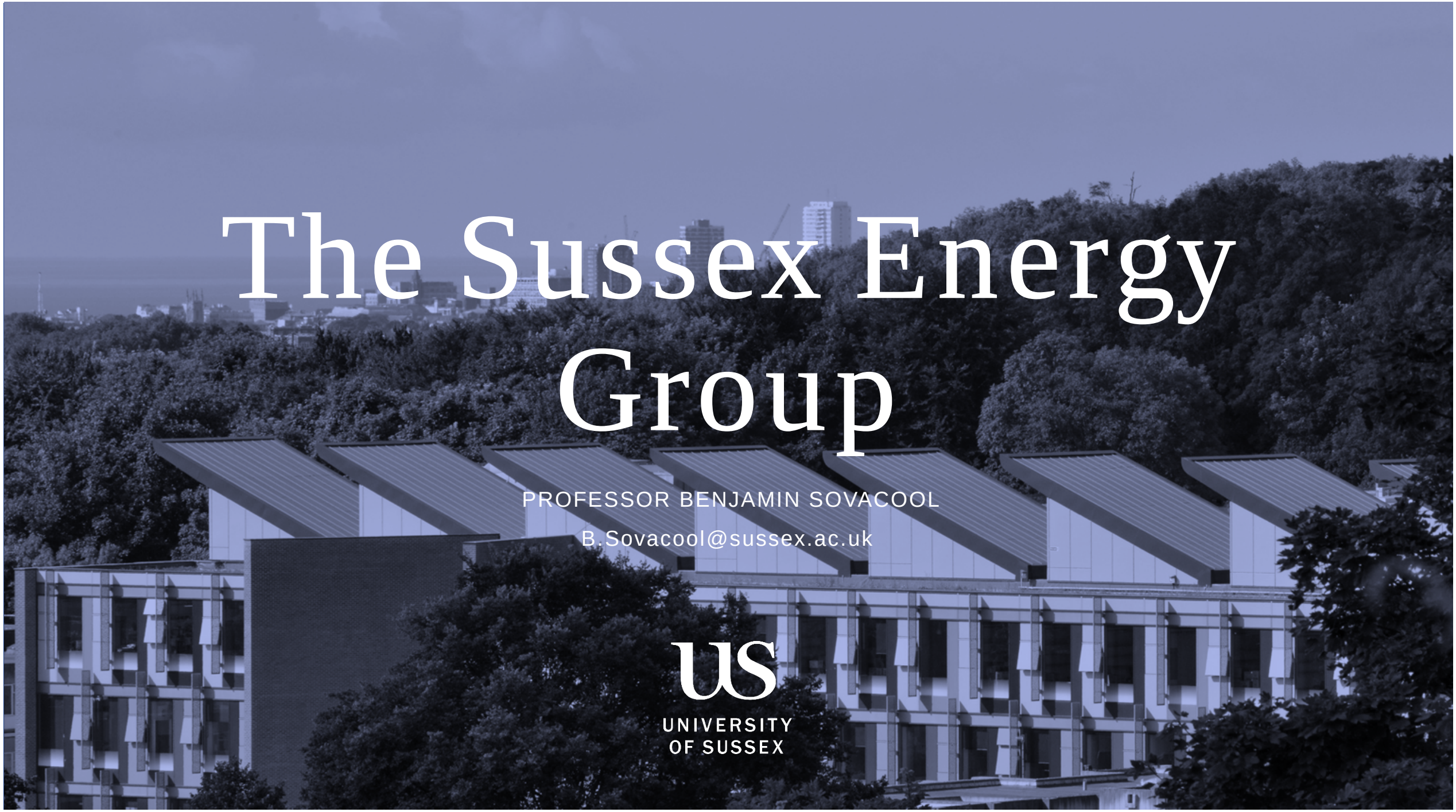


The Sussex Energy Group

PROFESSOR BENJAMIN SOVACOOL

B.Sovacool@sussex.ac.uk

UNIVERSITY OF SUSSEX

School of Business, Management and Economics

UNIVERSITY OF SUSSEX

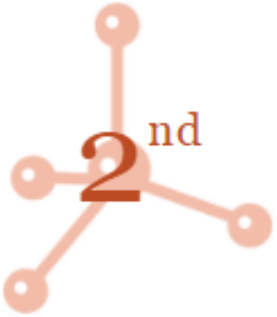
Facts and figures

Research

1st

in the UK for research in energy economics

Research Papers in Economics, 2017



2nd

in the UK for research in innovation

Research Papers in Economics, 2017

5th

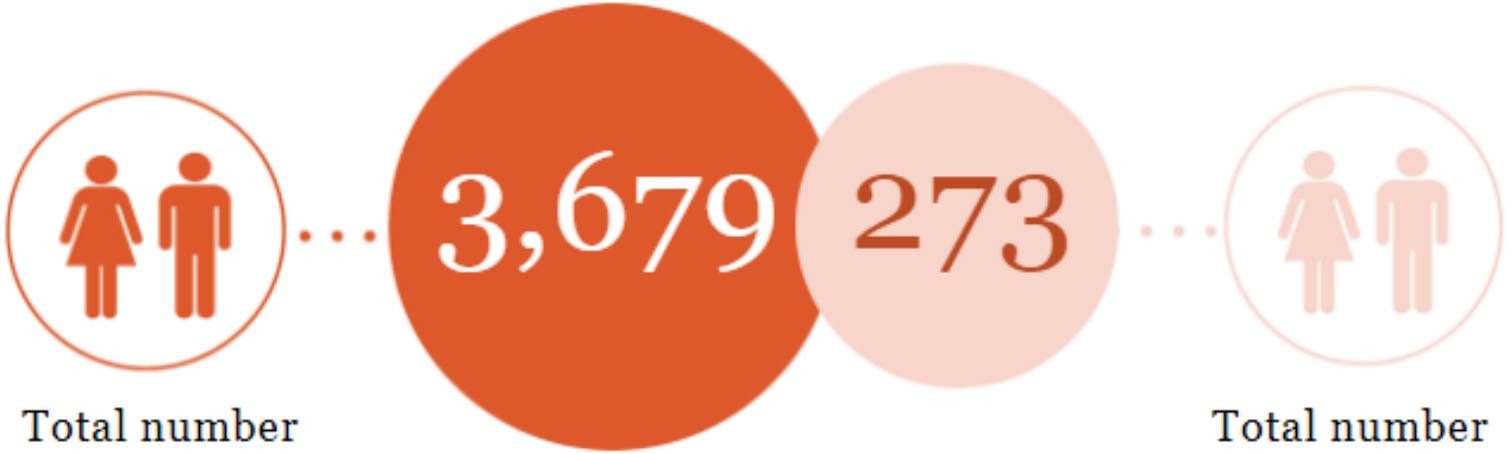
in the UK for value of research grant income

Chartered Association of Business Schools, 2017

UNIVERSITY OF SUSSEX

Facts and figures

Staff and Students



Student and staff numbers correct as of 1 December 2016

UNIVERSITY OF SUSSEX

Science Policy Research Unit

- Founded in 1966, SPRU was one of the first interdisciplinary research centres in the field of science and technology policy and management, and today remains at the forefront of new ideas, problem-orientated research and inspiring teaching

- 60 academic staff, over 70 doctoral students, more than 300 MSc students, over £6m of ongoing UK Research Council funded projects and over £2m of ongoing European Commission funded projects

SPRU

What we do: Teaching

Energy Policy

This course provides broad-based, interdisciplinary social science training for future energy policy professionals working in the public, private and not-for-profit sectors. The MSc focuses on the role of technological innovation and explores the opportunities, challenges and constraints in creating sustainable and low-carbon energy systems throughout the world. Our approach is interdisciplinary, practical and applied. The course is unique in combining ideas from economics, innovation studies and policy studies, providing you with the skills to analyse policy problems and to propose and evaluate viable policy solutions.

The course is led by the Sussex Energy Group (SEG), one of the largest independent social science energy policy research groups in the world. You will be taught by experts on climate change mitigation and the adaption of energy policy including:

Dr Steve Sorrell - Rebound

Dr Rob Byrne - Policy approaches to facilitate Low-carbon technology transfer

Dr Florian Kern - Sustainability transitions

What we do: Teaching

Sustainable Development

This course equips students with the knowledge and skills to translate theories of innovation into effective development policies and practices to achieve inclusive growth in the Global South.

The United Nations' post-2015 Sustainable Development Goals propose to end poverty and hunger while achieving sustainable production and consumption. The World Bank and other influential international agencies increasingly talk about sustainable development in terms of 'Inclusive Green Growth'. Yet the different aspects of economic growth, greening and inclusiveness, may be at odds with each other. Therefore, strategies to address these challenges are fast becoming a 21st century imperative.

The course, convened by Professor Maria Savona, will help students to translate theories of social and technological innovation into effective development policies and practices to achieve genuinely sustainable development. The QS University World Rankings have ranked the University of Sussex number one in the top 100 universities in the world for development studies.

What we do: Teaching

Science and Technology Policy

This course provides a solid foundation in the language, logic and tools of policy analysis, enabling you to investigate specific science and technology policy challenges across public policy, industrial innovation and strategy and to evaluate and recommend policy solutions. The course will equip you to tackle tomorrow's most important social and environmental challenges.

Our Science and Technology Policy MSc is the world's oldest and most comprehensive introduction to this important field. You will be taught by key figures in the field including;

Dr Rob Byrne - Policy approaches to facilitate Low-carbon technology transfer

Professor Erik Milstone - author of The Atlas of Food, which won Memorial Fund's Best Food Book Award in 2004.

What we do: Teaching

Strategic Innovation Management

Successful innovation management can create significant value, both economic and social, but is neither easy nor automatic. This course equips you with the knowledge and skills needed to lead and manage innovation at both operational and strategic levels. You develop an integrative approach that combines the management of the market, technological and organisational changes – and learn how to create value from innovation.

The course is convened and taught by Professor Joe Tidd. He has written eight books and more than sixty papers on the management of technology and innovation, including the award winning *Managing Innovation* the best–selling text for MBA, MSc and advanced undergraduate courses on management of technology, innovation management and entrepreneurship. Globally recognised, this book has been translated into several languages.

For a superb introduction to the course, please view Joe Tidd's videos.

What we do: Teaching

Project Management

As a student on this course you a compelling set of critical skills to help you manage projects in today's dynamic business and economic environment. The course provides you with a comprehensive understanding of core competencies including how to manage complex projects, risk and innovation. In addition, we have introduced exciting new modules in advanced project management good practices and leadership. Skills in these areas are highly valued by employers and many of our graduates have found immediate employment in large international corporations, not-for-profit organisations and management consultancies. You will graduate with solid analytical skills and the critical thinking essential for leadership roles.

Students will be taught by leading academics who bring cutting-edge research and practice into their lectures including Dr. Carlos Sato (expert on Project Management) and Dr. Allam Ahmed (expert on Management, Marketing and Leadership). This course is ideal for lucrative careers in consultancy and project management.

Sussex Energy Group (SEG)

- Energy and climate research at SPRU since early 1970s
- PhD programme and MSc in Energy Policy
- Multiple collaborative projects and networks covering UK, EU and developing countries
- Currently 60+ academics – one of the largest social science energy research groups in the world

- Truly interdisciplinary:
  - SPRU
  - IDS
  - Global Studies
  - Law Politics & Sociology
  - Engineering and Informatics
  - Psychology
  - Media, Film & Music

Sussex Energy Group (SEG)

Energy innovation and transitions

Fostering the transition towards sustainable energy systems is central to addressing climate change and other pressing societal issues. We examine technical, social and political aspects of change processes in multiple sectors. By engaging with policymakers, industry and civil society across the globe, we aim to open up pathways to inclusive and sustainable energy futures.

Economics and finance

Economics and finance are central to the challenge of the low carbon transition. We draw upon mainstream and alternative economic perspectives to better understand the complex relationships between energy, finance, innovation and economic growth. Our projects are problem-oriented and applied, and engage with a range of contemporary UK and international policy debates.

Energy justice

We investigate both the process and outcome of energy policies and transitions through a justice lens. This includes questions of vulnerability and fuel poverty in Europe; corruption and violence against marginalized groups in Africa and Asia; and global issues of energy and human rights. We also explore how energy innovations can create new possibilities for improving equity and well-being.

Sussex Energy Group (SEG)

Energy demand and behaviour

Significant changes in energy demand will be necessary to meet the challenges of climate change and sustainability. Energy demand research often focuses on incremental behaviour change or technological fixes. Our research goes beyond this, considering how people use and interact with technology, how organisations effect change and how policies can encourage this change.

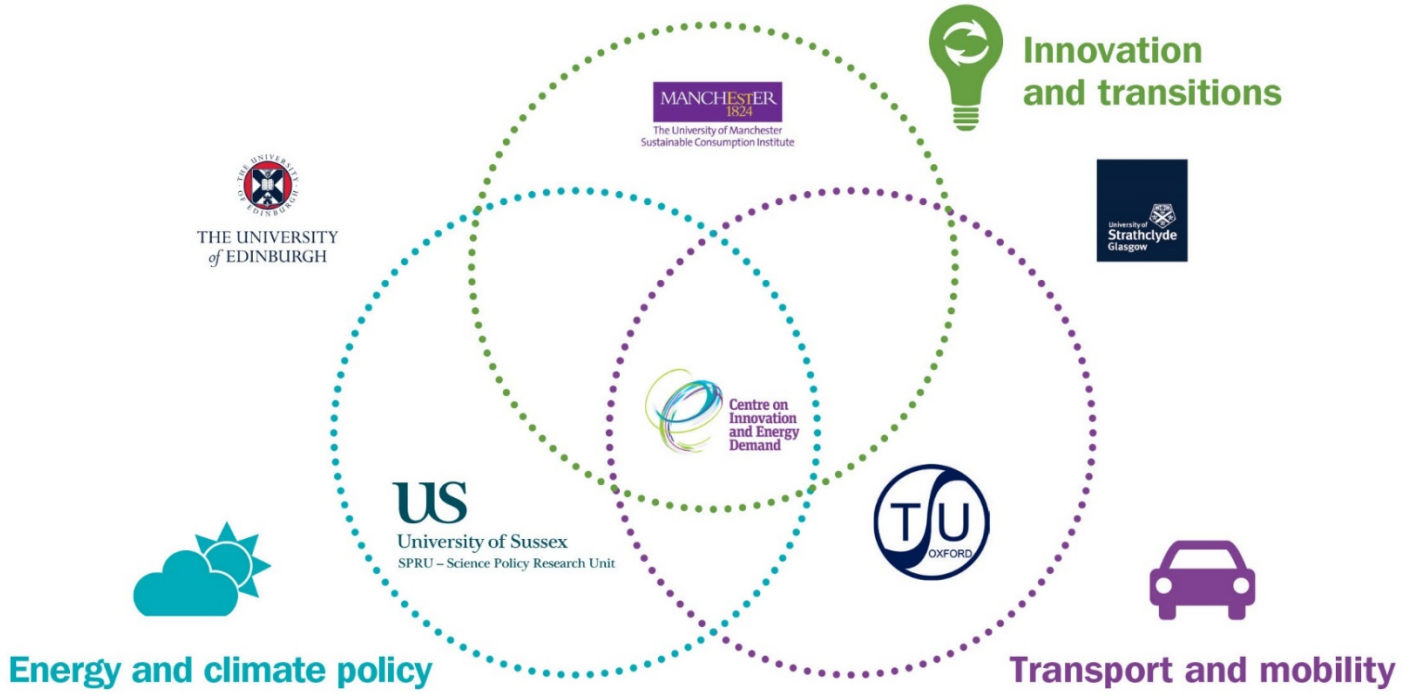
Smart infrastructure

Capital-intensive infrastructures – such as electricity grids, pipelines, rail networks, roads, electric charging points, buildings, and ICT – are key to delivering energy services. We investigate the governance challenges resulting from the increasing interconnectedness of such infrastructures, and how investment in smarter, low carbon infrastructures can be accelerated.

Energy supply technologies

We study the economics, social acceptance and broader sociotechnical implications of different energy supply options. We conduct policy-relevant research on a range of technologies including nuclear, coal, gas and renewables. Our research examines issues related to the deployment of new technologies as well as the discontinuation of carbon-intensive technologies and the management of nuclear waste.

Center on Innovation and Energy Demand (CIED)



Our research programme is:

Interdisciplinary

We draw on ideas from economics, history, innovation studies, sociology and urban geography.

Multi-method

We use qualitative and quantitative techniques ranging from historical and contemporary case studies, surveys, modelling and econometric analysis.

Practical and relevant

We investigate low-energy innovations relevant to transport, industry, households and non-domestic buildings, and work with stakeholders to better understand their adoption of low-energy innovations.

Center on Innovation and Energy Demand (CIED)

Who We Are

Science Policy Research Unit, University of Sussex

Basque Centre for Climate Change, Spain

Cambridge Econometrics, UK

Energy Research Centre of the Netherlands

Swiss Federal Institute of Technology

Institute for Structural Research

Joint Implementation Network, Netherlands

National Technical University of Athens, Greece

Stockholm Environment Institute, Stockholm, Nairobi and Oxford

University of Graz, Austria

University of Piraeus Research Centre, Greece

Pontifical Catholic University of Chile

Our Project

Climate change is with us and huge cuts in carbon emissions have been agreed as a response. The next 30 years will see most nations making radical transitions to low carbon economies

TRANSrisk is studying the risks and uncertainties within low carbon transition pathways, and how transitions can be implemented in ways that are technically, economically and socially feasible. The project will produce a new assessment framework, and tools, for policy makers.

We are studying low carbon transitions in 15 different countries across Europe, North America, Asia, Africa and Latin America.

12 leading universities and research institutes from Europe and beyond have come together for TRANSrisk, with funding provided by the European Commission.

Visit us:

www.transrisk-project.eu

Email us:

transrisk@sussex.ac.uk

Follow us on social media:

@TRANSrisk_EU

transriskEU

TRANSrisk_EU

TRANSrisk

The TRANSrisk project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642260.

TRANSrisk

TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

A global study of technically, economically and socially feasible low carbon transitions, with a focus on understanding risk and uncertainty

Visit us at:
www.transrisk-project.eu

Online Tools

Technology Matrix

Presents historic and projected characteristics, and associated uncertainty, of key low-carbon technologies

Policy Assessment Framework

Presents key evidence-based characteristics of policy instruments and mixes to encourage the low-carbon transition

Interactive Decarbonisation Simulator

Allows co-designers to estimate the roles and trade-offs for different decarbonisation strategy options

Low-Carbon Pathways Platform

Allows detailed examination of state-of-the-art low-carbon pathways produced by INNOPATHS

Partners

Contact us

http://www.ucl.ac.uk/bartlett/sustainable

+44 (0) 20 3108 5935

http://www.innopaths.eu

@innopathsEU

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730403.

INNOPATHS

Innovation Pathways, Strategies And Policies For The Low-Carbon Transition In Europe

Newcastle University

National Centre for
Energy Systems Integration

Prof Gordon MacKerron

- **University of Sussex**
- Email: Gordon.Mackerron@sussex.ac.uk

Gordon is Professor of Science and Technology Policy at the Science Policy and Research Unit (SPRU). He specialises in the economics and policy issues of electricity, especially nuclear power, and more broadly in energy security questions. He currently chairs the Research Committee of UKERC and was deputy director of the Strategy Unit, Cabinet office team that wrote the 'Energy Review' in 2003.

He is currently overall PI in the Horizon 2020 project TRANSrisk, a collaboration of 11 partner institutes engaged in assessing the risks attaching to different policy pathways consistent with achievement of European 2050 climate change commitments.

Gordon works on a number of CESI Work Packages, and is lead for **Work Package 1**:

- WP1 Commercial, Regulatory & Policy Aspects
- WP6 Multi-scale Architectures, Planning & Operation
- WP7 Impact, Engagement & Management

UKCRED (led by Tim Foxon and Steve Sorrell)

Sub theme	Projects (Years 1 – 3)
5.1 ICTs and energy productivity	5.1.1. Reviewing the evidence on ICTs and energy consumption
	5.1.2. Estimating historical impacts of ICTs on energy consumption
	5.1.3. Anticipating future impacts of ICT's on energy consumption
5.2 Business models in the digital economy	5.2.1. Digital platforms for the sharing economy
	5.2.2. New energy service business models
5.3 Smart systems and user practices	5.3.1. Accelerated diffusion of smart meters
	5.3.2. Expectations for automated vehicles
	5.3.3. User acceptance of smart homes
	5.3.4. The potential for teleworking

SPRU to lead new £2m research programme on Digital Society and Energy Demand

UNIVERSITY OF SUSSEX

SWS Heat

- Task 7.5: Social Life Cycle Assessment

- Task 7.6: User acceptance and policies

Task 7.5: Social Life Cycle Assessment (M4 to M48)

Task leader: UOS; Contributing partners: UNIPG, NTUA, UFP, UDL, ARCHIT

This Task concerns firstly the investigation of case studies of past, rapid transitions in low-carbon heat, looking for lessons that can be applied to SWS-heating. Then, a novel dedicated survey questionnaire eliciting social and user perceptions of SWS-heating and other heating devices will be developed. It would ensure a mix of respondents (end-users, construction companies, etc.), a mix of countries (representative EU countries from south/central/north Europe) and a randomised sample. Questions will focus on aspects such as user expectations and practices with SWS-heating and heat as an energy service, but also business models (providing input to Task 8.4) and policy recommendations (input to Task 7.6).

Social aspects of the system with positive and negative impacts along its life cycle will be evaluated. The analysis will be performed considering specific stakeholder categories such as producers, consumers, building managers, etc. The final Social-LCA (SLCA) will focus on: energy efficiency, indoor climate comfort, building/home security, health monitoring etc. A dedicated survey for investigating the KPI achievement will be developed and submitted to stakeholders via both printed and web-based questionnaires, including 3D images of the envisaged system integrated in buildings for a better understanding of this technology.

The final outcome is a report including all social aspects examined during the project and the results of social KPI tracing and survey results assessment.

Task 7.6: User acceptance and policies (M37 to M48)

Task leader: UOS; Contributing partners: UNIPG, UFP, NTUA

User acceptance of SWS-heating will be enhanced through dedicated analysis that connects insights about technology complexity, real and perceived costs, and feasibility issues with potential business models (with input from Task 8.4) and policy mechanisms to promote open innovation. Results will help inform social network campaigns and KPI definition of user acceptability and achieved acceptance will be performed and progressive results will be analysed to validate the success of the incorporation of the end user into the value creation process.

7.5: Social life cycle assessment

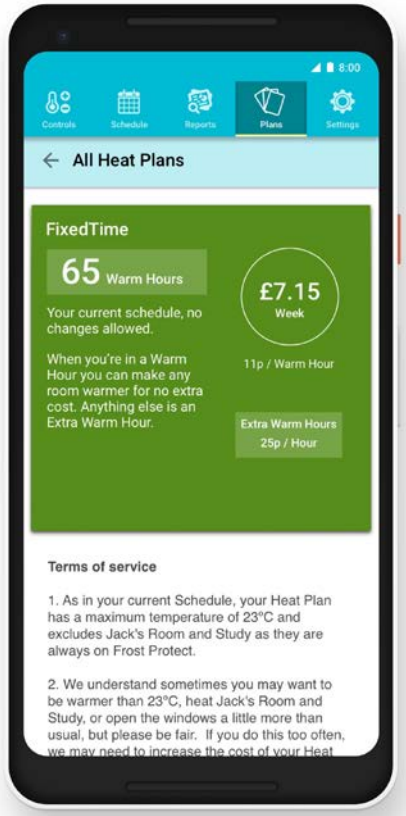
Country	Years	Technology	Polycentric component	Description
China	1995-2015	Solar thermal hot water and space heating	Stimulated industrial research with strong municipal and national targets and policies	Household use of solar heating grows from a few thousand units in the 1990s to 1 million units being manufactured each year by 2015, corresponding to 70 million square meters of collectively installed solar collection; some urban areas saw adoption rates surpass 95% of homes; China holds 76% of worldwide capacity by 2015; solar thermal systems displace an estimated 75.7 million tons of carbon dioxide per year in 2015
Denmark	1976-2011	District heating networks and combined heat and power	Blends small-scale decentralized community control with national standards and policies	Reversed Danish dependence on oil for heating in five years; converted 800,000 heating systems and installed 45,000 kilometers of heat pipes; provided 80% of household heating needs in 2011; reduced national carbon dioxide emissions by 20%
Finland	2000-2018	Heat pumps	Harnessed user and peer-to-peer learning and innovation alongside national and European policies and incentives	Diffusion grew 613-fold from approximately 1500 heat pumps in 2000 to 930,000 in 2018; roughly 30% of all Finnish homes have a heat pump; 70% of new homes choose a heat pump
United Kingdom	1960-1977	Natural gas central heating	Coordinated a nationalized Gas Council and Area Boards with industry groups, appliance manufacturers, installers and marketing campaigns	Converted 40 million appliances and 14 million homes (almost half of all homes at that time) to run on natural gas from the North Sea, rather than town gas; a majority of these conversions happen in just 10 years' time; Corresponding fuel consumption went from almost entirely town gas in 1966 (110,000 GWh), to almost entirely natural gas (443,000 GWh) by 1977; 92% of the population of the UK had a gas grid connection

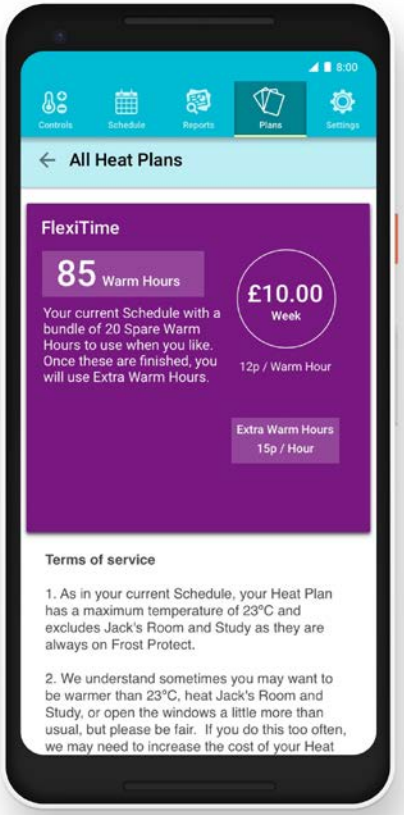
7.5: Social life cycle assessment

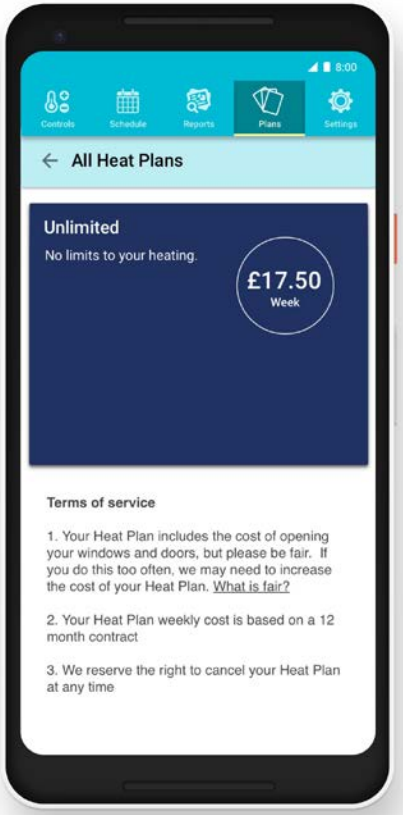
- **<u>Stage two, the survey (pushed to 2020)</u>**
- We will be soon soliciting tenders and bids from major survey companies/firms to determine optimal length vs. sample type, size, and cost (e.g. Qualtrics, YouGov and Dynata)
- In tandem with two other grants I have also designing surveys, CREDS (smart homes) and ESRC-NERC (shale gas)
- Will likely mimic these surveys which have sections on support/oppose different technologies, practices, values, trust, business models and policy
- Currently thinking of Sweden, Germany, UK, and Spain

Living lab – a trial in Bridges End, Bristol, Birmingham and Manchester

- Upgraded to zonal control
- Designed around how people use heat
- Priced on expected cost in their home
- Pay no more than the cost of their plan
- Call to learn how they pick a plan
- Policy to discover what is fair
- Monitoring uptake to estimate ‘profit’

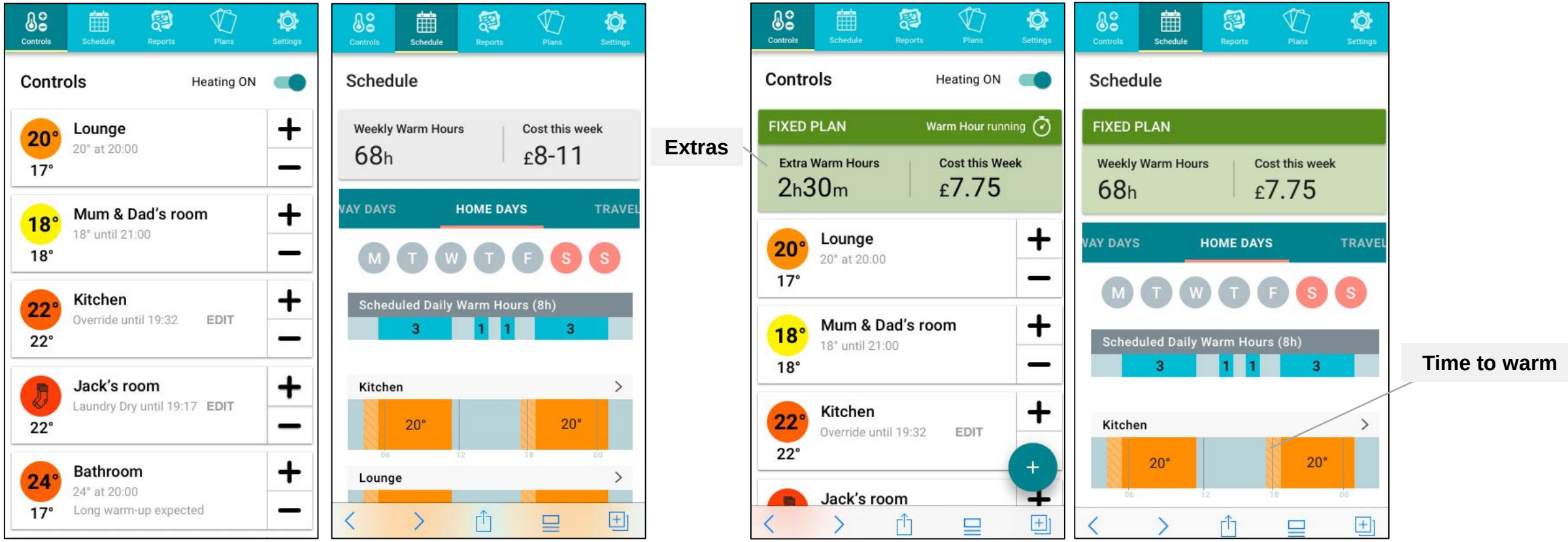






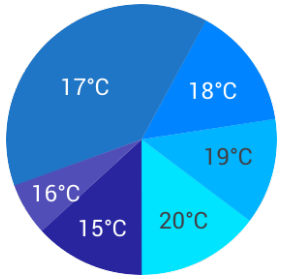
Living lab – a trial in Bridges End, Bristol, Birmingham and Manchester

- Consumers were then continuously monitored (4m data points!) so they can discover what they enjoy, what limits their experience (e.g. time to warm), what shapes the cost and what is excluded from their plan (i.e. extras)



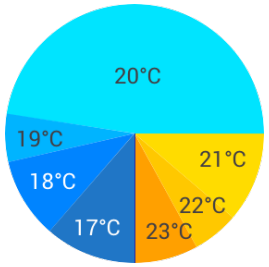
Results: people prefer different temperatures and have distinct heating profiles

Cool Conservers



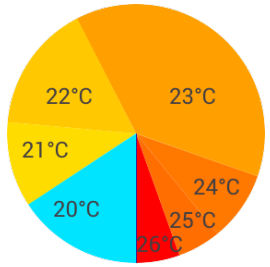
Often tweak heating as worried about bills and trying to minimise costs

Hot & Cold Fluctuators



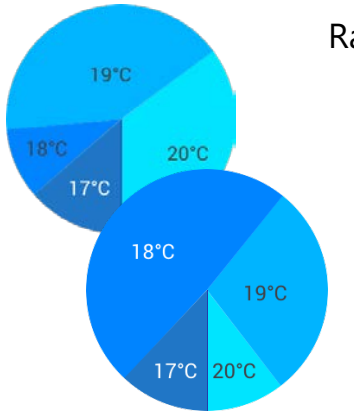
Often adjust temperature to get comfortable

On-Demand Sizzlers



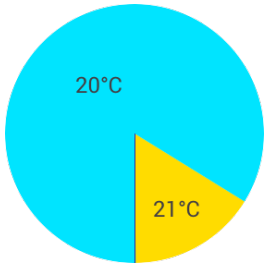
Hate feeling cold, but dislike 'waste', so turn heat up high when needed

Steady and Savvy



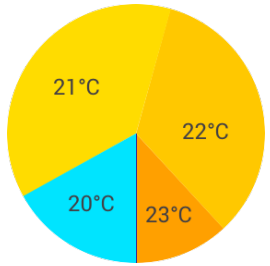
Rarely adjust schedule

On-off Switchers



Want home warm when someone is in, but not that bothered about heating. Could afford to leave it on all day, but prefer to spend the money on something else.

Toasty Cruisers



Love having a cosy home and would prefer not to put on a jumper if they are cold

“Fracking”, Framing and Effective Participation (FFEfP)

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(non-sequential) Work Packages

- WP1: Publics (led by Jonn Axsen)
  - General public: national survey of attitudes
  - Local public: interviews with communities
- WP2: Policy and frames (led by Benjamin Sovacool)
  - Interviews with expert stakeholders
  - Content analysis of political documents (including testimony)
- WP3: Public engagement and participation (led by Andy Stirling)
  - Document analysis, participant observation, and interviews
- WP4: Synthesis and engagement
  - Policy recommendations

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journal homepage: www.elsevier.com/locate/gloenvcha

The discursive politics of 'fracking': Frames, storylines, and the anticipatory contestation of shale gas development in the United Kingdom

Laurence Williams*, Benjamin K. Sovacool

Science Policy Research Unit, University of Sussex, UK

ARTICLE INFO

Keywords:
Shale gas
Hydraulic fracturing
Fracking
Frames
Storylines
Framing

ABSTRACT

How contested sources of energy such as shale gas are perceived in frontier countries considering their development is incredibly important to national and international climate policies. The UK shale development case is of particular interest currently as the Government attempts to position the UK as a pioneer of European, safe, sustainable shale gas development. We conduct a mixed-methods analysis of the UK policy debate on shale gas development involving 30 stakeholder interviews and 1557 political documents. This empirical focus extends the existing literature by identifying the use of frames in and through the institutions and practices of formal UK politics. We identify nine key frames and their associated storylines, analyse their use over time, and compare these findings with other national case studies. Perhaps unsurprisingly, given most UK Governments within our timeframe have supported shale development, pro-shale development frames dominate in the policy debate; however, we also find a high level of anti-shale development frame use, suggesting a deep and ongoing framing contest in national formal political sites. We find in particular a more prominent focus on land-use issues and impacts on the landscape than other UK studies or other national contexts. Conceptually, the study puts forward an integrative approach to the related concepts of frames and storylines, as well as arguments concerning the impotence of storylines in anticipatory political debate and the polyvalence of framing strategies. Questions about governance are raised by the general lack of consensus over the framing of shale development within formal political sites, let alone amongst the broader public; and by the lack of a coherent response from the Government to criticisms of its approach. Finally, we reflect on the apparent lack of evidence for Hajer's 'communicative miracle' in our case, and speculate as to whether the lack of broad-based resonance of the 'bridge' storyline signals trouble for the positive-sum thinking of ecological modernisation.

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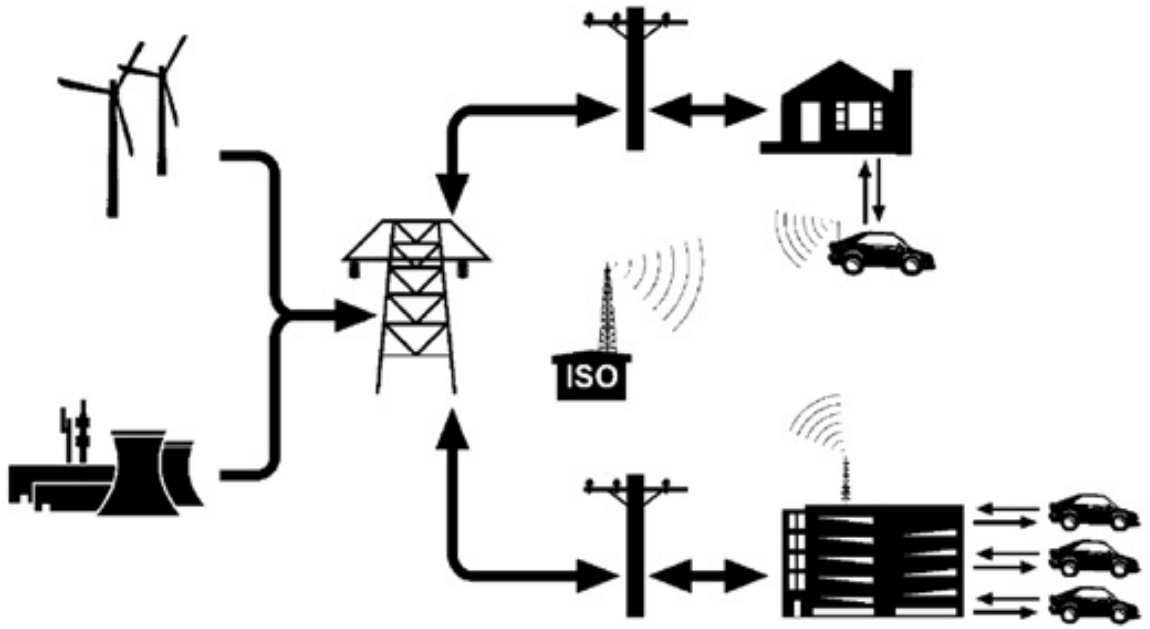
Nordic Vehicle-to-Grid (NV2G) Project

Question: What are the societal and business benefits, barriers, and policies for a vehicle-to-grid (V2G) transition in the Nordic region?

- *Most vehicles are not in use 90% of the time*
- *The equivalent capacity of automobile batteries surpasses that of the grid in all Nordic countries*
- *Electricity is much cheaper than liquid fuel per km driven*
- *Recharging at night wouldn't need significant new power plant infrastructure*

A V2G configuration means that personal Electric Vehicles (EVs) have the opportunity to become mobile, self-contained resources interconnected to homes and power grids



Nordic Vehicle-to-Grid Project (NV2G) Methods

- 257 expert interview participants across 17 cities in Denmark, Finland, Iceland, Norway and Sweden (almost 1 million words of transcribed text), various papers
- 8 focus groups in Aarhus, Bergen, Copenhagen, Gothenburg, Helsinki, Reykjavik, Stockholm, and Tampere(standalone under review in *Transportation Research Part D*)
- 5,000+ adult survey responses (44 questions) in *Global Environmental Change* (demographics) and *Journal of Transport Geography* (politics, affluence, space)
- A choice experiment (based on the survey) in *Energy Economics*
- A separate survey of 587 schoolchildren 9-13 years of age across 15 schools in Denmark and the Netherlands (*Technological Forecasting & Social Change, Energy Research & Social Science)*
- 126 dealer visits in all 5 Nordic countries *(Nature Energy*)
- Scenarios and simulations to capture co-benefits, externalities, optimization *(Transport Policy, Energy)*
- Content analysis of standards (ISO and EVSE) (*Journal of Cleaner Production)*

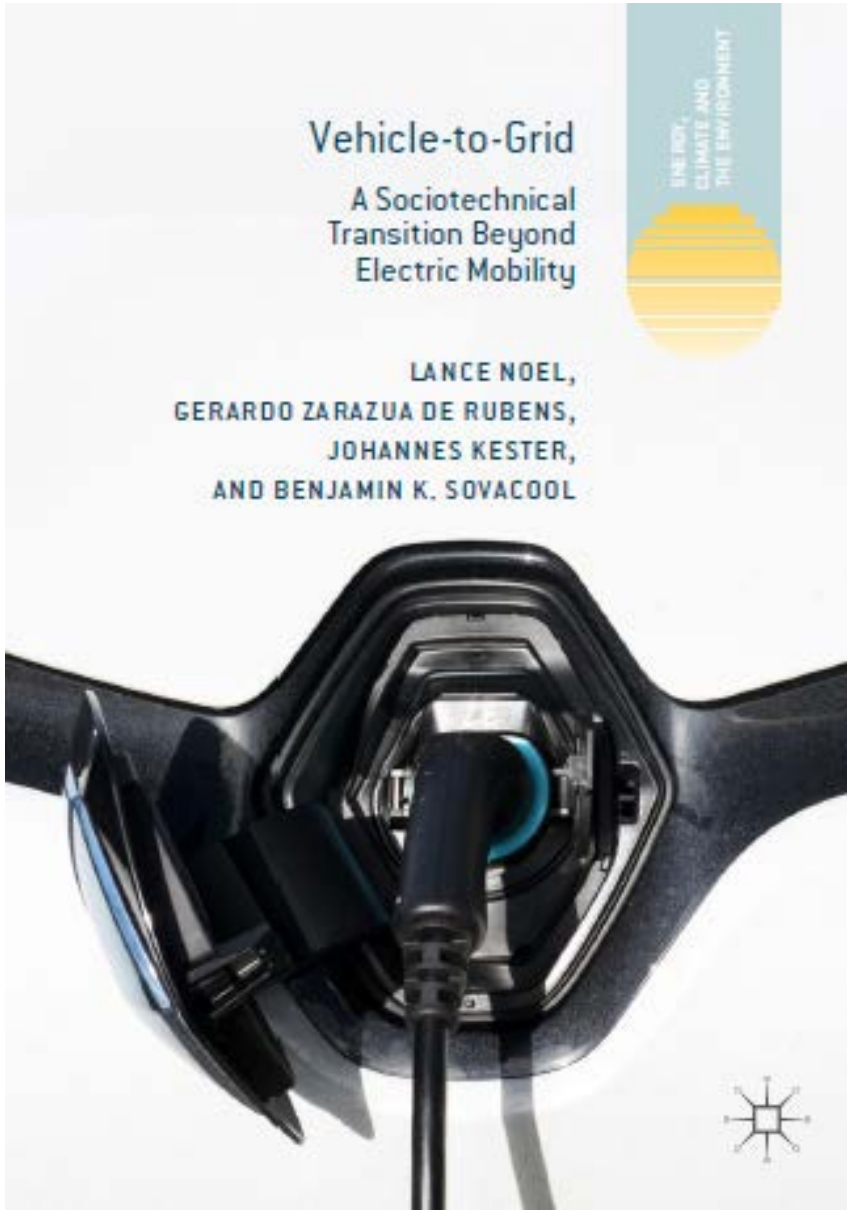
Integrated or “deep” articles on:

- A spin-off survey in China (805 respondents across all Chinese provinces) (*Transportation Research Part A*)
- Barriers for electricity and transport policy *(Energy*)
- Policies and policy mixes for EVs *(Renewable & Sustainable Energy Reviews)* and V2G (*Energy Policy*)
- Automobility and frames *(Transportation Research Part A*)
- Justice and equity (*Ecological Economics)*
- Business models (Better Place) (*Energy Policy, Technological Forecasting & Social Change)*and innovation activity systems for V2G (*Energy Policy)*
- Range anxiety (*Energy Research & Social Science)*
- Gender (*Transportation Research Part D*)
- Urban/rural dynamics and spatial politics (*Journal of Transport Geography*)

Integrated or “deep” articles on:

- Visions and narratives (*Environmental Innovation and Societal Transitions)*
- Luxury and conspicuous consumption (*Environmental Innovation and Societal Transitions)*
- Innovation styles and approaches within the two automotive OEMs Fiat-Chrysler Automobiles and BMW (*Environmental Innovation and Societal Transitions)*
- A historical look at automobility and “societal embedding” with applications to EVs *(Transportation Research Part D*)
- The role of users in electric vehicle adoption (as well as automated mobility and shared mobility/ridesharing) (*Transportation Research Part D*)
- Theories for electric mobility and sociotechnical transitions *(ERSS* and *Social Studies of Science)*
- Plus two reviews (*Annual Review of Environment and Resources* and *Environmental Research Letters*)

The “capstone” output



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