinking in government, with the aim of helping shape better policy.

Our Policy Fellows come from across the public sector. They share a common aim: to understand engineering thinking and to contribute to the most important policy challenges of our time.

We are delighted with the difference they are making.

Policy Fellowships' community



A new generation of future policy leaders



by **Paul Kett**

Member of the Policy Fellowship Advisory Group, Senior Adviser to PwC and previously Director-General at the Department for Education.

The design, development and delivery of public services is of huge importance to citizens - yet, as we know, it is incredibly hard to get right.

Engineering is a discipline which has a particular contribution to make - particularly in finding ways to navigate complexity. This programme gives policy professionals access to leading engineering expertise, both domain specific - like net zero or infrastructure - and general techniques like systems engineering tools. I have seen the collaboration bring new insight and impact to some of the most challenging policy areas, and build capability across a new generation of future policy leaders - and an inspiring group of alumni.

And I see experienced, world leading, engineers excited to contribute to some of society's biggest challenges. For the participants in policy roles across local and central government, the programme is equipping the leaders of the future with the expertise to help secure improved outcomes for citizens from ever more complex systems.

Sarah Brown

New Reactors Policy Business Partner,
Office for Nuclear Regulation



Sarah Brown is the policy business partner for New Reactors and policy lead for Better Regulation at the Office for Nuclear Regulation.

I wanted to understand how we can best learn from those we engage within the nuclear sector and beyond to improve our effectiveness.

The Policy Fellowship provided me with a unique opportunity to step outside of my day-to-day role and gain new perspectives on how we can best learn from those we engage with to improve.

Applying systems thinking with the help of experienced engineering Fellows helped to define the problem, put the system into context, and put people at the heart of the problem.

The engineering input helped me think about what our stakeholders need from us. Through the articulation of the behaviours needed to build consensus from the world of standards, and the frequent acknowledgement of the importance of relationships and behaviours in facilitating a meaningful dialogue with stakeholders, I was reminded of the need to consider relationships and people before processes.

Undertaking the Policy Fellowship has taught me to apply systems thinking to policy challenges and put people at the heart of the advice I provide.



The Policy Fellowship provided me with a unique opportunity to step outside of my day-to-day role and gain new perspectives on how we can best learn from those we engage with to improve.

Gareth Lavan

Policy Lead for Climate Education and Sustainability Leadership, Department for Education



Gareth Lavan is the Policy Lead for Climate Education and Sustainability Leadership at the Department for Education.

One of my core projects, and the subject of my Policy Fellowship, is to enable all education settings to have in place a climate action plan by 2025, owned and implemented by a structure of leadership at individual setting level.

My time as a Policy Fellow has been instrumental in allowing me to progress my policy challenge. To the uninitiated (as I was!), the term 'systems thinking' does, prima facie, conjure up pictures of cold logic models – but the opposite is actually true: rigorous systems thinking demands that the user and their needs be put at the heart of policy making.

The programme gave me new tools to study and engage with stakeholders to design a policy intervention that is properly attuned to those diverse needs. It will (hopefully) ensure that the policy, when rolled out, is successful in allowing real leaders to take action over ensuring their settings become more sustainable. Furthermore, an introduction to concepts such as systems of influence vs systems of interest has allowed me to create a more in-depth understanding of stakeholder need, how to meet it, and how to coordinate help and support already out there for the education system.



The programme gave me new tools to study and engage with stakeholders to design a policy intervention that is properly attuned to those diverse needs.

New Policy Fellows in 2022

In 2022, 19 policy professionals became Policy Fellows, joining from a broad range of government departments, public agencies, and other national and regional institutions with a public service mission.

Abby Jitendra
Principal Policy Advisor, Care and Relationships,
Joseph Rowntree Foundation

Andy Sweeting
Head of Transport, Labour Market and Skills,
Department for Transport

Anuj Mathew
Deputy Director for Analysis, Department for
International Trade

Ben Christy
Quantum Policy Lead, Department for
Business, Energy and Industrial Strategy

Cambyse Jafari-Pak
Deputy Director, Retained EU Law and Better
Regulation, Department for Transport

Charlie Smoothy
Senior Policy Adviser, National Security Cyber
Policy Lead, Home Office

Frances Downey
Head of Cross cutting themes investment strategy,
UK Research and Innovation

Gareth Lavan
Policy Lead, Climate Education, Green Skills and
Careers, Department for Education

George Economides
Head of AI and Autonomy, Department for
Transport

Giulia Cuccato
Head of Science Systems and Academic
Engagement, Government Office for Science

James Claverley
Head of Government Relations and Partnerships,
National Physical Laboratory

James Davey
Head of Inventory and Mitigation, Department for
Business, Energy and Industrial Strategy

Joe Carroll
Senior Policy Officer, Delivery and International,
Office for Science and Technology Strategy

Matt Wright
LEP Innovation Lead and Universities Innovation
Manager, Lancaster University

Matthew Blackmur
Innovation Lead, Energy, Clean Growth and
Infrastructure Sector Team, UK Research and
Innovation

Sponsoring organisations and government departments

Ross Burton
Area Lead for Oxfordshire, Cities and Local Growth
Unit, Department for Business, Energy and
Industrial Strategy

Sarah Brown
New Reactors Policy Business Partner, Office for
Nuclear Regulation

Sarah Butler
Energy Innovation Programme Manager,
Department for Business, Energy and Industrial
Strategy

Simone Cooper-Searle
Head of Hydrogen Heating, Strategy and
Communications, Department for Business, Energy
and Industrial Strategy

- Department for Transport
- Department for Business, Energy and Industrial Strategy
- Home Office
- Department for International Trade
- Office for Science and Technology Strategy
- Government Office for Science
- Department for Education
- Joseph Rowntree Foundation
- Lancaster University
- National Physical Laboratory
- Office for Nuclear Regulation
- UK Research and Innovation

Matt Wright

Head of Partnerships and Engagement for
Regional Innovation, Lancaster University



At the time of his fellowship, Matt Wright was seconded to Lancashire Local Enterprise Partnership to support the development of innovation policy for the county.

My challenge was to create a 'canvas' tool for regional innovation strategy to interpret emerging technologies and assist those engaged in local economic development.

The Policy Fellowship gives an excellent introduction to systems thinking through workshops and high-level connections to engineering leaders in the UK. Through interviews with 13 national engineering leaders, my policy challenge explored key aspects of how public-private partnerships execute innovation strategy; considered how emerging engineering technologies are assessed when developing such plans; and the parameters for a "canvas" tool that could be used by practitioners to develop their local economies.

I produced a summary report that reflected on the challenges and approaches experienced by Lancashire in developing an innovation strategy and the insights of engineering leaders into regional development. It highlighted the key themes and framework for a one-page canvas tool for visualising innovation-led economic development in a region.

Further work is being undertaken to refine the framework and to test the tool.

The work informed the development of the Lancashire Innovation Plan and supported regional engagement policy at the university, including a North West CyberTech proposal to Innovate UK. The tool is undergoing refinement with a view to a more detailed paper, and I am continuing to engage closely with the Royal Academy of Engineering with a view to trialling the tool through a webinar.



The Policy Fellowship gives an excellent introduction to systems thinking through workshops and high-level connections to engineering leaders in the UK.

Cambyse Jafari-Pak

Deputy Director, Retained EU Law and Better
Regulation, Department for Transport



During his Policy Fellowship, Cambyse Jafari-Pak was Head of Seafarer Protections at the Department for Transport.

An economist by background, I have worked in various policy and analyst roles across the UK government, but with a particular interest in all things transport.

My policy challenge was an exploration of how governments can champion and bolster the attractiveness of the maritime offer to drive growth.

The Policy Fellowship provided me with an opportunity to develop insight into a fundamental and complex part of the transport industry. This was also a chance to develop and reflect on rich insights across themes such as innovation and skills in maritime, and the role of governments in facilitating the partnerships required to drive change and positive outcomes for the sector.

Each Fellow had different areas of expertise, but all of their insight and experience across a wide variety of fields (such as energy, shipbuilding, decommissioning, people, skills, technology, and initiatives underway around the world) proved highly relevant and deeply valuable in progressing the policy challenge.

It has also helped me to build my own capabilities in important and transferrable skills such as systems thinking, as well as learning much more about transport!



It has also helped me to build my own capabilities in important and transferrable skills such as systems thinking.

Frances Downey

Head of Cross cutting themes investment strategy,
UK Research and Innovation



Frances Downey is a science and engineering policy and strategy specialist and has worked across government, the National Academies and the third sector. She was Head of Research & Innovation Culture at the time of her Policy Fellowship.

Having led a series of impactful programmes focused on research culture, I wanted to better understand what innovation culture was and how it differed to my previous work. The Royal Academy of Engineering set me up with a broad range of Fellows and other stakeholders to help me to scope out this idea. We discussed ideas of access to, and success in, the innovation world; we talked about how it was different to SMEs, large established companies, and start-ups; we discussed risk-aversion and financing; and we looked at the intersection with research culture and where issues across both collide.

These conversations enabled me to sketch out innovation culture as a concept and start to consider the issues we see in this space at a systems level. I have used this thinking to support other teams working in this space within UK Research and Innovation (UKRI), as well as inform my own work which currently brings together thinking around levelling up, commercialisation, and talent.



The Royal Academy of Engineering set me up with a broad range of Fellows and other stakeholders to help me to scope out this idea.

What can engineering thinking do for policy?

In conversation with
Professor John Clarkson FEng

John Clarkson is Professor of Engineering Design at the University of Cambridge, Professor of Healthcare Systems at Delft University of Technology, Director of the Cambridge Engineering Design Centre and Co-Director of Cambridge Public Health.

He designed and delivers the workshop Systems Thinking 101 for the Policy Fellowships programme and is the chair of the working group overseeing the Royal Academy of Engineering's work supporting the application of systems approaches in government.

Your most influential work is about improving health and care, can you tell us about it?

The challenges facing the health and social care systems are considerable with competing pressures from an ageing population, increasing numbers of patients with multiple morbidities, new technologies, and the need for increasing efficiencies. The complexity of such systems means that efforts to improve them often only achieve limited benefits and can have unforeseen consequences.



Over time, there have been numerous calls to implement a more holistic systems approach to transform health and care, however, there had been no clear definition of what this might mean in practice. As engineers, we routinely use a systems approach to address challenging problems in complex projects.

We understand the interconnected perspectives of systems, design, risk and people, and use this to first define the problem, then consider the layout of the system, defining all the elements and interconnections, to ensure that the whole system performs as required. In response to that challenge, I chaired a cross-disciplinary Working Group to work with the health and care professions to explore how engineers can add to current understanding and practice of systems engineering in quality improvement and healthcare design.

The resulting report *Engineering Better Care*, a systems approach to health and care redesign and improvement, was co-published by the Royal Academy of Engineering, the Royal College of Physicians and the Academy of Medical Science. I subsequently developed an accompanying toolkit for Improving Improvement and continue to work with health and care professionals to improve the quality of our health and care system.



We, as engineers, routinely use a systems approach to address challenging problems in complex projects.



Taking a systems view is not particularly difficult in principle, but when the system increases in complexity, you need systems-aware people with access to good tools, key stakeholders and the public to help.

What can engineering thinking do for policy?

The thinking at the heart of a system approach is about finding improvement pathways in complicated and complex systems. Engineering has done that for decades. We have developed numerous approaches to understand and manage complexity, and I think there is a place for some of them in co-designing socio-technical systems.

For me, as a design researcher and practitioner, there is little difference between physical or social systems beyond the obvious – both require careful consideration of the function and behaviour of all elements and/or people in the system and, critically, their interaction.

A systems approach is a process, a way of thinking about anything that's complex. Taking a systems view is not particularly difficult in principle, but when the system increases in complexity, you need systems-aware people with access to good tools, key stakeholders and the public to help.

We have designed the Policy Fellowships programme as a place for policy professionals to begin their personal journey towards systems leadership within their chosen profession.

What have you learnt from your work with the Policy Fellowship?

Many things! It has been fascinating to work with Policy Fellows through the programme, with many showing a natural aptitude for systems thinking. Working with them has reinforced the importance of some of the foundational elements of my work. For instance: there are always more stakeholders than you think, and it is essential to understand their particular needs and the rationale for what sits behind those early in the improvement process.

There is also a tendency for people to want to see some results rather than the right results; spending more time thinking about the problem before starting to think about the solution helps with that. This focus on stakeholders and problem-framing has resonated with Policy Fellows. In the programme workshop and through the individual coaching that I do with them, we use a set of questions to guide them through key lenses (see figure p14) to do that.

What is your advice to policymakers who want to use systems thinking in their work?

The world is made of systems-of-systems. To gain insights on how those systems affect any government policy area, it is essential to take a helicopter view. Systems thinking will help you to initiate and structure appropriate conversations internally and externally. You will have tools to explore the boundaries of what you know and gain this broad perspective.

You will also learn a lot about needs and demands from a diversity of stakeholders and think about how to balance those needs. For example, in the NHS, formal performance reporting is critical, as is getting permission and headspace to do meaningful improvement.

With a systems view, it does not take more time to do both. In a context where people are always under pressure to deliver results fast, systems thinking increases the chance of delivering services and interventions that are genuinely fit for their intended purpose.

Also, start simple – a systems approach can be summarised as the desire to answer just two questions: 'how can we do it better?' and 'what could possibly go wrong?' where the interplay between these, at all stages of the policy development and delivery process, encourages a more rigorous and integrated focus on systems, design, risks, and people.



The thinking at the heart of a systems approach is about finding improvement pathways in complicated and complex systems

Figure
Key questions that summarise an effective systems approach.
From Engineering Better Care, 2017 and Systems Thinking 101 workshop, Policy Fellowships programme.

People

Who will use the system?

Leads to understanding of the diversity of people involved and their needs and capabilities (identify).

Where is the system?

Leads to an understanding of the physical organisational and cultural context if the system (locate).

What affects the system?

Leads to an understanding of the political and policy landscape within which the system is situated (situate).

Systems

Who are the stakeholders?

Leads to a common view of the stakeholders and their individual interests, needs, values and perspectives (understand).

What are the elements?

Leads to an agreed system boundary, architecture and details of the interfaces between all the system elements (organise).

How does the system perform?

Leads to a complete, operational system that is proven to meet the stakeholder requirements (integrate)

Design

Who are the needs?

leads to a common understanding of the needs for a system, taking account of the full range of stakeholders (explore).

How can the needs be met?

Leads to a range of possible solutions that would help meet the needs identified by the explore phase (centre).

How well are the needs met?

Leads to an evaluation of possible concepts that could meet the needs identified by the explore phase (evaluate).

Risk

What is going on?

Leads to an understanding of the system architecture and details of the interfaces between the elements (examine).

What could go wrong?

Leads to a systematic assessment of the likelihood and potential impact of threats and opportunities in the system (assess).

How can we make it better?

Leads to a range of possible solutions that would help mitigate the threats or exploit the opportunities (improve).



This focus on stakeholders and problem framing has resonated with Policy Fellows.

Alumni project on 'Systems thinking in policy'

In 2022, our alumni championed 'Systems thinking in policy' for 800 policy professionals, as part of a miniseries of Knowledge Sharing events coproduced in partnership with the government's Policy Profession Unit.

The miniseries will continue in 2023, with more information available at: available on the Policy Profession website (for public servants, by registration). [↗](#)

Christopher Thomson

Counsellor, Scottish Government America, British Embassy, FDCO

Eleanor Brown

Deputy Director bovine TB Programme, Department for Environment, Food and Rural Affairs (Defra)

Hannah Gibson

Innovation Lead, Industrial Challenge Fund - Transforming Construction, Innovate UK

Hannah Pullen

Principal Economist, Ofwat

Louise Dunsby

Deputy Director, Office for Science and Technology Strategy (OSTS)

Matt Crossman

Deputy Director Infrastructure, Department for International Trade (DIT)

Owen Jackson

Director of Policy, Cancer Research UK

Ragne Low

Deputy Director Onshore Electricity Policy, Strategic Coordination and Energy Consents, Scottish Government



Hannah Gibson looked at how systems thinking can help in the complex task of changing the culture within an industry sector: in this case, encouraging the construction industry to think more about whole-life value (looking at the economic, environmental and social impacts that a building has over its lifetime). The case study looks at the sometimes conflicting roles that government can play within a system, and using systems approaches to manage the unpredictability of human behaviour.



Chris Thomson has applied systems thinking in what might appear to be very different environments, addressing very different problems: regeneration along the River Clyde, and navigating the complex world of diplomacy in Washington, DC. The case study explores the importance of soft skills within systems approaches, and how it helps in tackling a 'wicked problem' to focus on clarity around concepts, finding shared language and identifying shared goals.



Louise Dunsby's case study looks at how a systems view can help to ensure that issues of equality, diversity and inclusion are taken into account in public policymaking. Louise had been grappling with the problem of embedding the public sector equality duty (PSED) into policymaking, which requires government departments to think about whether policies might disadvantage people with protected characteristics (such as those around race, age, and disability). The case study looks at how systems thinking can encourage a kind of perspective-taking, making it less likely that the needs of certain groups of people will be overlooked.



Matt Crossman was tackling the policy challenge of increasing infrastructure resilience within the UK: ensuring that the country's infrastructure systems can cope with future shocks, threats and challenges. The case study looks at how, even for people with an engineering background, systems thinking can offer new approaches to problem-solving. It also examines the focus that systems thinking encourages, not just on the hard assets of infrastructure, but on the more intangible things such as consumer behaviour and demand, which also affect resilience.



Eleanor Brown took a systems approach to the complex – and highly controversial – question of how to manage (and ultimately eradicate) bovine tuberculosis. The case study gives an example of how systems thinking can help policymakers to make rational decisions in areas where hard science can come up against strong emotion, and what needs to be done to ensure that evidence-based policy gets the buy-in of different groups.



Owen Jackson This case study looks at how systems approaches can help in the process of turning complex, nuanced science into something that a wide variety of people can understand and get behind. It considers the importance of storytelling in setting and implementing policy, and describes how Owen has applied systems approaches to two equally complex, but seemingly very different, challenges: protecting the environment and fighting cancer.



Hannah Pullen focused on how to improve the speed and efficiency with which infrastructure projects are delivered, when those projects can be hugely complex, and may well last longer than the lifetimes of the people who originally conceived them. The case study explores the importance of co-creation and co-design, and how systems approaches can help to create a collective understanding of complicated systems, beyond what an individual can comprehend.



Ragne Low spoke about using systems approaches as she wrestled with the challenge of how to decarbonise buildings – how to reduce the carbon dioxide emissions that come from them. This study describes the practical effectiveness of systems approaches (which isn't always recognised), and how systems thinking can help overcome the inertia that can beset policy responses to complex issues, by clearly demarcating what's within the scope of action, and what isn't.

Transforming leadership in an age of complexity

By Dame Clare Moriarty DCB

Member of the Policy Fellowships Working Group, Chief Executive at Citizens Advice and previously Permanent Secretary at the Department for Environment, Food and Rural Affairs



The Policy Fellowship shatters the myth that 'engineering is for engineers', making engineering thinking accessible and relevant for anyone seeking to design resilient solutions to complex and wicked issues.

Through exposure to a range of perspectives on problem-framing and problem solving, the programme helps Policy Fellows lead more effectively in their roles - as policymakers, strategists and decision makers - and ultimately deliver better outcomes for society.

The testimonials from our alumni show the relevance of engineering and systems thinking to a great diversity of issues: exploring how government can bolster the attractiveness of the maritime offer to drive growth, how a systems view can improve the way that equality, diversity and inclusion is taken into account in public policymaking, or how to manage (and ultimately eradicate) bovine tuberculosis. And not content with changing their own thinking, we're seeing alumni championing the approaches they've encountered, inspiring other policymakers to dare to think differently.

Acknowledgements and thanks

The Royal Academy of Engineering would like to thank Tamara Finkelstein, Permanent Secretary of the Department for Environment, Food and Rural Affairs and Government Head of Policy Profession for her generous support to the programme.

Our thanks also go to the Policy Profession team, in particular John Murphy and Samuel Carpenter for their advice and collaboration on our joint Knowledge Sharing miniseries.

The Academy would also like to record its gratitude to Sir Patrick Vallance KCB HonFREng

FRS FMedSci, Government Chief Scientific Advisor for his generous support to the programme from the start and for sponsoring the first Policy Fellowships' alumni publication *Engineering better policy* in 2021. [↗](#)

We are particularly grateful to the Academy Fellows and awardees, fellows and staff of the Professional Engineering Institutions and partners of the National Engineering Policy Centre, Fellows of the British Academy, and all experts, entrepreneurs and academics who have given their time in 2022 to support the programme and to meet our Policy Fellows.

Policy Fellowships Working Group

Dr David Cleevely CBE FREng (Chair)
Dr Steve Denton FREng
Dame Judith Hackitt DBE FREng
Paul Kett
Dame Clare Moriarty DCB
Paul Taylor CBE FREng

Programme team

Ajo Kacmar
Programme Manager Policy Fellowships

Marine Shah
Head of Policy Programmes and Partnerships

And in 2022:

Liz Byron
Programme Officer National Engineering Policy Centre

Michelle Machin
Executive Officer Policy and International

Arizona Rodriguez
Policy Advisor Innovation

Isabella Stevens
Policy Officer Climate and Sustainability Policy

Apply

Twice a year the Royal Academy of Engineering will select exceptional policymakers to become Policy Fellows.

Successful Policy Fellows are civil servants or public servants with responsibility for policy or service design in any sector and with the ability to influence and impact public policy.

The Academy is committed to diversity and inclusion. We welcome applications from a range of backgrounds for example: economics, politics, sociology, health, planning, digital, science or engineering; and from a range of institutions with a public service mission, including central, devolved and local government, arm's length bodies or public agencies.

Key dates

APPLICATION DEADLINE

1 March to 1 June 2023

1 September to 1 December 2023

PROGRAMME STARTS

September 2023

March 2024

For more information, please visit:
www.raeng.org.uk/policyfellowships 

or contact the programme team at
policyfellowships@raeng.org.uk.

The 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 our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

What we do

Talent and diversity

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

Innovation

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

Policy and engagement

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.

For more information about the Policy Fellowships programme, please visit <https://raeng.org.uk/policyfellowships> or contact policyfellowships@raeng.org.uk.



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