Funders NSF UK Research and Innovation
NSF Award No. 2330565
UKRI Award No. EP/Y026233/1

CLEETS

Systems approaches for decarbonising energy and transport in the CLEETS Global Centre

Jonathan Radcliffe, Professor of Energy Systems
University of Birmingham

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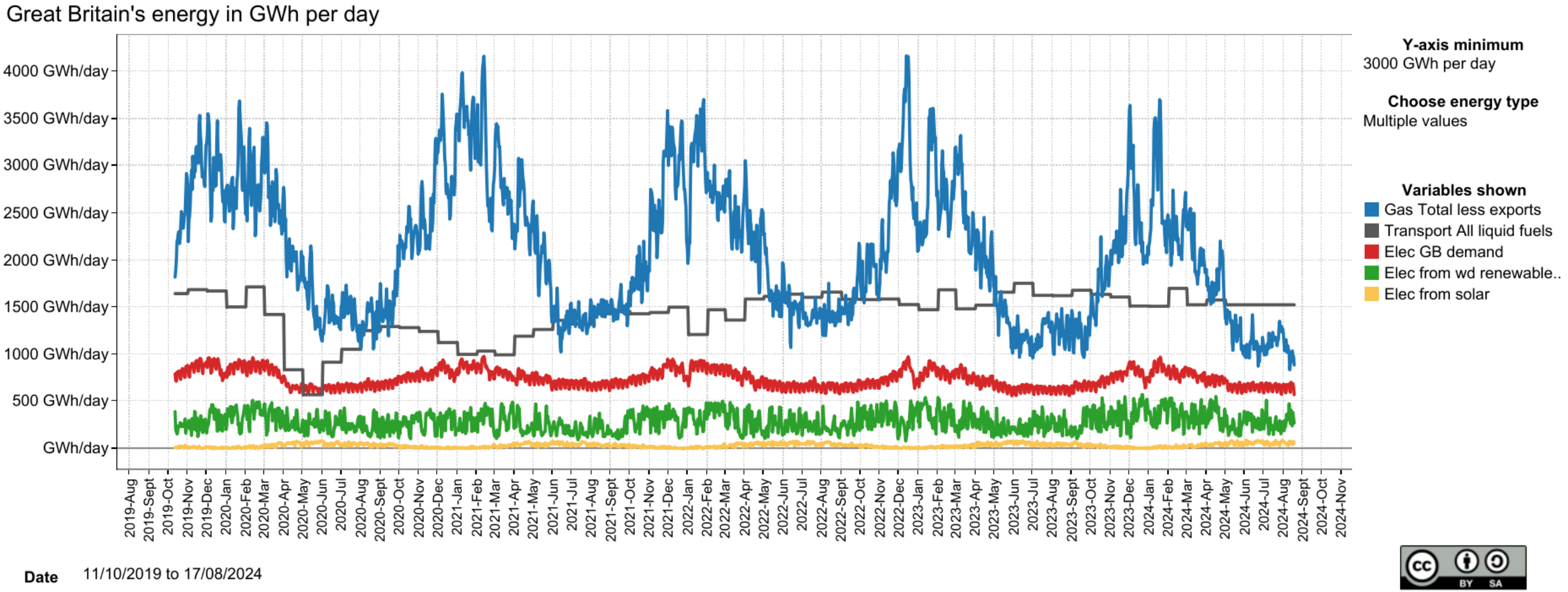
Energy *and* Transport



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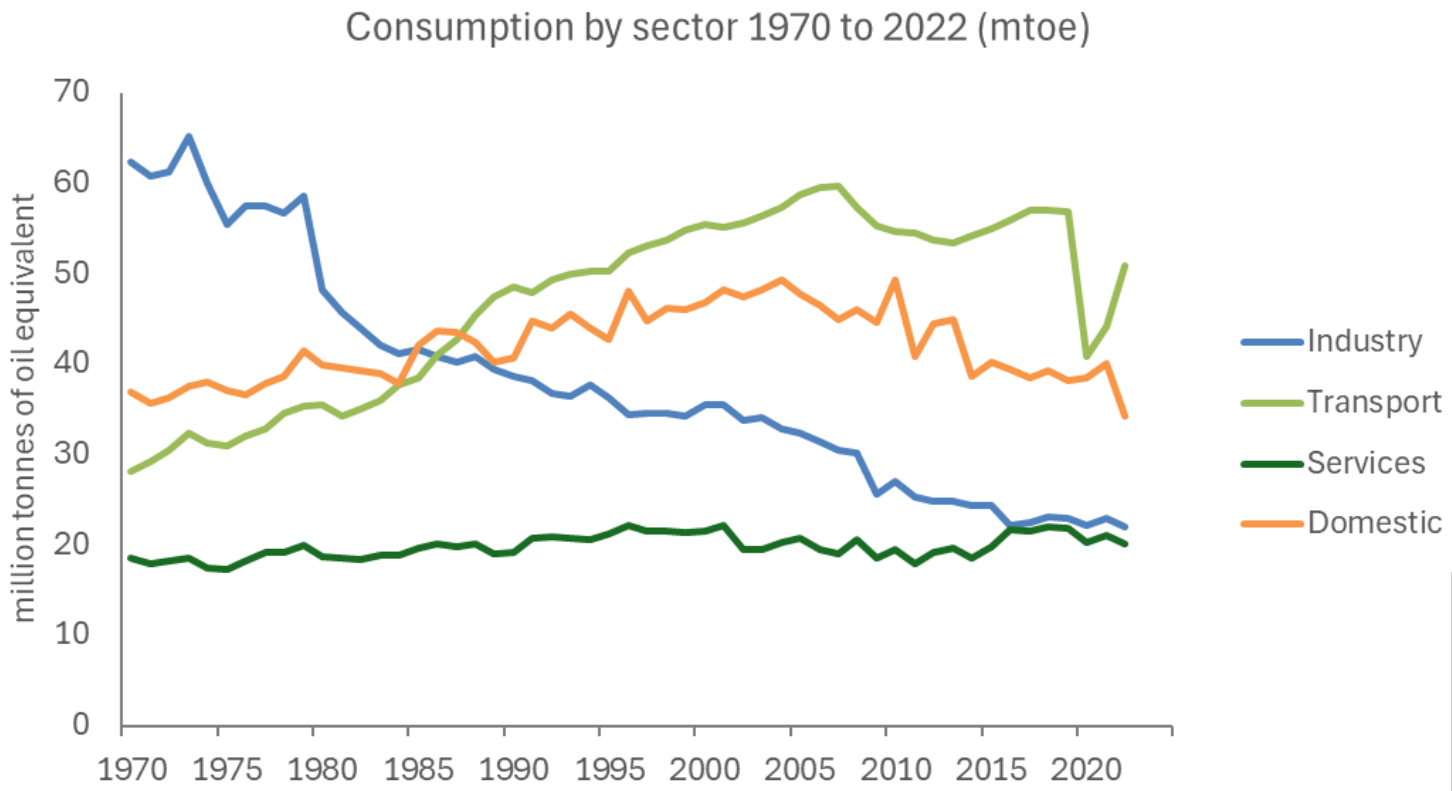
Underlying data are from National Grid ESO, National Gas, Elexon and DESNZ
Figure created by Dr Grant Wilson: i.a.g.wilson@bham.ac.uk
Energy Systems and Data Group, University of Birmingham

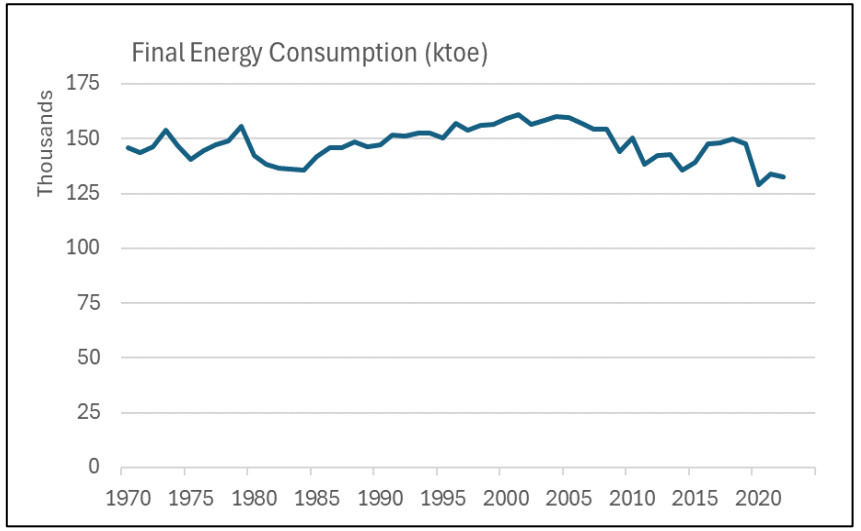
Grant Wilson (UoB) https://public.tableau.com/app/profile/grant.wilson/viz/GreatBritainsenergydailydata/GBenergyperday

UK’s energy consumption, trends over time



HM Government (2023) Energy Consumption in the UK

https://www.gov.uk/government/statistics/energy-consumption-in-the-uk-2023



Future energy scenarios – electrical demand

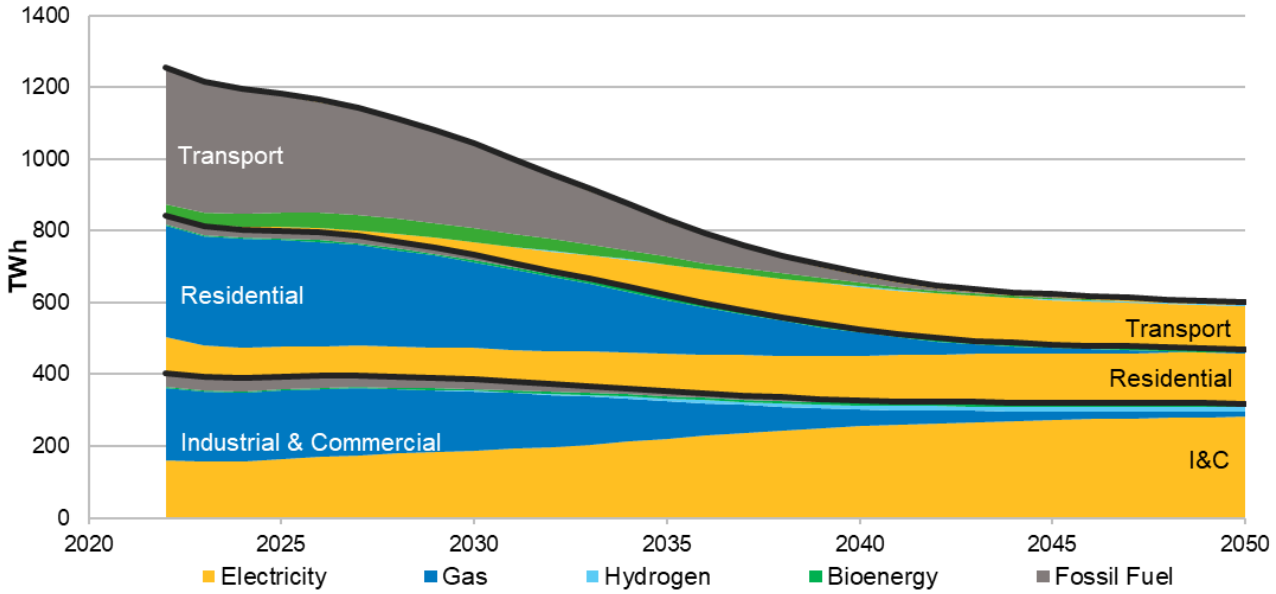


Figure EC.01 Annual consumer demand in Consumer Transformation by fuel and sector

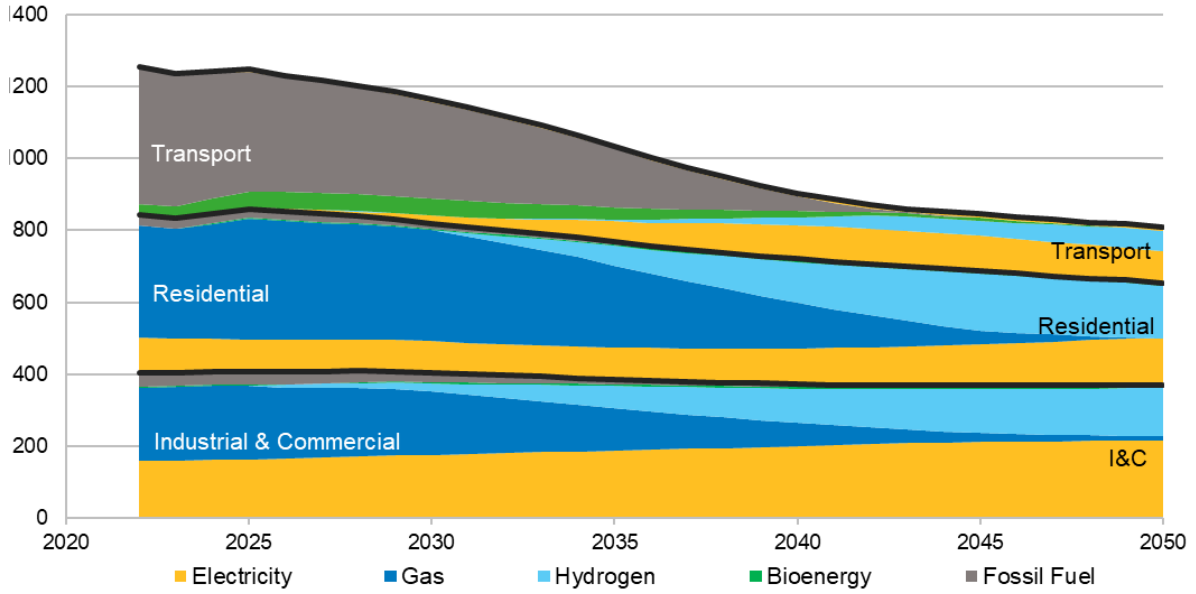


Figure EC.02 Annual consumer demand in System Transformation by fuel and sector

National Grid Future Energy Scenarios 2023

https://www.nationalgrideso.com/future-energy/future-energy-scenarios

Future energy scenarios – elec. generation

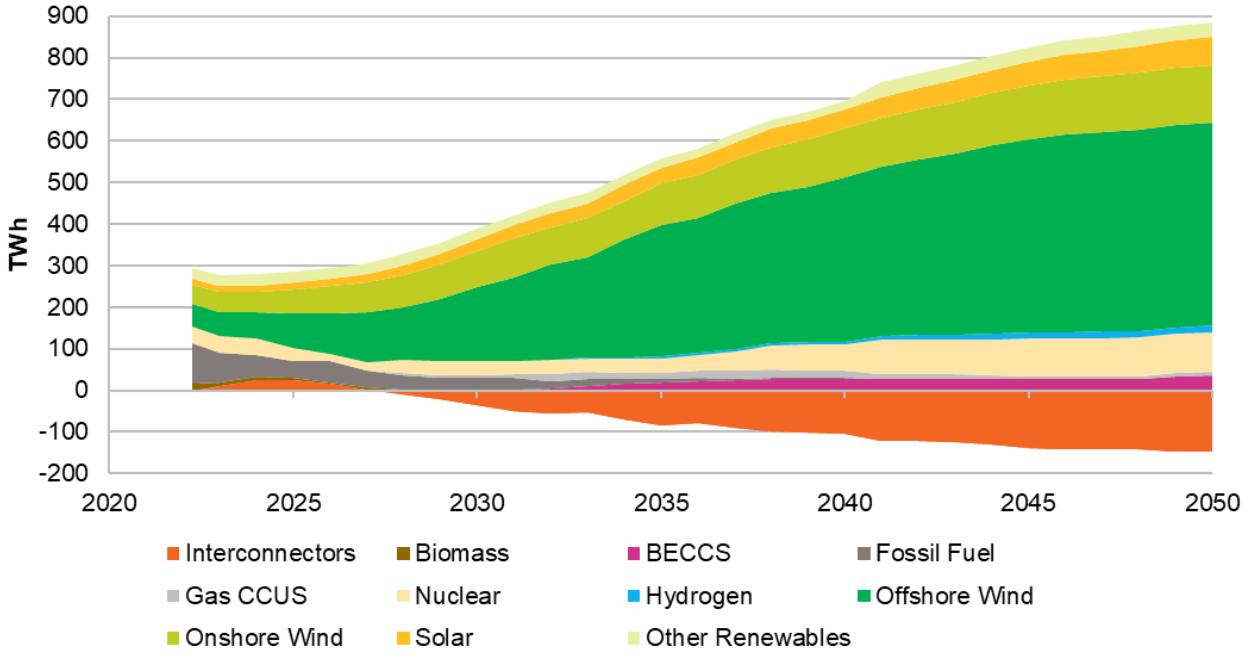


Figure ES.05: Electricity output by technology in Consumer Transformation

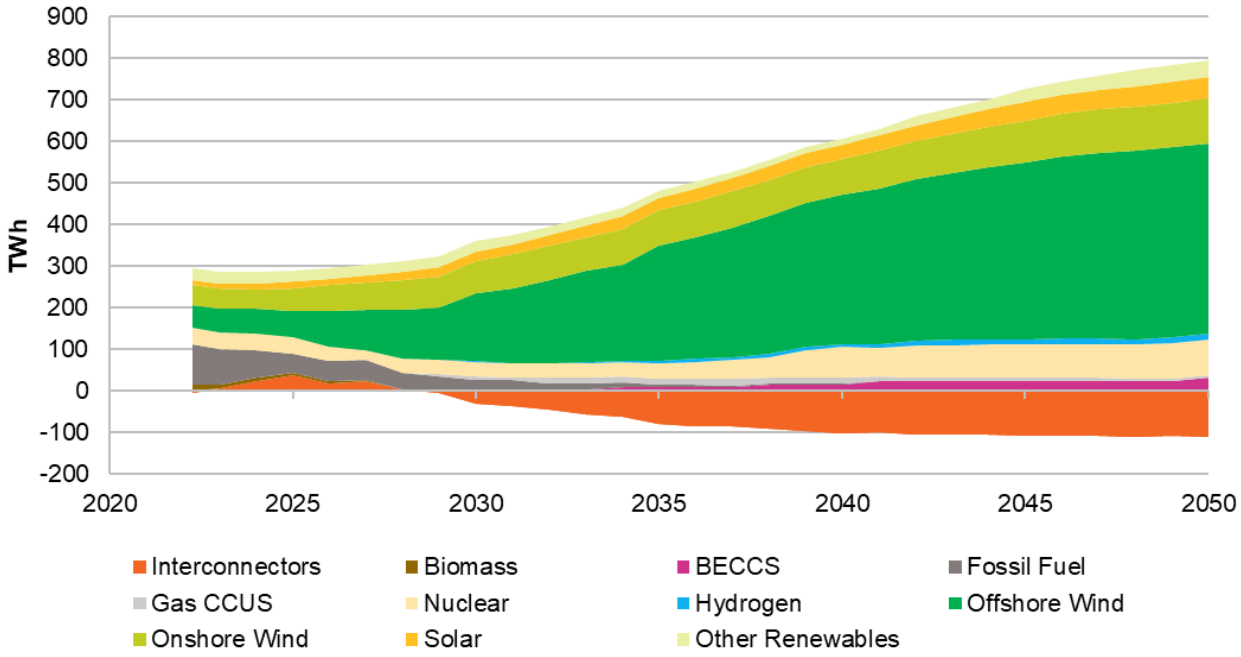


Figure ES.06: Electricity output by technology in System Transformation

National Grid Future Energy Scenarios 2023

https://www.nationalgrideso.com/future-energy/future-energy-scenarios

Global Centres in clean energy

The Global Centres programme is an NSF-led effort, implemented in partnership with like-minded international funders: CSIRO (Australia), NSERC and SSHRC (Canada) and UKRI.

To support “convergent interdisciplinary research collaborations focused on assessing and mitigating the impacts of climate change on society, people, and communities.”

Successful Global Centres announced in September 2023, in UK also covering hydrogen production, electric power innovation, and nitrogen innovation:

https://www.ukri.org/news/global-collaboration-to-accelerate-clean-energy-innovation/

https://new.nsf.gov/news/nsf-international-partners-invest-764-million

CLEETS funded in US: $5m; UK: £6.25m

Start date: 1st December 2023; https://www.cleets-global-center.org/

CLEETS

Mission statement: The "CLean Energy and Equitable Transportation Solutions (CLEETS)" NSF Global Center will bring together eminent climate, energy, data science, and transportation experts to advance interdisciplinary research and education and accelerate equitable *use-inspired* decarbonized road transportation pathways by engaging government, private sector, industry, and end-user communities.

‘**Objectives**’

1. Establish a global center for climate change, clean energy, and clean transportation research.
2. Enhance international collaboration
3. Knowledge transfer, community, and stakeholders as beneficiaries
4. Education, Training, and Inclusion

CLEETS Global Centre team

US: Ashish Sharma (PI) at Discovery Partners Institute, part of the University of Illinois System, with University of Illinois Urbana-Champaign (UIUC), University of Illinois Chicago (UIC), Arizona State University (ASU), the U.S. National Center for Atmospheric Research (NCAR)

UoB: Jonathan Radcliffe (PI, Chem Eng), William Bloss (GEES), Lee Chapman (GEES), Dilum Dissanayake (GEES), Phil Jones (GEES), Jian Zhong (GEES), Andrew Quinn (Engineering), Louise Reardon (CoSS), Suzanne Bartingon (Appl Health), Neha Mehta (Chem Eng), Paul Anderson (Chem) + post docs

With UK project manager Rebeckah (Beckie) Trinder

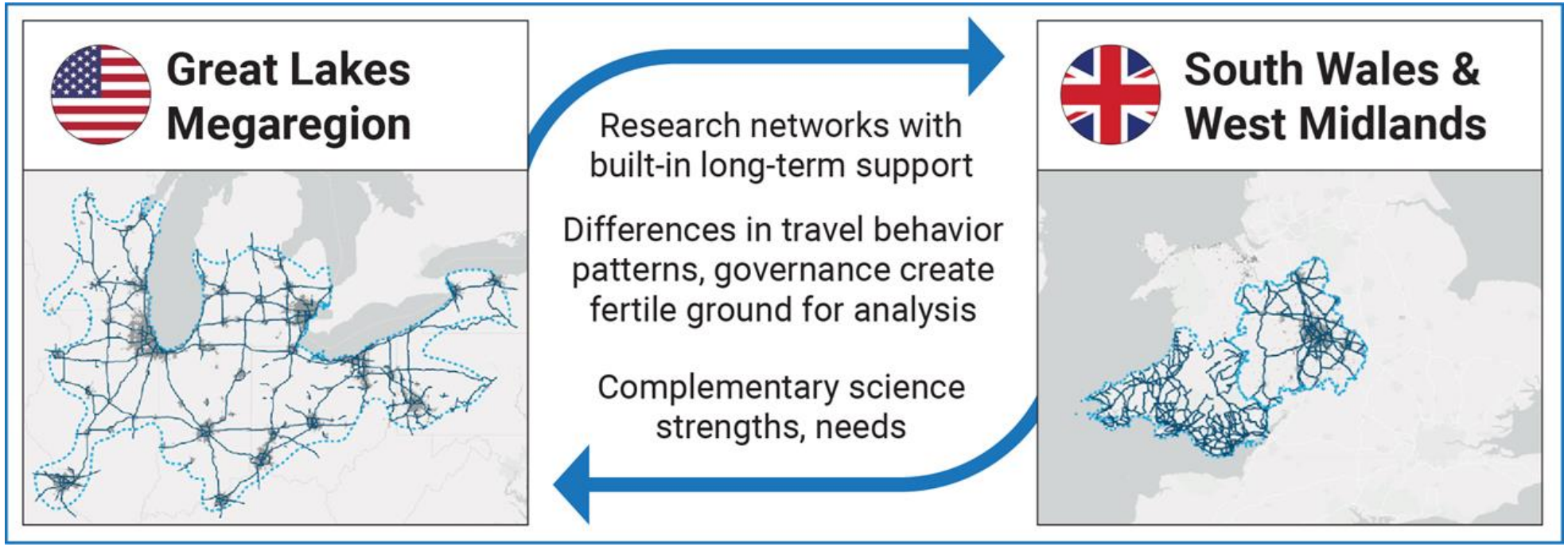
Cardiff: Omer Rana (Comp Sci), Dimitris Potoglou (Geog), Crispin Cooper (Comp Sci), Liana Cipigan (Engineering), Duncas Wass (Chem), Maurizio Albano (Energy Sys), and Neetesh Saxena (Comp Sci) + post docs

Motivation

- The US and the UK are taking a leadership role in combating climate change and accelerating clean energy adoption by implementing science-founded climate-neutral policies and interventions.
- However, uncoordinated investments in infrastructure, rapidly increasing population densities, and existing divide in the social fabric of our communities exacerbate the issue.
- Climate science must be integrated with transportation, energy, infrastructure modeling, policies, investments, and research from the private sector and community knowledge to solve this problem.
- CLEETS will help shift this paradigm to a sustainable, resilient, and economically viable pathway.

Use-inspired research

From a societal-needs perspective, the Great Lakes, West Midlands and South Wales regions are excellent testbeds for CLEETS use-inspired research. These regions have deep-rooted social inequities, inadequate land use planning and design, environmental stresses, and high emissions from dense and congested fossil-fuel transportation systems.



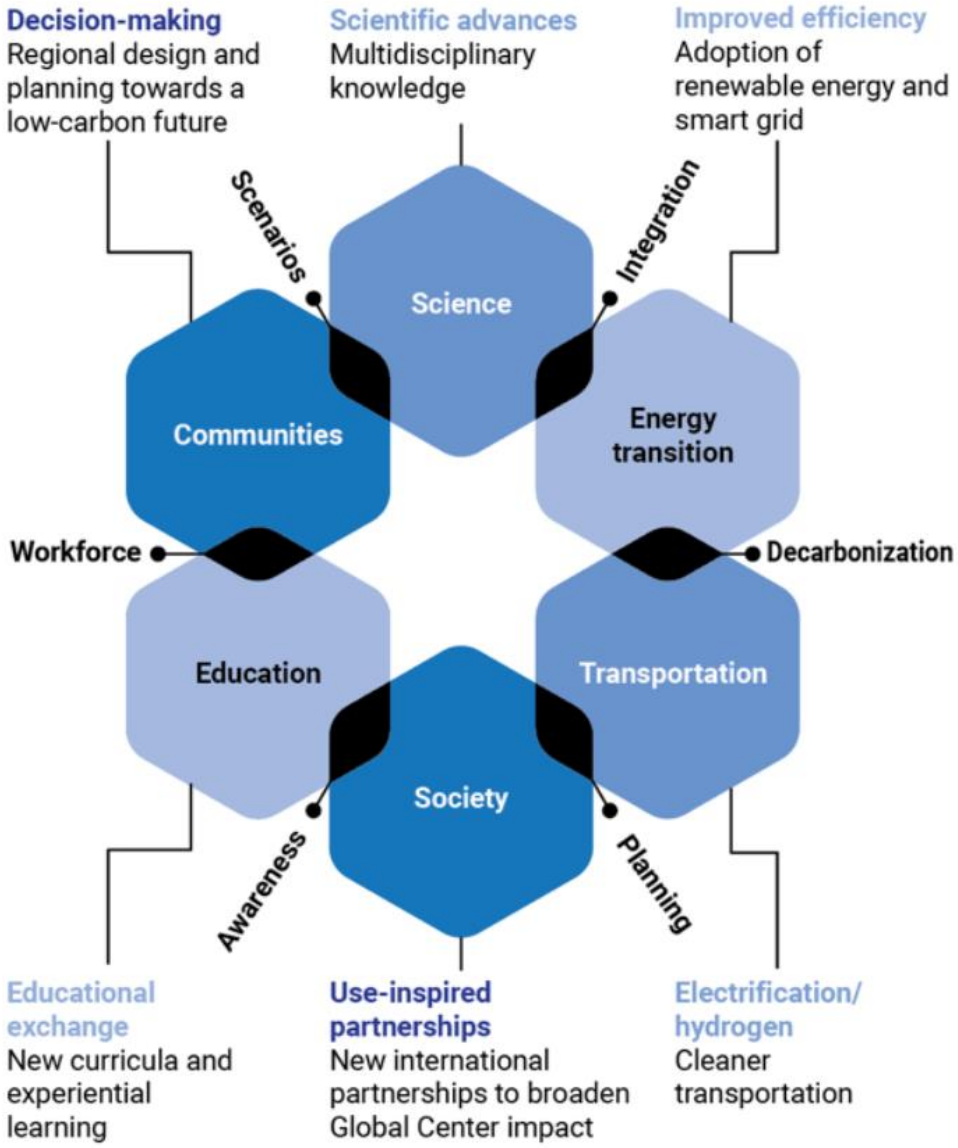
CLEETS convergence science approach

Convergence research is a means of solving vexing research problems, especially those focusing on societal needs.

- It is driven by a specific and compelling problem.
- It shows deep integration across disciplines.

CLEETS will advance our understanding of key Coupled Infrastructure Systems feedback mechanisms that require effective monitoring, sanctioning, sharing information, and decision making without generating unintended consequences.

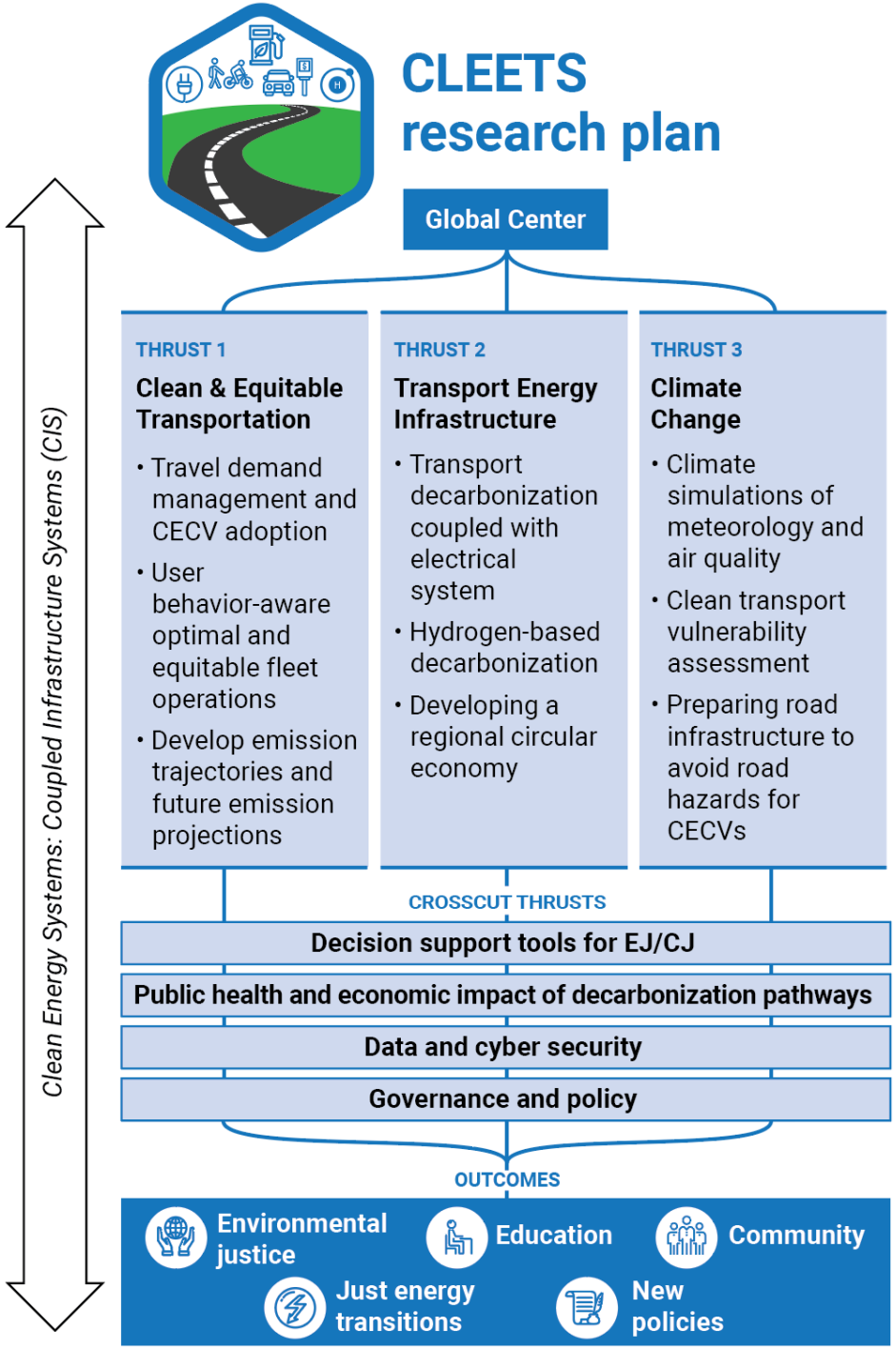
https://new.nsf.gov/funding/learn/research-types/learn-about-convergence-research



CLEETS Research plan

Research in three thematic thrusts, with cross-cutting analyses of common challenges, to

- achieve a just energy transition,
- inform policy development,
- provide workforce development and education opportunities,
- engage communities, and
- address environmental justice issues.



Research

Thrust 1. Clean and Equitable Transportation

Studying the impact of transportation choices as well as the pace of equitable clean energy transportation adoption by individuals and fleet owners

Thrust 2. Transport Energy Infrastructure

Coupling electricity, transportation, water, petrochemical, and mineral resources, to avoid shifts in emission sources and optimize resource allocation

Thrust 3. Climate Change

Climate simulations corresponding to transport decarbonization scenarios to determine the policy pathways most beneficial to society and are least disruptive

Crosscuts

On climate justice, public health, governance, cyber-security, and coupled infrastructure systems.

Progress

- Project start December 2023
- In-person 3-day workshop, June ’24, with external stakeholders
- Research collaborations building
- Pivoting to cross-thrust, challenge-based, approach
- Session at UN General Assembly Science Summit, September 2024 (https://sciencesummitunga.com/)
- ‘Fall School’ online and in-person: today! 16th October 2024
- Next CLEETS workshop: June ’25, Chicago alongside SRI (https://sricongress.org/home/sri2025/)

Stakeholder views

- Policy leads to change
- Support policy decisions from research and analysis
- Scenarios as a useful tool for considering options

- The ability for publics to change behaviour is constrained by systems
- Communication strategies are important to motivate behaviour change
- Exploring behaviour change mechanisms, such as the effectiveness of incentives versus penalties, could be key to promoting sustainable transport outcomes.

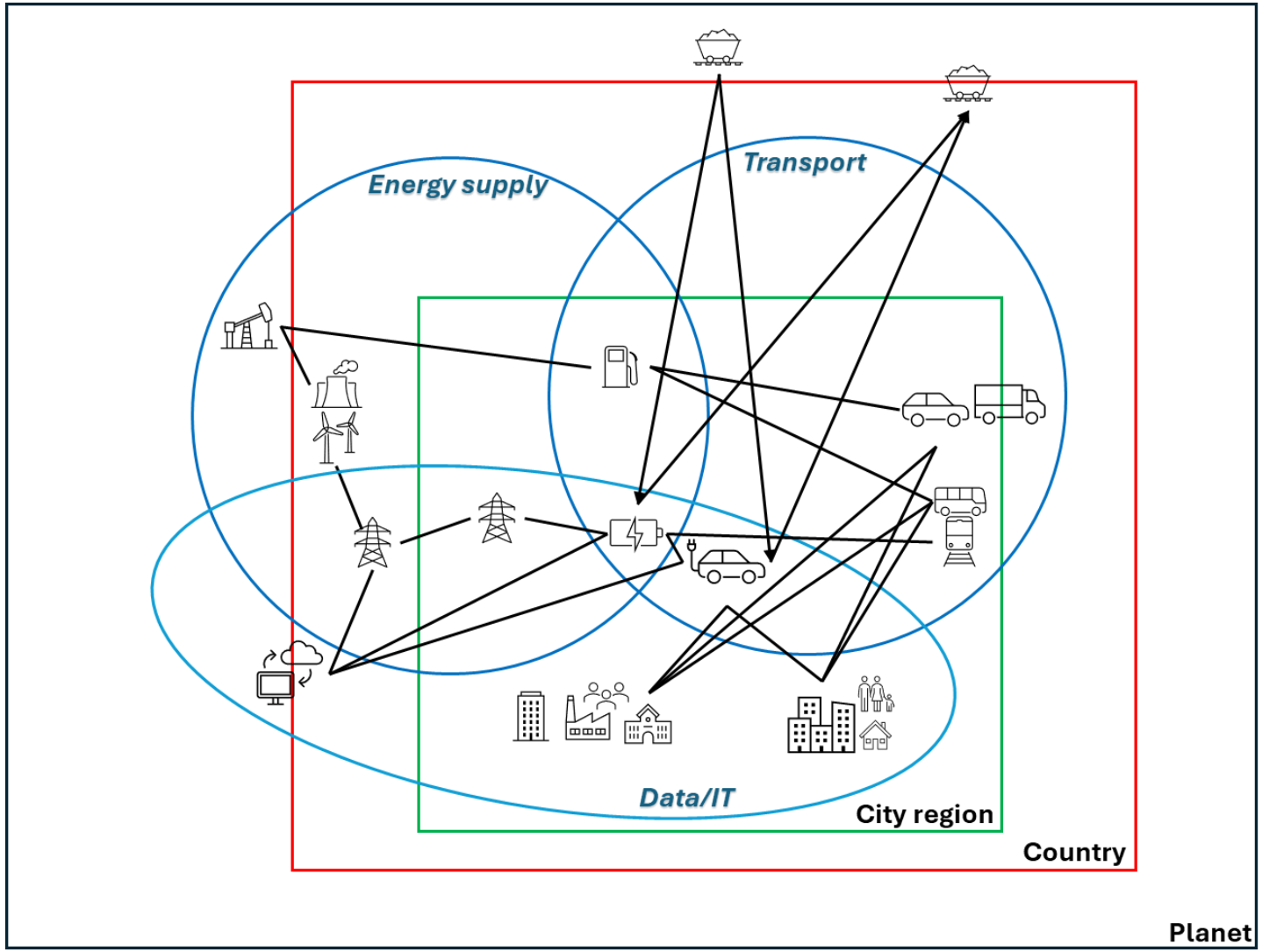
- Enhancing digital connectivity could have multiple positive impacts to reduce demand or improved efficiency
- Slow growth of electrical infrastructure will limit adoption of clean alternatives
- Must consider wider environmental impacts of decisions, from battery manufacturing/end-of-life to air quality and public health.

Emerging thinking on systems and scenarios

Transformation of energy and transport/mobility is very different to incremental change.

How can this be achieved through institutional mechanisms, and what could be the impacts?

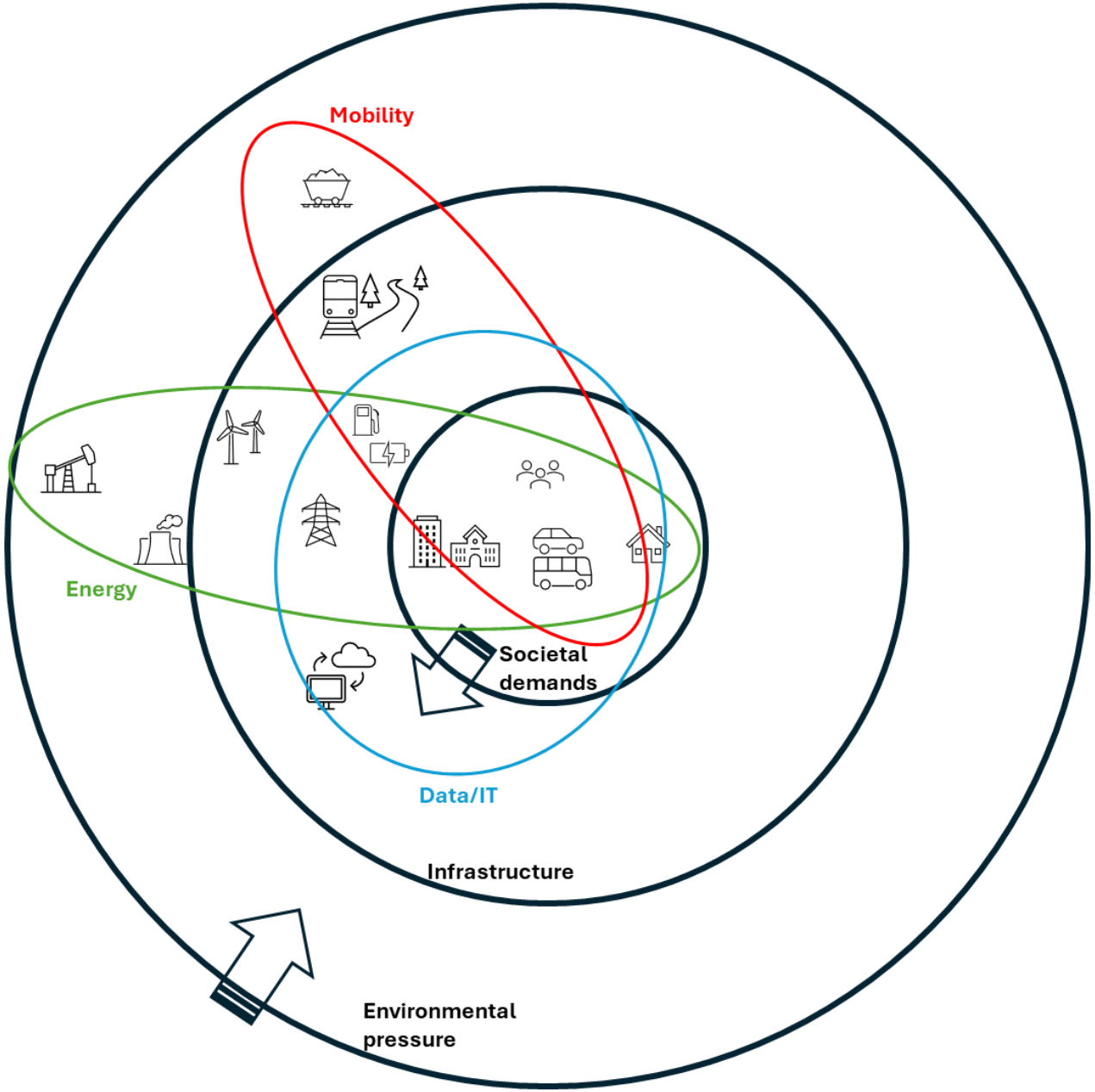
Intersections between systems are likely to become more prevalent and can introduce vulnerabilities.



We are exceeding socio-environmental boundaries.

What does a desirable future look like?

How do we use scenarios to consider pathways back to a ‘safe and just’ operating space?



Concluding

How can we transform energy and mobility systems in cities so they are sustainable and resilient?

- Understand the needs of partners in policy and industry
- Exchange approaches, models, data, people across the consortium
- Engage with wider research community and stakeholders
- Aim to inform decisions, in particular on infrastructure investments, the consequences of which will be long-lasting