



wholeSEM  
Annual Conference 2017

The Past, Present and Future of  
Energy Modelling

3rd & 4th July 2017





## About the Whole Systems Energy Modelling Consortium (wholeSEM)

The whole systems energy modelling consortium (wholeSEM) is a ground breaking, multi-institution initiative to develop, integrate and apply state-of-the-art energy models.

Our aim is to employ extensive integration mechanisms to link and apply interdisciplinary models to key energy policy problems, with substantive bilateral engagement with stakeholders in academia, government and industry. Funded by EPSRC, the consortium is led by University College London and consists of Imperial College London, the University of Cambridge and the University of Surrey. The consortium is led by Professor Neil Strachan and administered by Pascale Davies, both based at UCL Energy Institute.

Energy models provide essential quantitative insights into the 21st Century challenges of decarbonisation, energy security, energy equity, and cost-effectiveness. Models provide the integrating language and framework that assists energy policy makers – focusing at different scales and time periods – to make improved decisions and trade-offs in conditions of pervasive uncertainty. Whole systems energy modelling also has a central role in helping energy supply companies to make technical and economic decisions with regard to future energy technologies and infrastructure, as well as in the assessment of the potential role of societal and behavioural change.

Follow us on Twitter at @wholeSEM. We welcome you to tweet and share your thoughts about our event using the hashtag #wholeSEM17

Engineering and Physical Sciences  
Research Council

wholeSEM is funded by EPSRC from July 2013 through January 2018 (EP/K039326/1)

EPSRC is the main UK government agency for funding research and training in engineering and the physical sciences, investing more than £800 million a year in a broad range of subjects - from mathematics to materials science, and from information technology to structural engineering.

cover image ©

All images, illustrations, information graphics, and text content in this document remains the property of wholeSEM, or the individual contributors named herein. Material may not be reproduced, copied, digitally stored, or distributed without the express permission of wholeSEM or named contributors acknowledged.

# wholeSEM Annual Conference 2017

## The Past, Present and Future of Energy Modelling

#wholeSEM17 @wholeSEM

### About the Conference

wholeSEM presents our 4th Annual Conference - The Past, Present and Future of Energy Modelling.

The past, retrospective analysis: a look back at over a decade of energy decarbonisation modelling, funded by RCUK and other bodies' research investments, and impacting successive UK policy positions.

The present, current analysis: a set of presentations on state-of-the-art on the implementation of the energy trilemma (decarbonisation, security, equity).

The future, new approaches: innovative sessions including focus groups and discussion sessions on developing and communicating the new insights in terms of technology, society, infrastructures and resources needed by decision makers to achieve the energy systems transition challenge over the next decades.

The wholeSEM conference has established itself as a major UK and international event, a chance to bring the modelling community together and showcase some of the excellent work that has been done over the year.



# Day One

10.00 Open for registration

10.45 - 11.00 Welcome to the wholeSEM consortium and to our fourth annual conference, Neil Strachan, UCL

## The Past: Retrospective Analysis

11.00 - 11.30 Keynote Speaker: John Loughhead, Chief Scientific Adviser at the Department for Business, Energy & Industrial Strategy

11.30 - 12.00 Key panel members discuss the energy modelling-policy interface and insights from the first 15 years of the UK's low carbon transition. (Roundabout Room)

Brian O' Gallachoir, Energy Policy and Modelling Research, University College Cork

Gert Jan Kramer, Sustainable Energy Supply Systems, Utrecht University

Heather Haydock, Ricardo Energy & Environment

## The Present: Current Analysis

12.00 - 12.30 PhD student rapid fire presentations (Roundabout Room)

Doctoral students are invited to deliver insights from their research as two minute elevator pitches plus Q+A

Pablo Carvajal Sarzosa, UCL

Selma Causevic, Delft University of Technology

João Gorenstein Dedecca, Delft University of Technology

Audrey Dobbins, University of Stuttgart

Alice Gunn, University of Reading

Yingjian Guo, Imperial College London

Emma Hanley, University College Cork

Verena Heinisch, Chalmers University of Technology

Francisca Jalil Vega, Imperial College London

## Break for lunch

13.30 - 15.30 Parallel sessions with a focus on current energy modelling topics

Session 1: Household Energy Demand: Exploring the Intersection of Technology, Practices and Policy  
(Roundabout Room)

Chair Nigel Gilbert, University of Surrey

13.30 Russell Hitchings, UCL

14.00 Chris Jones, University of Sheffield: 'Overcoming the issue of perceived home relevance on intentions to install Home Energy Management Systems (HEMS)'

14.30 Kersty Hobson, Cardiff University: 'From 'behaviour change' to 'prosumers': what role for the 'household' in (future) energy landscapes?'

15.00 Kavin Narasimhan, University of Surrey: 'HOPES: an empirically-informed practice-centric approach to model the dynamics of household energy use'

Session 2: Energy, Economy and Technological Transitions (Cyber Room)

Chair Ilkka Keppo, UCL

13.30 Will Usher, ITRC : 'Modelling energy as a component of a system-of-systems framework in ITRC-MIS-TRAL'

14.00 Enrica De Cian, FEEM:

14.30 Uwe Remme, IEA: 'Energy Technology Perspectives: Catalysing Energy Technology Transformation'

15.00 Sam Foster, Element Energy : 'Modelling the infrastructure impacts of energy system transitions'

Session 3: Energy, Resources and Wider Impacts (Global Room)

Chair Julian Allwood, University of Cambridge

13.30 Kira West & Araceli Fernandez, IEA: Exploring low-carbon opportunities for materials production in a beyond 2-degree world

14.00 Peter Levi, University of Cambridge: Cost optimal decarbonisation trajectories for the global chemical sector: A multi-regional TIMES model

14.30 Fabian Wagner, IIASA: 'Energy and air pollution. Lessons from the past, challenges for the future'

15.00 Abhishek Shivakumar, KTH

Session 4: Operation and Design of Energy Systems Infrastructure (Cloud Room)

Chair Goran Strbac, Imperial University

13.30 Phil Taylor, Newcastle University: 'Gas and Electricity distribution infrastructure interaction'

14.00 Erik Delarue, University of Leuven: 'Integrated energy system modelling: linking the electricity generation and demand side through heat-pump demand response'

14.30 Giulia De Zotti, Technical University of Denmark: 'A framework for controlling electricity load in integrated energy systems'

15.00 Florent Le Strat & Dominique Lafond, EDF: 'Challenges of the representation of short term electricity system flexibility in energy system models'

15.30-16.00 BREAK

16.00 - 16.30 PhD student rapid fire presentations (Roundabout Room)

Doctoral students are invited to deliver insights from their research as two minute elevator pitches plus Q+A

Erin Johnson, Imperial College London

Martin Klein, Institute of Engineering Thermodynamics

Florian Knobloch, Radboud University Nijmegen

Vicky Papaioannou, University of Reading

Neha Patankar, NC State University

Dmytro Romanchenko, Chalmers University of Technology

Erik Sandberg, Luleå University of Technology

Kristoffer Steen Andersen, Technical University of Denmark

Jacopo Tattini, Technical University of Denmark

16.30 - 17.30 Presentation of the Top Down Integration Project (Roundabout Room)

Introduction: Marianne Zeyringer, UCL

Case Study 1: Social Practices: Kavin Narasimhan, University of Cambridge

Case Study 2: Flexibility: Marko Aunedi, Imperial University

Case Study 3: NEXUS: James Price, UCL

17.30 - 19.30 Networking Drinks (M by Moncalm Urban Coterie Lounge)

# Day Two

## The Future: New Approaches

9.20 - 9.30 Opening Session: Neil Strachan, UCL (Roundabout Room)

9.30 - 11.30 Modelling Cafes

Focus groups to scope out ideas for new questions to be answered by models in the future.

| Group 1 (Roundabout Room)  | Group 2 (Global Room)                                |
|--|--|
| Facilitator: Florian Habermacher, Aurora Energy Research   | Facilitator: Evelina Trutnevyte, ETH Zurich          |
| What carbon price (how high and how long) is needed to mainstream new low carbon power generation, transport and heating technologies? | Who invests in strategic new energy infrastructures? |

| Group 3 (Cloud Room)   | Group 4 (Silicon Room)   |
|--|--|
| Facilitator: Joe DeCarolis, UNC  | Facilitator: Katy Roelich, University of Leeds   |
| How will residential consumers' change in energy demand due to the introduction of new energy consuming technologies | How can we keep options open for low carbon heating while ensuring zero emissions in the future? |

| Group 5 (Tech City Room)   | Group 6 (Cyber Room)  |
|--|---|
| Facilitator: Chris Bataille, ISDIR   | Facilitator: David McCollum, IIASA                              |
| How to approach specific industrial sectors have very few decarbonisation options? | How consistently government energy policies will be maintained? |

11.30 - 12.30 Facilitators to report back findings (Roundabout Room)

## Break for lunch

13.30 - 14.30 New Approaches Discussion Session (Roundabout Room)

Discussion session with key panel members on new approaches to energy modelling, the next big idea and new perspectives.

Catherine Bale, Energy Research Institute, University of Leeds

Emma Harrison, Systems Integration, Energy Systems Catapult

Amy Mount, Greener UK Unit, Green Alliance

Liz Varga, Complex Systems Research Centre, Cranfield University

14.30 - 15.00 Closing remarks and PhD poster prizes (Roundabout Room)

15.15 - 17.15 wholeSEM Advisory Board (by invitation only)

# SPEAKERS A-Z



Dr Catherine Bale is a University Academic Fellow at the University of Leeds. Her position is a joint appointment between the School of Chemical and Process Engineering and the School of Earth and Environment, which reflects her interdisciplinary approach to research in energy across the disciplines of engineering, economics and social science. Catherine received a Masters degree and a DPhil from the University of Oxford in the physical sciences. Her current research relates to urban energy systems and the application of complexity science to inform energy policy in support of transition to a low-carbon economy. She has recently completed a fellowship from the Engineering and Physical Sciences Research Council exploring the development of heat networks in cities. Through her research Catherine collaborates closely with local government, and has advised organisations such as Infrastructure UK and the Committee on Climate Change. She tweets about her research as @EnergyFrin.



Chris Bataille started a WholeSEM fellowship in April 2016 with the UCL team. He is reviewing UCL's suite of models from the perspective of behaviourally realistic bottom-up and hybrid modelling, with the aim of suggesting improvements in this area. Chris has been involved in energy and climate policy analysis for 19 years as a researcher, modeller, analyst, writer, project manager, and executive. Chris is an Associate Researcher at the Institute for Sustainable Development and International Relations (IDDRI) in Paris, and lead editor of a special issue of Climate Policy on the Deep Decarbonization Pathways Project (DDPP), as well helping manage the DDPP and being a co-author of the Canadian chapter of the DDPP. He is an Adjunct Professor at Simon Fraser University in Vancouver, and board member and co-chair of Ecotrust Canada.



Dr Enrica De Cian is a researcher at Fondazione Eni Enrico Mattei (FEEM) and Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Italy. Enrica has a PhD in Economics and Organization from Ca' Foscari University of Venice in Italy (completed in 2008). Her research focuses on technological change, integrated assessment modeling, climate change impacts and adaptation. She has published in the fields of climate change economics, integrated assessment modeling, energy economics, and environmental and resource economics. She collaborated with several research organizations, CEPS in Brussel (2004-2005), the Joint Program on the Policy and the Science of Climate Change (JP) at the Massachusetts Institute of Technology (MIT) in Cambridge (2005-2006), the ZEW in Mannheim (2012). In 2012 she was awarded a Marie Curie Research Fellowship for the project DYNAMIC through which she started to collaborate with Prof. Ian Sue Wing from the Department of Earth and Environment at Boston University on the empirical analysis of climate change impacts in agriculture and energy. She has been involved in several international projects. Since 2007 she has been a lecturer in the PhD program Science and Management of Climate Change at Ca' Foscari University of Venice. Since 2014 she has been a lecturer in the Environmental Program Studies at Boston University Study Abroad Venice.



Dr Joe DeCarolis is an Associate Professor in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University. His research is focused on the interdisciplinary assessment of technologies and public policies that promote long term energy sustainability. He is particularly interested in developing robust decision-making strategies for climate mitigation by conducting analysis with technology-rich energy system optimization models.





Professor Erik Delarue, born October 17th, 1982, obtained the MSc in Mechanical Engineering in 2005, and the PhD degree in Mechanical Engineering in 2009, both from KU Leuven. From December, 2009, till December, 2010, he was employed as post-doctoral researcher at the Florence School of Regulation, EUI, Florence, Italy. He has been a research fellow of the Research

Foundation – Flanders (FWO) at KU Leuven from 2010 till 2016. E. Delarue has been visiting researcher at MIT in both 2008 and 2014. As of October 2015, E. Delarue is appointed Assistant Professor at KU Leuven. Key qualifications include energy systems modeling; power plant scheduling; CO2 emission abatement; energy markets; energy policy. E. Delarue has published over 50 international refereed journal papers. He is active in the EERA joint program on Energy Systems Integration. He is member of the IAEE and IEEE. Erik Delarue is married and has 2 daughters and 1 son.



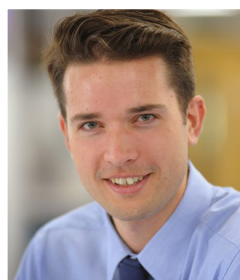
Giulia De Zotti received the B.Sc. in Energy Engineering and the M.Sc. in Electrical Engineering from the University of Padova, Italy, in 2012 and 2015, respectively. In 2015, she wrote her Master's thesis about Water-Energy Nexus at Tsinghua University, China, investigating the energy efficiency of water supply in Italy and China. She started her PhD in Dynamical Systems at DTU

Compute, Denmark, in 2016. The PhD project focuses on market mechanisms for the integration of distributed energy resources and investigates different DSO-TSO interaction schemes. Her main research topics include model predictive control, price-based control, energy markets, stochastic optimization and time series applied to smart grids. The PhD project consists of a collaboration with SmartNet, which is funded by the European Union's Horizon 2020.



Araceli Fernandez leads the industry technology analysis at the IEA on long-term scenarios with more than ten years' experience in the Oil & Gas field. Araceli holds a MEng in Chemical Engineering and a MSc in Process Engineering. Before joining the IEA, she worked on process optimization and emissions monitoring at refinery

sites for BP, as well as designing thermal equipment and steam reforming units for green-field refinery and petrochemical projects as EPC contractor. She focused more lately on defining energy efficiency upgrade and plant performance improvement strategies for refinery operators.



Dr Sam Foster is a Principal at Element Energy, leading Element's work in the Built Environment sector. In his time at Element Energy, Sam has worked on a wide range of studies relating to energy use in the buildings sector, focusing on how heat and power could be provided in a low carbon, low cost and resilient manner. This has included

projects for the Department of Energy and Climate Change, the Committee on Climate Change, the European Climate Foundation, the Greater London Authority, the Energy Technologies Institute, the Sustainable Energy Authority of Ireland, the Irish Department of Communications, Energy and Natural Resources, the World Bank, the Moroccan Government and a number of local authorities and several private sector clients. Sam joined Element after completing a Ph.D. in organic photovoltaics at Imperial College London. While working on his doctorate, Sam carried out consultancy projects for the Department of Energy and Climate Change regarding the potential for low carbon technologies to contribute to the sustainable development of India and China towards 2050. He has also consulted for a solar PV start-up, and spent six months in the hi-tech materials development industry in Japan



Dr Florian Habermacher is researcher at the Aurora Energy Research in Oxford, where he is Head of the energy modelling team, and Research Fellow at the Oxford Institute for New Economic Thinking at University of Oxford. He has written a PhD in Economics and Finance, with specialization in economics and econometrics, at University of St. Gallen and at University

of Oxford. His thesis focused on deepening our understanding of global and dynamic effects of climate policies, and exhaustible resource theory. He earned his PhD while working at the Swiss Institute for International Economics and Applied Economic Research with a focus on public finance and policy questions. He was awarded a scholarship for the completion of his dissertation at the University of Oxford, where he stayed at the Oxford Centre for the Analysis of Resource Rich Economies (OxCarre). Before moving into economics, Florian studied Environmental Sciences and Engineering at ETH Lausanne (EPFL).



Emma Harrison is Head of Systems Integration at Energy Systems Catapult. The Energy Systems Catapult is supporting British industry to unleash innovation and exploit the opportunities of the global energy revolution. Our vision is for a clean, intelligent, energy system that works for people, communities and businesses. Emma's current work is

focused on Smart Systems and Heat programme. Prior to joining Energy Systems Catapult Emma worked as Managing Director for GSE Systems Ltd and prior to that had a number of senior roles in ABB, Rolls Royce and BAE systems. Emma holds a degree in Engineering and an MBA.



Dr Russell Hitchings is a Senior Lecturer in Human Geography at UCL. In his research, he uses qualitative methods to investigate different aspects of everyday life. The wider aim is to contribute to our understanding of how societies could be better organised in terms of resource use and social wellbeing. He has applied these methods in a variety of contexts to date, having looked at how domestic gardens

are lived with, how recreational running is experienced by groups of casual runners, and, most recently, how human heating and cooling has come to be arranged in a range of social spaces across a range of countries.



Heather Haydock is a Chartered Engineer with over 25 years' experience of directing, managing and contributing to consultancy projects in the areas of climate change policy analysis, energy technology forecasting, energy modelling and policy/programme evaluation for UK Government and other national and international clients.

She has extensive experience of greenhouse gas projections and cost-effectiveness and cost-benefit analysis in the energy, industry and transport sectors, including MARKAL, LEAP and MACC modelling. Heather supported the UK Committee on Climate Change to recommend carbon budgets based on marginal abatement costs using MACC and MARKAL modelling, spent a year as Lead Advisor to the IEA's Energy Technology Perspectives project, and led a project on long-term options for radical decarbonisation of heat in industry for the UK Government. She recently led a project to identify and quantify future energy and emissions scenarios for the UK that reflect possible step-changes in technology or behaviours.



Dr Kersty Hobson is an environmental social scientist whose research interests focus on issues of socio-environmental transformation, particularly the fields of sustainable production and consumption, and multi-level environmental governance.

She has held academic positions at the University of Birmingham, Australian National University, and the University of Oxford, where her research has examined household sustainability practices in the UK and Australia; environmental non-governmental organizations; and public responses to climate change governance. Her latest ESRC and EPSRC-funded research has focused on citizen responses to the circular economy agenda: and evaluating UK low carbon community groups' responses to socio-environmental issues.

# wholeSEM Annual Conference 2017

## The Past, Present and Future of Energy Modelling

#wholeSEM17 @wholeSEM



Dr Chris Jones is a lecturer in social and environmental psychology at the University of Sheffield. With a research background in the principles of attitude formation and change; his current research interests focus on public attitudes and responses to environmental change, including public perceptions of energy generating technologies (e.g., nuclear power stations, wind farms, carbon capture and storage) and responses to household energy-use interventions (e.g., smart-metering). He received his undergraduate degree in Psychology from the University of Birmingham (2002) before moving to the University of Sheffield to complete an MSc in Psychological Research (2003) and a PhD in Social Psychology (2007).



Professor Gert Jan Kramer (1961) holds an MSc and PhD in physics from Leiden University (1988). After his PhD, he joined Shell at its Amsterdam research centre and worked as a scientist on catalysis and reactor engineering of refinery and gas processes. Since 2000 his work has increasingly focused on alternative fuels (notably hydrogen) and renewable energy. From 2010 to 2016 he was as Manager Energy Futures responsible for technology assessment of future energy technologies. He also worked closely with Shell's Scenarios team. He has been a part-time professor at the Technical University Eindhoven from 1998 until 2010 and at the Centre for Environmental Sciences of Leiden University from 2010 until 2016. As of May 2016 he is Professor of Sustainable Energy Supply Systems at the Copernicus Institute of Sustainable Development at Utrecht University. In Utrecht his research themes are ex ante assessment of low-carbon technologies, agent-based modelling of the energy transition, and the Dutch energy transition with a focus on the transformation of industry to achieve zero emissions. Gert Jan is the editor of a recent free e-book *The Colours of Energy – essays on the future of energy in society*, available via [www.shell.com/colours](http://www.shell.com/colours).



Peter Levi's PhD project is entitled Resource efficiency in the chemical and petrochemical sector: energy, emissions and material flows, and is supervised by Dr Jonathan Cullen. The over-arching aim of the project is to compare upstream mitigation options – mainly related to energy-efficiency improvements – with downstream mitigation options; many of which can be broadly characterised as material efficiency measures. Models of energy consumption, emissions and material flows are constructed for the sector's key products and processes to facilitate the comparison described above. Peter holds an MEng degree from the University of Bristol and an MPhil degree from the University of Cambridge, both in Engineering.



Professor John Loughhead is the Chief Scientific Advisor at the Department for Business, Energy and Industrial Strategy. Previous career highlights include: Chief Scientific Advisor, Department of Energy & Climate Change. Executive Director, UK Energy Research Centre (UKERC). Corporate Vice-President of Technology and Intellectual Property, Alstom. John's professional career has been predominantly in industrial research and development for the electronics and electrical power industries, including advanced, high power industrial gas turbines, new energy conversion systems, spacecraft thermal management, electrical and materials development for electricity generation and transmission equipment, and electronic control systems. He has extensive international experience in both industry and academia. John is a Chartered Engineer, graduating in Mechanical Engineering from Imperial College, London, where he also spent five years in computational fluid dynamics research. He is Past-President of the UK's Institution of Engineering and Technology, Fellow of both the UK and Australian national Academies of Engineering, Professor of Engineering Cardiff University and Fellow of Queen Mary University of London.



Dr David McCollum is a Research Scholar with IIASA's Energy (ENE) Program. He also holds an appointment as a Research Fellow in Energy and Environment at the Howard H. Baker Jr. Center for Public Policy at the University of Tennessee (USA). Dr McCollum's main fields of scientific interest include techno-economic analysis of advanced

energy and transport technologies and the development and application of energy-economic and integrated assessment models. His research attempts to inform national, regional and global energy and environmental policies on matters related to climate change, sustainable transport, energy security and air pollution. To this end, Dr McCollum performs long-term scenario analyses and employs multi-criteria analysis techniques, particularly focusing on potential transitions for the energy system over the coming decades and the complex synergies and trade-offs between multiple energy objectives. Dr McCollum received his doctorate from the University of California, Davis (USA) in 2011.



Amy Mount became the head of Green Alliance's new Greener UK Unit in September 2016. The unit is coordinating partner organisations across the environmental sector, to ensure that the UK's environmental protections and climate leadership are strengthened during and after the process of leaving the European Union.

She joined Green Alliance in 2014 to work on low carbon energy policy, and continues to lead projects in this field. Before starting work at Green Alliance, Amy was a Mellon Fellow at Yale University, graduating with an MA in Global Affairs and a Masters in Environmental Management. Her thesis focused on the politics of oil drilling in Alaska's Arctic Ocean. Previously, Amy worked at the Futerra Sustainability Communications, the Royal Geographical Society, and Cambridge University Geography Department. She holds a BA in Geography from Cambridge University.



Dr Kavin Narasimhan is a Research Fellow at the Centre for Research in Social Simulation (CRESS) at University of Surrey. She holds a PhD in Computer Science (passed with no corrections) from Queen Mary University of London. She leads the work on the WholeSEM HHouseholds and Practices in Energy use Scenarios (HOPES) model at the University of Surrey. HOPES is an

agent-based model which uses the conceptual lens of a body of work referred to as Social Practice Theory to simulate the dynamics of energy use in households. The model demonstrates how an in-context practice-centric view offers a more realistic explanation of the patterns of energy use in households, and thus provides relevant policy insights. Kavin's research interests are in using agent-based modelling for understanding the causal mechanisms underlying complex social phenomena, data visualization and data analytics. Kavin teaches on the CRESS Agent-based Modelling for the Social Scientist course and supervises MSc internship students. She also actively engages in research outreach activities. She led the creation of the animation on Household Energy Use (<http://bit.ly/2an5dv1>). Kavin has also worked for various software companies in India and the UK as a software and web developer.



Dr Brian O' Gallachoir is Professor of Energy Policy and Modelling in University College Cork's Environmental Research Institute and School of Engineering. He is also a Principal Investigator in SFI's MaREI Centre, an energy and marine-based research, development and innovation hub based in Ireland. Brian is elected Chair of the Executive Committee

for IEA's Technology Collaboration Programme on energy systems modelling (IEA-ETSAP). His research focus is on building and using integrated energy systems models to inform energy and climate change mitigation policy. He is a member of Ireland's Gas Innovation Group and the Steering Group of Energy Cork, an industry-driven cluster pursuing coordinated actions to strengthen enterprise and employment within the energy sector in the Cork region.

# wholeSEM Annual Conference 2017

## The Past, Present and Future of Energy Modelling

#wholeSEM17 @wholeSEM



Dr James Price joined the UCL Energy Institute as a Research Associate in October 2014. Before that he worked at the Met Office Hadley Centre and in environmental consultancy following the completion of a PhD in Physics at the University of Bristol. James' research focus under WholeSEM is modelling

the integration of high shares of variable renewable energy (VRE), principally wind and solar, into the UK power system. For this purpose he co-develops the high spatial and temporal resolution renewable electricity system model (highRES) at UCL. highRES, with its spatially and temporally explicit representation of VRE and the UK high voltage transmission system, is ideally suited to study cost-effective and technically robust power system scenarios that have a high penetration of intermittent renewables. He also works on uncertainty analysis within the TIMES Integrated Assessment Model at UCL (TIAM-UCL) as part of the EU ADVANCE project.



Dr Katy Roelich is an Academic Fellow at the University of Leeds and co-leads the Energy and Climate Change Mitigation Group within the School of Earth and Environment. Prior to this she co-lead the Rethinking Development theme at the Stockholm Environment Institute and was a senior sustainability consultant at Arup. Her current work

is concerned with decision making and energy transitions; particularly how long-term decision making can become more adaptive and consider the interaction between decision makers at different scales and in different systems. Katy has worked on a range of RCUK and EU-funded projects, including the UK Energy Research Centre and is currently part of the Centre for Industrial Energy, Materials and Products (CIE MAP) one of the End Use Energy Demand Centres.



Abhishek Shivakumar is a researcher at the Division of Energy Systems Analysis at KTH Royal Institute of Technology in Stockholm, Sweden. He also acted as the manager of INSIGHT\_E, a think tank informing the European Commission on energy policy. His research covers a wide range of energy issues from valuing the cost of electricity supply interruptions,

developing open investment planning toolkits to expand Africa's electricity system, business models to foster Europe's transition to a low carbon energy system, household DC networks, and indicators to measure the techno-economic potential of demand response. In addition, since 2015 Abhishek has managed the development of OSeMOSYS—an open source energy modeling tool. His work has been used in projects with the European Commission, UNDESA, African Development Bank, and the World Bank. Abhishek holds a dual MS in Energy Technology and Industrial Engineering from KTH (Sweden) and UPC (Spain). Before that, he graduated with a BE in Chemical Engineering from Manipal Institute of Technology in India.



Professor Neil Strachan is an interdisciplinary energy economist. He is a Professor of Energy Economics and Modelling at the University College London (UCL) Energy Institute ([www.ucl.ac.uk/bartlett/energy/](http://www.ucl.ac.uk/bartlett/energy/)) where he also serves as its Deputy Director. He received his PhD in Engineering and Public Policy from Carnegie Mellon University

in 2000. At the UCL Energy Institute, Neil's research interests revolve around energy-environment-economic modelling, the quantification of scenarios and transitions pathways, and interdisciplinary issues in energy economics and policy. Over the last 8 years he has been principal or co-investigator on research projects worth over £10 million. This includes as principal investigator of the Whole Systems Energy Modelling Consortium (wholeSEM), the UK's ground breaking multi-institution initiative to develop, integrate and apply state-of-the-art energy models ([www.wholesem.ac.uk](http://www.wholesem.ac.uk)). He is the author of 50 peer reviewed journal papers, and over 100 book chapters and technical reports. He has led a decadal collaboration applying energy systems models to underpin UK Governmental energy policy analysis. He was a lead author of the Energy Systems chapter of the IPCC's 5th Assessment Report. He is a non-executive director of the Energy Systems Catapult (<https://es.catapult.org.uk>).



Uwe Remme is energy analyst in the Energy Technology Policy Division of the International Energy Agency (IEA), where he leads the energy supply-side analysis within the Energy Technology Perspectives project. He has more than fifteen years' experience in energy systems modelling and analysis. Prior to joining the IEA, he worked as researcher

at the University Stuttgart on several national and European projects in the field of energy modelling as well as on the assessment of technologies and policy instruments. Uwe studied chemical engineering at RWTH Aachen University, Germany, and Carnegie Mellon University, Pittsburgh, and completed a PhD degree in mechanical engineering at the Institute of Energy Economics and the Rationale Use of Energy (IER), University Stuttgart.



Phil Taylor joined Newcastle University in 2013 where he is currently employed as the Deputy Pro Vice Chancellor for the SaGE Faculty as well as Head of Engineering and Siemens Professor of Energy Systems. Phil is currently leading a five year collaborative project with the Russian University Skoltech and MIT as well as working with the Indian/UK

company, ENZEN. Phil has published around 100 papers in international journals and conference proceedings. In 2012 he was nominated for the Royal Society Kavli Medal for research achievements in the energy sector. He has provided consultancy and advise to National and International organisations. Previously Phil was Co-Director and founder of the Durham Energy Institute at Durham University. He joined the School of Engineering at Durham University in 2004, after working in industry for eight years.



Dr Evelina Trutnevyte is a senior researcher, team leader and lecturer at ETH Zurich, Department of Environmental Systems Science, USYS Transdisciplinarity Lab. She is a member of the Swiss Competence Center for Energy Research-Supply of Electricity (SCCER-SoE), ETH Energy Science Center (ETH ESC), and an associate

of the ETH Institute of Science, Technology and Policy (ETH ISTEP). She is also an Honorary Senior Research Associate at University College London, Bartlett School of Environment, Energy & Resources. She holds the competitive Swiss National Science Foundation Ambizione Energy career grant for analysis of cross-technology and spatial risk trade-offs in the Swiss electricity generation portfolio (RIGOROUS project). She is an energy systems analyst and modeler, specializing in socio-technical approaches and energy decision making under deep uncertainty and at science-society interface. She is an engineer by training and completed her PhD studies at ETH Zurich, Chair of Natural and Social Science Interface. She brings expertise from universities in Switzerland, United Kingdom, United States of America, Denmark, Norway, and Lithuania.



Dr Will Usher has over seven years experience in the field of energy and infrastructure systems modelling in academia. He has a broad understanding of the interface between energy modelling and policy stakeholders in the UK and globally, having completed projects using Energy System Models for DECC (now BEIS), the Committee

on Climate Change and the Energy Technologies Institute. He has experience with the use and specification of the range of optimisation and simulation models used at the interface of energy and policy under decarbonisation pathways, including MARKAL, TIMES, ESME and NISMOD. He is currently coordinating the integration of a range of simulation models of infrastructure as part of the ITRC-MISTRAL project, working closely with industrial and government partners. Dr. Usher's research interests include decision making under uncertainty, global sensitivity analysis and the coupling of systems models. Prior to taking up his current position as Infrastructure System Modeller at the University of Oxford, he studied for a PhD in Energy & Modelling at UCL Energy Institute under Prof. Strachan and Dr. Keppo, worked in various post-doctoral research posts across shipping and energy systems at UCL and graduated from the MSc Environmental Technology at Imperial College.



Professor Liz Varga is Professor of Complex Infrastructure Systems and Director of the Complex Systems Centre at Cranfield University, UK. Professor Varga has trans-disciplinary expertise in interdependent infrastructure systems (energy, transport, water, waste and telecoms) as well as social infrastructures such as food and product supply chains.

Her interests are in sustainable innovation and interventions which promote resilient and adaptive systems for the benefit of the economy, society and the environment. Global challenges of climate and weather change, population growth and urbanization, social inequity, pollution and toxic emissions, are primary drivers for her work. She applies both qualitative and quantitative methods to implement computational complex systems' models which represent our integrated infrastructure systems. The models explore potential futures within different scenarios and governance regimes, examining the effect of technology, innovation and policy transformation. She runs several research projects, supervises doctoral students, and is a regular speaker and RCUK reviewer.



Dr Fabian Wagner is a Senior Research Scholar in the Air Quality and Greenhouse Gases (AIR) Program at the International Institute for Applied Systems Analysis (IIASA). During the academic years 2014-16, he was the Gerhard R. Andlinger Visiting Professor for Energy and the Environment at Princeton University's Andlinger Center

and the Woodrow Wilson School of Public and International Affairs. Before joining IIASA in 2004, Dr. Wagner was a researcher at the IPCC National Greenhouse Gas Inventories Programme located at the Institute for Global Environmental Strategies (IGES) in Hayama, Japan. Prior to that, he had been a postdoc with the International Energy Analysis Group at the Lawrence Berkeley National Laboratory (LBNL). Dr. Wagner received both his PhD (theoretical physics) and two master's degrees (mathematics, history and philosophy of science) from Cambridge University (UK, Trinity College). In 1998, Dr. Wagner won the Cambridge University's J.T. Knight's Prize in mathematics.



Kira West has a Bachelor's degree in Political Science from the University of Pittsburgh, and a Master of Public Policy from the University of Maryland, where she specialized in sustainable development. She currently works as an Energy Modeller in the International Energy Agency (IEA), where she focuses

on energy use in industrial sectors, as part of a larger energy system model covering all supply and demand sectors.

Dr Marianne Zeyringer joined the UCL Energy Institute in 2013 as a Research Associate under wholeSEM. Her research focuses on the integration of variable renewable



energy sources into the energy system. Together with James Price she has been developing the high spatial and temporal electricity system model highRES. Before joining UCL, Marianne was working

at the European Commission Joint Research Centre – Institute for Energy and Transport in the Netherlands. She has been pursuing doctoral studies at Utrecht University and BOKU University in Vienna. Her dissertation is on spatially and temporally explicit energy systems modelling.

## PhD Student Poster List

Pablo Carvajal Sarzosa, UCL

Assessing uncertainty of climate change impacts on long-term hydropower generation using the CMIP5 ensemble - The case of Ecuador

Selma Causevic, Delft University of Technology

Reliable power supply through dynamic distribution of local energy resources during outages

João Gorenstein Dedecca, Delft University of Technology

OGEM: the Offshore Grid Exploratory Model

Audrey Dobbins, University of Stuttgart

The significance of energy poverty on the assessment of household energy demand and emissions in Germany

Alice Gunn, University of Reading

Stakeholder perceptions of energy system models and their role in policymaking

Yingjian Guo, Imperial College London

Global Natural Gas Game facing Low-carbon Transition, An Analysis with Agent-based Modelling

Emma Hanley, University College Cork

Short-Term Vs Long-Term Planning – Impact of Emissions Pathways on Energy Resource use

Verena Heinisch, Chalmers University of Technology

Modelling interactions between residential electricity prosumers Impact from community electricity trading schemes on affordability of residential PV battery system, self-sufficiency and electricity transactions

Francisca Jalil Vega, Imperial College London

Spatially-resolved systems modelling for cost-effective heat decarbonisation: A case study

Erin Johnson, Imperial College London

Greening Britain's Gas: Biomethane & hydrogen for heating buildings

Martin Klein, Institute of Engineering Thermodynamics

How to model (and regulate) the future uptake of residential PV battery systems

Florian Knobloch, Radboud University Nijmegen

A behaviourally realistic model of technological change in the EU's residential heating sector

Vicky Papaioannou, University of Reading

Time-varying grid carbon intensity in the UK for the years 2009-2016

Neha Patankar, NC State University

Energy Planning Under Deep Uncertainty In Conflict Prone South Sudan

Dmytro Romanchenko, Chalmers University of Technology

Modelling thermal energy storage in district heating: a comparison of centralised storage and thermal inertia of buildings

Erik Sandberg, Luleå University of Technology

Improving process integration possibilities in ESOMs – A step towards site based modelling

Kristoffer Steen Andersen, Technical University of Denmark

Economic growth or CO2 reduction? Reconciling the impact of energy savings in a hybrid modelling setup

Jacopo Tattini, Technical University of Denmark

Incorporating modal choice behaviour in bottom-up energy system models



# PhD Student A-Z



Pablo E. Carvajal (Ecuador) has more than 10 years of experience in the energy sector. He has worked on the installation of renewable energy systems, namely solar thermal collectors, biogas systems and PV mini-grids in the rural settings in Ecuador and Brazil. He has been a regional consultant for the International Renewable Energy Agency (IRENA), Inter American Development Bank (IADB)

and German Technical Cooperation (GIZ). He has also been an energy advisor for the Ecuadorian Ministry of Energy being responsible for the National Energy Balance and the modelling of future energy systems. He also has experience as a lecturer in energy systems and microeconomics. He holds a M.S. in Renewable Energy from Oldenburg University, Germany and a B.S. in Mechanical Engineering from the National Polytechnic School, Ecuador. Since 2015 he has been working on his PhD at UCL Energy Institute focusing on long-term climate change uncertainty and its impacts on hydropower.



João Gorenstein Dedecca has been a PhD candidate in the Erasmus Mundus Joint Doctorate in Sustainable Energy Technologies and Strategies (SETS) since 2014, working on a market and policy framework for the North Seas offshore grid for integrating wind power and European power markets. João is an electrical engineer and a M.Sc. in

energy systems planning by the Campinas State University (UNICAMP), with the dissertation “Barriers to the development of wind power in Brazil and Argentina : an application of the analytic hierarchy process”. While at UNICAMP he participated in studies on renewable power in Latin America, and authored a study on greenhouse gases emission scenarios for the Brazilian industry. João has worked from 2012 to 2014 at GE in the wind, energy management and healthcare divisions and graduated in 2014 in GE’s Operations Management Leadership Program (OMLP), then working as a GE manufacturing engineer before joining SETS.



Selma Čaušević is a PhD candidate at Delft University of Technology, faculty of Technology, Policy and Management, Systems Engineering section. She has an MSc in Computer Science from Sarajevo School of Science and Technology, Bosnia and Herzegovina. While doing her Masters, she worked part-time in the industry and became interested in the application of

Computer Science in the area of Power Systems. She started her PhD in 2015, and is working on the Adaptive clustering for Decentralised Resilient Energy Management project, in cooperation with two Indian Institutes of Technology. Her research is focused on designing and developing mechanisms for self-organization of consumers, prosumers and producers into groups that locally match supply and demand in areas with high penetration of renewable resources. By implementing these mechanisms, the aim is to move towards more reliable power supply and a more resilient power system.



Audrey Dobbins is a research associate at the Institute of Energy Economics and Rational Energy Use (IER), University of Stuttgart in Germany. She earned a Masters in Energy Studies from the University of Cape Town, South Africa in 2006. While in South Africa, she also worked for an NGO on applied research aiming to improve the energy welfare of

residents in informal settlements and to develop and implement Energy and Climate Change Strategies together with cities. Currently, her research focuses on analysing the significance of energy poverty on the energy system through the application of an energy-economic model. Her research works towards enhancing the energy welfare of vulnerable households and, more broadly, achieving the energy and social objectives of the energy transition in the German context through improved energy planning.



Alice Gunn is in the final year of her EngD at the University of Reading with industry partner, SSE. Alice's background is in energy policy and she worked in SSE's corporate policy team for 2 years prior to beginning her EngD. Alice's research focuses on the impact that energy system models have in policy making. The project identifies core modelling techniques

through a review of government and academic model uses and creates representative versions of those to test. The strengths and weaknesses of these tools are examined through a number of case study questions using the island of Shetland. The final piece of the story, and what she will be presenting at this conference, is how stakeholders perceive the usefulness of these models. Outside of her doctoral research, Alice also works part time as a Knowledge Transfer Manager for SSE Airtricity, participating in the Horizon2020 funded domestic DSR demonstration project in Ireland 'RealValue'.



Yingjian Guo is a PhD student in the department of Chemical Engineering. Her research focus is on modelling Natural Gas transmission in a global scale. She completed her undergraduate studies in National University of Singapore with a 1st Class Honor degree. She took part in a variety of researches including DNA microfluidics experiment, data-driven

PID controller design, protein mechano-sensitivity analysis, and Eco-industrial park Heat-Exchange-Network optimization. She is building an agent-based game-theoretic model to study long-term global natural gas market dynamics, with an emphasis on contract-related investment decisions and stranded assets in infrastructure development. She has in-depth understanding of optimization, energy systems modelling, and imperfect competition. The model is being constructed based on Python and interacts with database. She is now being supervised by Dr. Adam Hawkes, who is the Deputy Director of the Sustainable Gas Institute.



Emma Hanley is a PhD candidate in the Energy Policy and Modelling Group, at the Environmental Research Institute, a MaREI research centre, University College Cork. Emma holds a BSc Energy and MSc by Research in system dynamic modelling of decentralised hydrogen storage systems from the University of Limerick. The main

research focus of her PhD is using the Irish TIMES energy system model for the analysis of policy questions most recently investigating non-ETS emissions targets, carbon budgets and electrification under different scenarios. Emma recently joined the CREDENCE project a collaborative project between North Carolina State University, Queens University Belfast and UCC. Her main focus as part of this project is to explore to what extent will energy systems be electrified and to investigate the optimal level of electrification that is required for our future heat and transport energy needs.



Verena Heinisch is PhD student at the Division of Energy Technology at Chalmers, University of Technology in Göteborg. Her research focuses on the techno-economic modelling of future electricity systems. The project aims at understanding centralized and decentralized developments in the electricity system infrastructure and their implication on techno-economic

modelling of electricity system operation and investment planning. In a first step the role of electricity prosumers and their incentives to invest in and operate decentralized generation and storage systems under different market set-ups is focus of the analyses. The goal is to provide methods and evaluations on considering decentralization in electricity system modelling.



Martin Klein works as a PhD candidate at the German Aerospace Center (DLR) at the Department of Systems Analysis and Technology Assessment. He is also a member of the Helmholtz Research School on Energy Scenarios. In his thesis, he wants to investigate how to design energy policy instruments with computational methods. Specifically, he

focuses on agent-based modeling of electricity markets. Martin has studied Physics at RWTH Aachen and KTH Stockholm and Renewable Energy Management at the University of Freiburg. He has been a guest researcher at TU Delft and a research assistant at the Fraunhofer Institute for Solar Energy Systems ISE and at Jülich Research Center.

# wholeSEM Annual Conference 2017

## The Past, Present and Future of Energy Modelling

#wholeSEM17 @wholeSEM



Francisca Jalil Vega is a Mechanical Engineer from Universidad de Chile and MSc in Sustainable Energy Futures from Imperial College London. She is currently a doctoral researcher at Imperial College London, where she is developing an energy systems model to study decarbonisation pathways for heat in the UK. Her research includes implementing a model that can address the specific issues arising from heat demand and supply, such as the inclusion of different temperature heat networks, the inclusion of low carbon end-use technologies, and infrastructure trade-offs, at a fine spatial resolution.



Erin Johnson is a PhD candidate at the Centre for Process Systems Engineering, Imperial College London. Her research applies supply chain modelling to assess how biomethane can best contribute to an affordable, secure and environmentally sustainable future energy system. This has particular relevance for decarbonising Britain's heating sector which is fed by one of the most comprehensive gas networks in the world. After graduating Imperial with a Master's in Chemical Engineering, Erin spent 5 years at National Grid where she gained an in-depth understanding of the issues affecting Britain's energy system.



Florian Knobloch is a PhD Candidate at the Environmental Science Department of the Faculty of Science at Radboud University Nijmegen, The Netherlands, and a Centre Researcher at the Cambridge Centre for Environment, Energy and Natural Resource Governance (C-EENRG), Department of Land Economy, University of Cambridge. His research focuses on the behavioural dynamics of energy technology diffusion, combining empirical research with the development of computational models of technological change. Before, Florian graduated from the University of Cambridge with a Master's degree (MPhil) in Environmental Policy, and studied Economics at Humboldt-University of Berlin (B.Sc. and M.Sc.) and Andrassy-University of Budapest (exchange semester). He has broad practical experience in policy analysis, including two years as a senior policy officer for the Federation of German Industries, consulting work for the European Commission (DG Energy) and a stay as a visiting fellow at Fundación Chile's energy policy team.



Vicky Papaioannou is a PhD student at university of Reading, UK, working under the supervision of Dr. Phil Coker (UoR), Dr. Ben Potter (UoR) and Dr. Valerie Livina (NPL) on the project "Applying power systems models to establish uncertainty ranges for carbon emissions allocated to build environment investment projects". Her main research interests are environmental management, renewable energy sources and electricity grid decarbonisation. Vicky had her first degree in Physics from University of Athens, specialised in environmental physics and worked as an intern in the Greek Ministry of Environment in the industrial GHG reporting sector. She later completed a master course in "Environmental Impact Assessment and Management" at Oxford Brookes University and worked as a part-time EIA consultant in URS (later AECOM). Before the PhD, Vicky worked as an energy data analyst in the department of Systems Engineering, University of Reading.



Neha Patankar moved from India to USA to explore her passion for the field of Operations Research and its applications. She started pursuing a PhD in Operations Research at North Carolina State University in 2015. During the period of last 2 years, she has become immensely interested in the applications of Operations Research in the field of energy system modelling. She has closely worked on the open source energy modelling platform known as Tools for Energy Modelling and Optimization (Temoa) to implement techniques from Operations Research in energy system models. Addressing parametric and structural uncertainties in the energy system models has been her prime interest during this period. Apart from her research interests, she is also an avid chess player and has represented her home state on national level.



Dmytro Romanchenko is a PhD student at Chalmers University of Technology, Sweden. He holds a M.Sc. in Sustainable Energy Systems and M.Sc. in Electromechanics. The aim of his research is to increase the understanding of how the Swedish building stock can contribute to the development of sustainable energy system. The project includes analysis of both the supply and the demand side. Unit commitment optimization model is developed and used to address the questions raised in the research project.



Erik Sandberg is a PhD-student working in the division of energy science at Luleå University of Technology. The overall focus of Erik's research is energy system studies of the industry to improve the policy support for biomass utilization from a national perspective. This involves studies for improving the representation of the industry and how the industry

sector can be better considered within energy system models. Erik's work is mostly conducted within the TIMES modelling framework, and TIMES-Sweden is the specific model where it is applied.



Kristoffer Steen Andersen is a PhD student at Technical University of Denmark's Management Engineering department. His research interest focus on reconciling the thinking of engineers and economists when it comes modelling energy and climate mitigation policies. This is being done by soft linking a Danish TIMES model to a macroeconomic model of the Danish

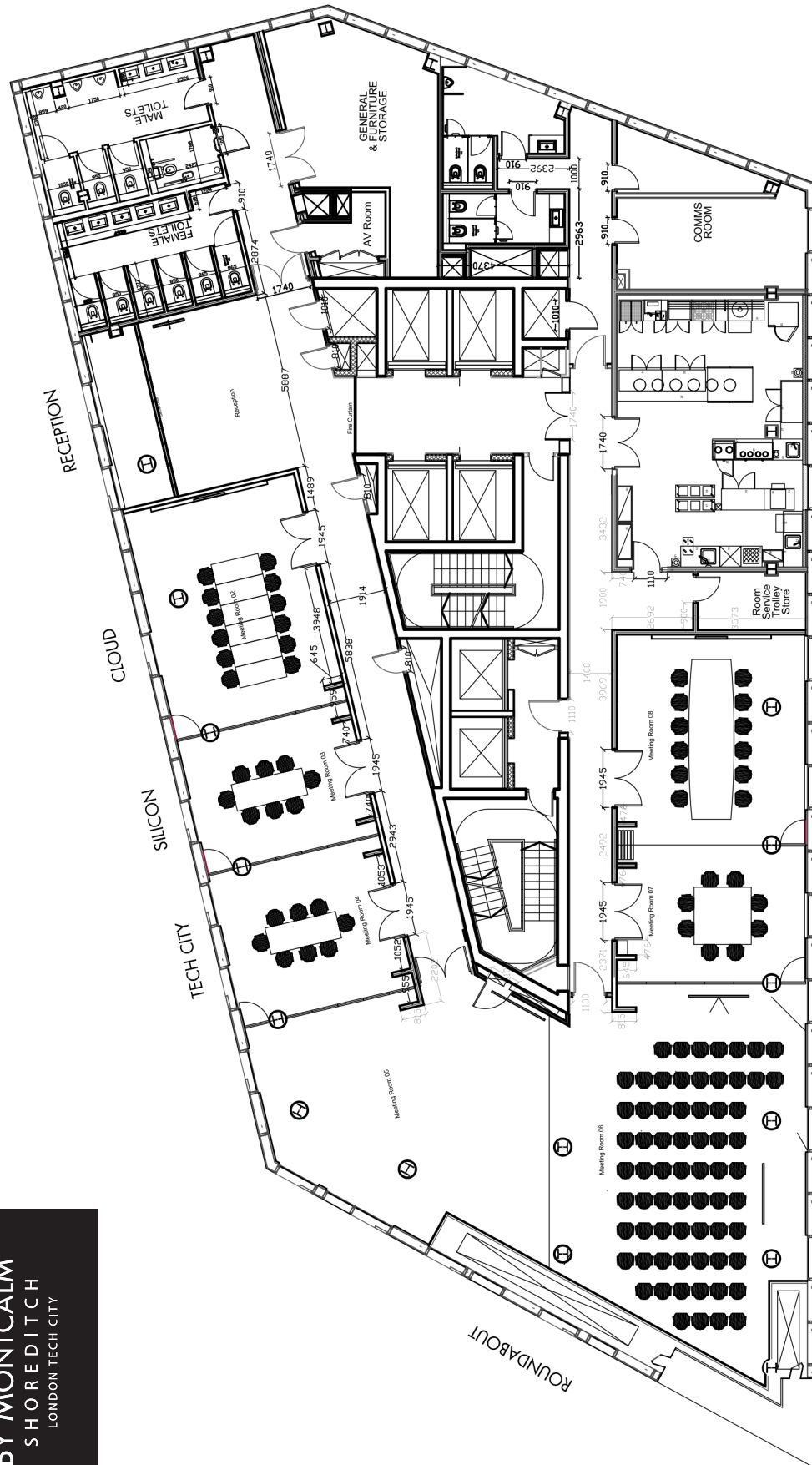
economy. Kristoffer is also working on scenario analysis and on ways to capture robustness of energy and climate policies, e.g. using Monte Carlo approach. Before joining DTU, Kristoffer served as an advisor in the Danish Energy Agency working with socio economic assessment, energy modelling and forecasts related to the Danish Energy Outlook.



Jacopo Tattini is a PhD student at the Energy System Analysis group of the Technical University of Denmark. He is working on the COMETS project, which aims to develop a decision tool within an integrated energy system framework for identifying strategies supporting Denmark's 2050 goal of becoming independent of fossil fuels. His

research focuses on improving the representation of behaviour in passenger transport within energy system models. He has developed and tested novel methodologies for incorporating modal choice in TIMES energy system models which are used to perform scenario and policy analyses on the transportation sector. Jacopo earned a BSc in Management Engineering at University of Florence in 2012 and a MSc in Energy Engineering from Politecnico di Torino in 2015.

# FLOOR PLAN



Second Floor

GLOBAL  
CYBER



## NOTES

## NOTES



wholeSEM

Central House, 14 Upper Woburn Place,  
London WC1H 0NN

[www.wholesem.ac.uk](http://www.wholesem.ac.uk)

@wholeSEM



Imperial College  
London

