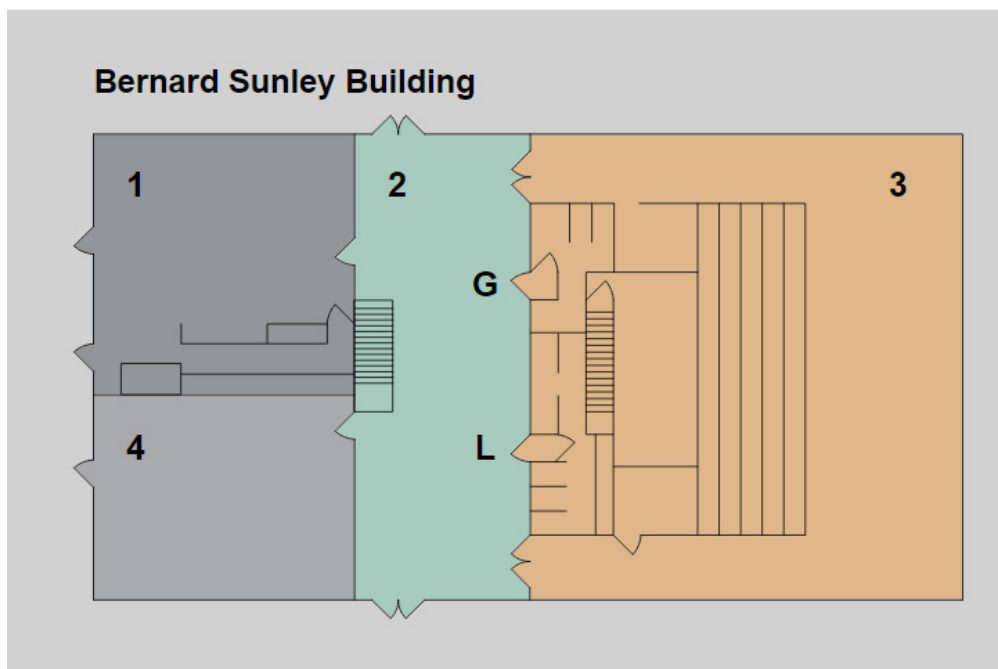


STRATEGIC MATERIALS FOR A LOW-CARBON FUTURE: FROM SCARCITY TO AVAILABILITY



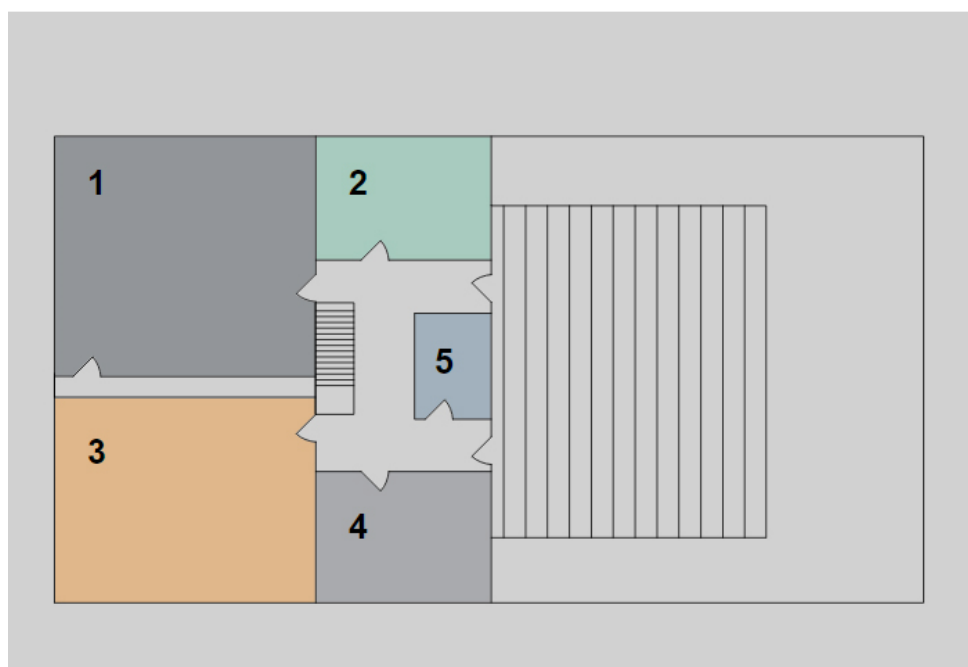
St. Catherine's College, Oxford
2-3 November 2017

Map



Ground Floor

- 1 - Room not in use
- 2 - Refreshment area and bathrooms
- 3 - Bernard Sunley Lecture Theatre – main plenary sessions & breakout sessions
- 4 - Room A – Refreshment breaks overflow room



First Floor

- 1 - Room D (Shaw Room) – breakout sessions
- 2 - room not in use
- 3 - Room C – breakout sessions
- 4 - Room B – green room & conference organisers office
- 5 - AV room, no admittance

The Resource Availability Conference 2017 is The Veolia Institute's 10th International Conference, organised in partnership with The Oxford Martin School



The Veolia Institute

The Veolia Institute is a non-profit organisation under French law, created in 2001 by the company Veolia. It operates as an independent environmental think-tank, promoting foresight reflection and providing an international platform for sharing state-of-the-art scientific knowledge and best field practices on sustainable development. Dedicated to encouraging long-term thinking and to anticipating the trends that will mark the society-environment interaction in the mid and long-terms, the Institute works systematically in partnership with pluridisciplinary networks of scientists and development practitioners in order to fulfil its goals. Acting as facilitator among interdisciplinary communities and catalyst of innovative reflection, the programme of international conferences organised since 2004 synthesizes the mission of the Institute: to identify emerging challenges of sustainable development, to raise public awareness and to inform decision-making. For more information, please visit www.institut.veolia.org/en



The Oxford Martin School

The Oxford Martin School at the University of Oxford is a world-leading centre of pioneering research that addresses global challenges. The School invests in research that cuts across disciplines to tackle a wide range of issues including climate change, disease, cyber threats, and inequality. The School supports novel, high risk and multidisciplinary projects that may not fit within conventional funding channels, but which could dramatically improve the wellbeing of this and future generations.

Established in 2005 through the generosity and vision of Dr James Martin, the School provides academics with the time, space, and means to work collaboratively and to engage policymakers, business people, and the general public. To qualify for School support, the research must be of the highest academic calibre, tackle issues of a global scale, have a real impact beyond academia, and could not be undertaken without the School's support. All research teams are based within the University of Oxford. In the School's first decade, more than 500 researchers have worked on 45 research programmes, from ageing to vaccines. For more information, please visit www.oxfordmartin.ox.ac.uk



The Conference is organised with the support from the Prince Albert II of Monaco Foundation.

Strategic Materials for a Low-Carbon Future: From Resource Scarcity to Availability

Introduction

How do we ensure the availability of strategic materials and mineral resources for a low-carbon world? Our economic development has been based on an unsustainable exploitation and use of natural resources. World extraction of material resources has tripled over the past 40 years and is expected to at least double with the development of emerging economies. Today, we extract and consume our planet's resources much faster than the rate at which they can be renewed. At the same time, transitioning to a low-carbon economy and energy system may increase demand for some key minerals and strategic materials.

The Veolia Institute's 10th International Conference, held in partnership with the Oxford Martin School, offers perspectives on how to make strategic materials and mineral resources available for a sustainable future, one that is transitioning to a low-carbon economy. It will build bridges amongst those who can contribute insights and solutions, from academics and the scientific community to policy-makers, civil society leaders, business leaders, financiers and entrepreneurs, across geographies and generations.

The Conference will tackle three topics related to resource availability in a low-carbon world:

- Materials for a low-carbon future;
- Primary resource availability in a low-carbon transition; and
- Disruptions in resource availability: the case for the circular economy.

The first identifies which materials need to be made available for a successful low-carbon transition and future. The second and third topics address how to make these materials available.

For each issue, a moderated groundwork discussion will set the stage, explore key themes and reveal the latest scientific thinking. Then, a series of breakout exchanges will delve more deeply into a specific aspect of the issue, with real-world applications that can be put to use immediately.

The moderated discussions and informal debate will explore questions such as:

- Which materials and minerals are critical now for a low-carbon future economy? In the transition to a low-carbon economy, how will the resource landscape change? Depending on demand scenarios, what will be the pace and scale of change needed to make those resources available?
- What are the consequences of this new resource landscape for our economies, societies, environment and geopolitics?
- What are the economic, energy, environmental or social constraints to resource availability in the low-carbon transition?
- In low-carbon focus sectors such as renewable energy, transport and information technology, what kinds of technical and financial innovations would encourage investment in new, substitute and renewable materials, and their recovery and reuse in a circular fashion?
- Beyond technological solutions, what kinds of collaboration and cooperation would business, policy-makers and communities need to ensure that key materials remain available, and what would encourage greater collaboration?
- What policies would enable responsible resource extraction and use and how would this impact on the circular economy?

DAY 1 – THURSDAY 2 NOV, 2017

8:30–9:15 Registration and welcome coffee

9:20–9:30 **OPENING:**

MC: Sophie Lambin, Co-Founder & Managing Director, Kite Global Advisors

Dinah Louda, Executive Director, Veolia Institute

Steve Cowley, Acting Director, Oxford Martin School, University of Oxford

9:35–9:55 **John Beddington**, Senior Adviser, Oxford Martin School & Professor of Natural Resources, University of Oxford

TOPIC 1: What materials are key to a low-carbon future? Exploring the implications of the transition to a low-carbon economy on primary resource demand

10:00–11:15 **Groundwork session 1: What materials for a low-carbon future? (venue: Lecture Theatre)**

What is the ‘low-carbon transition’, and what are its implications? Taking a foresight approach, the panellists will identify the sectors most affected by the low-carbon transition (for instance, energy infrastructure, construction, transportation, and digital technologies) and map out trends, scenarios and issues relating to material use as those sectors evolve. Resources to consider may include structural materials, key to low-carbon infrastructure in an urbanizing world (cement, sand, concrete, copper, aluminium, steel), as well as critical or strategic metals whose supply is at stake in a low-carbon economy (lithium, rare earth metals). What is the real potential for physical scarcity of such resources in the face of such demand?

Thomas Graedel, Clifton R. Musser Professor of Industrial Ecology, School of Forestry and Environmental Studies, Yale University

Cameron Hepburn, Director, Economics of Sustainability, The Institute for New Economic Thinking at the Oxford Martin School

Sigurd Mareels, Senior Partner, Brussels, McKinsey & Company

Edmund Nickless, Chair, International Union of Geological Sciences New Activities Strategic Implementation Committee, IUGS Councillor 2016–2020, International Union of Geological Sciences

Moderator: **John Beddington**, Senior Adviser, Oxford Martin School & Professor of Natural Resources, University of Oxford

11:15–11:45 Break

11:45–12:45 **Breakout sessions 1a to 1c**

Breakout 1a: Basic materials in tomorrow’s climate-friendly cities (venue: Room A)

By 2050, two-thirds of the world’s population will live in cities, creating pressure on urban infrastructure. What are the consequences of rapid urbanization on the demand for key material resources like cement, concrete, glass, or steel? How can cities grow sustainably into a low-carbon future, with an eye to end-of-life and change of purpose, and with minimal amounts of embedded carbon? What would low-carbon cities look like, and what is the implication for wider resource use?

Stefano D’Agostino, Divisional Director, Schneider Electric

Dabo Guan, Chair Professor in Climate Change Economics, School of International Development, University of East Anglia

Simon Ratcliffe, Infrastructure and Climate Advisor, UK Department for International Development (DfID)

Mark Swilling, Distinguished Professor of Sustainable Development, School of Public Leadership, University of Stellenbosch

Moderator: **Larry Yu**, Co-Founder & Managing Director, Kite Global Advisors

Breakout 1b: Powering the future: energy storage minerals (venue: Lecture Theatre)

The decarbonisation of the transport industry is resulting in a revolution in energy storage technologies. Electric vehicle demand is driving increased demand for lithium-ion batteries. What is the forecast demand for the key materials of lithium and cobalt? What is the impact on supply chain risk for end-users and can these risks be mitigated? What is the prospect for emerging battery technologies such as vanadium flow? What are the technological challenges in secondary supply?

Nick Cliffe, Innovation Lead for Advanced Materials, Manufacturing & Materials Team, Innovate UK

Hans Eric Melin, Founder, Creation Inn

Simon Moores, Managing Director, Benchmark Mineral Intelligence

Moderator: **Henry Sanderson**, Commodities Correspondent, Financial Times

Breakout 1c: Critical metals in high technologies: managing complexity (venue: Room C)

Rare earth elements are raising concerns from public authorities as they are increasingly used in strategic sectors of the economy such as telecommunication and defence. What is the reality of rare earth elements availability now and in the foreseeable future? How are digital technologies driving a more complex resource landscape? Is the increasing role played by rare earth elements in high technologies a reasonable source of concern? How is complexity and diversity making products more vulnerable to risks in supply of those metals? And what is the true risk from geopolitical imbalances of supply and demand?

Alex King, Director, Critical Materials Institute, The Ames Laboratory, U.S. Department of Energy

David Peck, Manager, KIC EIT EU Raw Materials Programme, Delft University of Technology (TU Delft) & Manager, Leiden-Delft-Erasmus Centre for Sustainability (CfS)

Markus Reuter, Director, Helmholtz Association

Moderator: **Xianlai Zeng**, Associate Professor of Environmental Science and Engineering, School of Environment, Tsinghua University

12:45-14:15 Lunch (venue: Dining Hall)

14:15-15:15 Breakout sessions 1d to 1f

Breakout 1d: Copper and aluminium in the low-carbon world (venue: Room C)

Copper and aluminium provide the building blocks for both industrial and economic growth, and are also key for new energy technologies. Will the demand landscape for common metals be radically different from past use? What are future trends of substitution in the search for lower carbon usages, for instance magnesium for aluminium, or fibre optics for copper? Can the proportion of metal coming from secondary sources increase in the future?

Thomas Graedel, Clifton R. Musser Professor of Industrial Ecology, School of Forestry and Environmental Studies, Yale University

Ben Jones, Managing Consultant, CRU

Sangwon Suh, Professor of Industrial Ecology, University of California, Santa Barbara

Moderator: **Elizabeth Surkovic**, Head of Policy, Resilience and Emerging Technologies, The Royal Society

Breakout 1e: Low-carbon technologies: resource scarcities, surpluses and uncertainties (venue: Lecture Theatre)

Clean technologies such as solar panels, and onshore wind have won tremendous market share gains over fossil fuels in recent years. What does the upcoming deployment curve look like, and what is the implication for the resources required to support that deployment? How is fast technological deployment impacting uncertainty of future materials demand and what are the consequences of such uncertainty? Will regulatory intervention help or hinder?

Aled Jones, Director, Global Sustainability Institute, Anglia Ruskin University

Jaakko Kooroshiy, Executive Director, Global Investment Research Division, Goldman Sachs

Olivier Vidal, CNRS-INSU Director of Research, Institut des Sciences de la Terre, University of Grenoble

Moderator: **Chris Llewellyn Smith**, Director, Energy Institute, University of Oxford

Breakout 1f: Fertilizers, yields and resource depletion: phosphates and the need for productive agriculture in Europe (venue: Room D)

Phosphorus may be the key to the increase in yields needed to maintain food requirements. Yet phosphate rock is not a renewable resource, recovered sources are hard to make cost effective, and over-use of phosphorus from any source risks being washed away and causing pollution. How might legislation on climate change or other environmental legislation affect phosphate use and supply?

What policies are likely to foster resource efficiency and recovery? What European policies are required for the management of a strategic resource in Europe? And what are the best sources of 'biofertilizers', for instance phosphorus from sludge?

Ludwig Hermann, President, European Sustainable Phosphorus Platform; Technology Manager, Outotec GmbH & Co KG

Kazuyo Matsubae, Professor of Environmental and Energy Economics, Graduate School of Environmental Studies, Tohoku University

Moderator: **Julie Hill**, Chair, WRAP (The Waste and Resources Action Programme)

TOPIC 2: Managing the impacts of extractive industries in a new low-carbon resource landscape. Will the extraction of primary resources fulfil rising demand?

15:30-16:45 Groundwork session 2: Primary resource availability in a low-carbon transition (venue: Lecture Theatre)

In the shift towards resource availability, physical factors like geological availability may not be the prime constraint to meeting demand for extracted materials. Rather, the limits may be environmental, social, political, or economic. Limits also arise from interdependencies with water, land or energy, for which there are competing social needs. These tensions are particularly prevalent in the extraction of metals and minerals – often in developing countries where social needs are acute and governance is less clear. What are the key limiting factors and what technical and organisational innovation can mitigate their impact? What is the impact of a low-carbon transition on the extractive industries? What will these industries look like in a low-carbon future, and what are the second-order implications down the road? How can governance mechanisms in extractive industries evolve to make the industry sustainable?

Georges Calas, Professor of Mineralogy, UPMC (Université Pierre et Marie Curie)

Sheila Khama, Practice Manager, Energy and Extractives Global Practice, World Bank Group

Oscar Landerretche, Chairman of the Board of Directors, CODELCO

Bernice Lee, Executive Director, Hoffman Centre for Sustainable Resource Economy, Chatham House

Karina Litvack, Independent Non-Executive Director, Eni SpA

Moderator: **Fiona Harvey**, Environment Journalist, The Guardian

16:45–17:00 Break

17:00–18:00 Breakout sessions 2a to 2c

Breakout 2a: The paradox of extraction and energy consumption in a low-carbon transition (venue: Lecture Theatre)

Some extracted materials are essential to low-carbon growth – yet their reserves may not be easily accessible, and the energy required to access them may make extraction economically unviable. This session considers whether increased demand for metals implies a need to access lower grade ores with accompanying consequences for energy use and carbon emissions. Is there an energy threshold where it becomes more cost efficient to recycle rather than to extract? Are there innovative policy or business solutions?

Ugo Bardi, Lecturer in Physical Chemistry, University of Florence
David Humphreys, Principal, DaiEcon Advisors

Moderator: **Olivier Vidal**, CNRS-INSU Director of Research at the Institut des Sciences de la Terre, University of Grenoble

Breakout 2b: The water – land – resource nexus (venue: Room C)

As easily accessible mines are depleted, finding and accessing new mines is likely to put pressure on resources, in particular water and land. Overall, the environmental impact of mining may even surpass planetary boundaries. In addition, new mines increasingly compete with local communities for water, energy, land or pressuring human health. How can disputes be settled at the local level? How can the private sector and public sector engage responsibly? Are there better ways of dealing with mining waste in a low-carbon world, and what are the best practices for the reduction of environmental impacts?

Raimund Bleischwitz, Chair in Sustainable Global Resources, University College London and Deputy Director, UCL Institute for Sustainable Resources (UCL ISR)
Jennifer Broadhurst, Associate Professor & Deputy Director, Minerals to Metals Initiative, University of Cape Town
Franck Galland, Director, Environmental Emergency & Security Services
Ester Van der Voet, Associate Professor, Institute of Environmental Sciences, Leiden University

Moderator: **Jan Klawitter**, Principal, International Relations, Anglo American

Breakout 2c: Financing sustainable resource availability (venue: Room D)

More investors today are scrutinising the non-financial impacts of their investments. What role does the financial sector play in sustainable resource extraction? How does it integrate interdependent risks related to resource scarcity? What innovative financial tools might stimulate efficient and responsible resource extraction? Will the cost of capital increase significantly for mining companies in the future? How can investments be directed towards solutions which might have higher upfront capital costs and even sustained periods of negative value, but which are the most sustainable – and therefore most valuable – solution in the long term?

Jamie Butterworth, Founding Partner, Circularity Capital
Ben Caldecott, Director, Sustainable Finance Programme, Smith School of Enterprise and the Environment, University of Oxford

Moderator: **Karina Litvack**, Independent Non-Executive Director, Eni SpA

18:30–19:45 Keynote Public Lecture (venue: Examination Schools)

Towards a low-carbon future

Nicholas Stern, IG Patel Professor of Economics and Government; Chairman, Grantham Research Institute on Climate Change and the Environment; and Head of the India Observatory, London School of Economics

DAY 2 – FRIDAY 3 NOV, 2017

TOPIC 3: Disruptions in resource availability: the case for the circular economy

9:00–10:00 **Groundwork session 3: (venue: Lecture Theatre)**

The circular economy has the potential to disrupt and radically change the resource use and availability landscape. The circular economy can contribute to decarbonising the economy and a fully circular economy could even be a new source of resources and materials. How can we encourage a true paradigm shift?

Paul Ekins, Professor of Resources and Environmental Policy & Director, UCL Institute for Sustainable Resources, University College London

Richard Kirkman, Chief Technology and Innovation Officer, Veolia UK & Ireland

Martin Stuchtey, Founder & Managing Partner, SYSTEMIQ Ltd

Moderator: **Sophie Lambin**, Co-Founder & Managing Director, Kite Global Advisors

10:05–11:05 **Breakout sessions 3a to 3c**

Breakout 3a: Scaling up recycling of complex products (venue: Lecture Theatre)

What are the current economic, technical, legal or social obstacles to scaling up recycling of complex products such as electronic items and energy products such as batteries or solar PV panels? Can new forms of collaboration between businesses and institutions help? How much can we expect to collect from recycling? Can design of products facilitate recycling of components? Can products be designed to be safer to recycle?

Christian Hagelüken, Director of EU Government Affairs, Umicore

Richard Kirkman, Chief Technology and Innovation Officer, Veolia UK & Ireland

Kerstin Kuchta, Director, Waste Resource Management Research Group, Hamburg University of Technology

Moderator: **Hans Eric Melin**, Founder, Creation Inn

Breakout 3b: The reach of closed loop recycling and remanufacturing (venue: Room A)

Can full closed loop recycling and remanufacturing become a reality for some materials? With sufficient design, manufacturing and repair innovations, can the need to mine be completely eradicated for specific materials or metals? What new business model would facilitate such closed loop systems? What new business models would help form closed loops and help avoid waste ending up in the environment?

Andrew Clifton, Sustainability Manager for Engineering & Design, Rolls-Royce

Amir Rashid, Associate Professor and Head of the Manufacturing and Metrology Systems Division, Royal Institute of Technology, Stockholm

Walter Stahel, Founder - Director, Product-Life Institute

Moderator: **David Peck**, Manager, KIC EIT EU Raw Materials Programme, Delft University of Technology (TU Delft) & Manager, Leiden-Delft-Erasmus Centre for Sustainability (CfS)

Breakout 3c: Eco-design in the built environment (venue: Room C)

Eco-design each year eliminates more than the annual energy consumption of Italy. Part of the circular economy principle is to think about how to design products so that they incorporate recycled materials and that they are easily reusable or recyclable. This implies thinking about resource efficiency in the product design process and a shift away from the mindset of planned obsolescence. How is this shift being incorporated into design or business education for buildings and the built environment? Can key components like steel girders be designed for re-use in buildings? In practice, which businesses or organisations are leading this charge and how? Can producer responsibility concepts be applied for buildings?

Vernon Collis, Adjunct Associate Professor, Department of Civil Engineering, University of Cape Town
Nitesh Magdani, Group Director of Sustainability, Royal BAM Group
Davide Stronati, Group Sustainability Leader, Mott MacDonald

Moderator: **Larry Yu**, Co-Founder & Managing Director, Kite Global Advisors

11:05-11:30 Break

11:30-12:30 Breakout sessions 3d to 3f

Breakout 3d: E-Waste: policies to foster the circular economy (venue: Room D)

Waste from electronic devices is predicted to increase dramatically due to consumption patterns of developed countries and the growing middle class of developing countries. How are developed and developing countries currently dealing with their e-waste, and how can e-waste be reinvented as a circular economy resource? How is China, the second largest consumer market in the world, tackling its e-waste compared to the US or Europe. What technologies already exist, and what is required for these technologies to be adopted at scale? How can we increase awareness of e-waste issues among consumers?

Jonathan Perry, Producer Responsibility Compliance Consultant, Dell
Malcolm Waddell, Delivery Manager – Electricals and Circular Business Models, WRAP (The Waste and Resources Action Programme)
Xianlai Zeng, Associate Professor of Environmental Science and Engineering, School of Environment, Tsinghua University

Moderator: **Dabo Guan**, Chair Professor in Climate Change Economics, School of International Development, University of East Anglia

Breakout 3e: Plastics in a zero-carbon world (venue: Room C)

To increase resource efficiency, complex plastics are increasingly replacing heavier metals. Many hybrid or electric vehicle makers are investigating the use of carbon-fibre reinforced plastic (CFRP) bodies. How do we ensure those new plastics, and the products that contain them, are designed to be recycled or re-used? What is the climate and waste impact of a shift from metals to complex plastics? How can plastics be incorporated in new uses? How can the use of recycled plastics vs the use of virgin plastics be incentivised when virgin plastics are cheaper at current oil prices? What can be done with plastics that can't be recycled?

Gary Leeke, Chair in Chemical Engineering and Head of the Bioenergy and Resource Management Centre, Cranfield University
Pascal Peslerbe, Deputy Manager of 2EI, Development and Innovation Department, Veolia

Moderator: **Julie Hill**, Chair, WRAP (The Waste and Resources Action Programme)

**Breakout 3f: Technological and scientific innovation in circularity
(venue: Lecture Theatre)**

Can digital and scientific technologies drive change towards the circular economy paradigm? What role can sustainable technological and engineering processes play in fostering efficient and circular resource use at different stages of the value chain? Can innovation in materials similarly generate radical innovations and accelerate a paradigm shift from the bottom up? Where are the current exciting areas for innovation in materials, processes and applications? What potential is there for innovation in polymer manufacturing and what impact can improved or novel polymer manufacture have on recycling rates? Are commercial manufacturers and users of materials interested in adaptability or in sustainability? What barriers exist for the implementation of circular economy principles in SME businesses today?

Graham Hillier, Strategy and Futures Director, Centre for Process Innovation (CPI)

Charlotte Williams, Professor of Inorganic Chemistry, Department of Chemistry, University of Oxford

Moderator: **Ken Webster**, Head of Innovation, Ellen MacArthur Foundation

12:30-13:00 Special Address and closing (venue: Lecture Theatre)

Antoine Frérot, Chairman & CEO, Veolia

13:00 Conference Closes

Speakers & Moderators

- **Professor Ugo Bardi**, Lecturer in Physical Chemistry, University of Florence
- **Professor Sir John Beddington**, Senior Adviser, Oxford Martin School & Professor of Natural Resources Management, University of Oxford
- **Professor Dr Raimund Bleischwitz**, Chair in Sustainable Global Resources, University College London and Deputy Director, UCL Institute for Sustainable Resources (UCL ISR)
- **Professor Jennifer Broadhurst**, Associate Professor & Deputy Director, Minerals to Metals Initiative, University of Cape Town
- **Jamie Butterworth**, Founding Partner, Circularity Capital
- **Professor Georges Calas**, Professor of Mineralogy, UPMC (Université Pierre et Marie Curie)
- **Dr Ben Caldecott**, Director, Sustainable Finance Programme, Smith School of Enterprise and the Environment, University of Oxford
- **Nick Cliffe**, Innovation Lead for Advanced Materials, Manufacturing & Materials Team, Innovate UK
- **Andrew Clifton**, Sustainability Manager for Engineering & Design, Rolls-Royce
- **Professor Vernon Collis**, Adjunct Associate Professor, Department of Civil Engineering, University of Cape Town
- **Professor Steve Cowley**, Acting Director, Oxford Martin School, University of Oxford
- **Stefano D'Agostino**, Divisional Director, Schneider Electric
- **Professor Paul Ekins**, Professor of Resources and Environmental Policy & Director of the UCL Institute for Sustainable Resources, University College London
- **Antoine Frérot**, Chairman & CEO, Veolia
- **Franck Galland**, Director, Environmental Emergency & Security Services
- **Professor Thomas Graedel**, Clifton R. Musser Professor of Industrial Ecology, School of Forestry and Environmental Studies, Yale University
- **Professor Dabo Guan**, Chair Professor in Climate Change Economics, School of International Development, University of East Anglia
- **Christian Hagelüken**, Director of EU Government Affairs, Umicore
- **Fiona Harvey**, Environment Journalist, The Guardian
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- **Dr Ben Jones**, Managing Consultant, CRU
- **Sheila Khama**, Practice Manager, Energy and Extractive Industries Global Practice, World Bank Group
- **Dr Alexander King**, Director, Critical Materials Institute, The Ames Laboratory, US Department of Energy
- **Richard Kirkman**, Chief Technology and Innovation Officer, Veolia UK & Ireland
- **Jan Klawitter**, Principal, International Relations, Anglo American
- **Jaakko Kooroshy**, Executive Director, Global Investment Research Division, Goldman Sachs
- **Professor Kerstin Kuchta**, Director, Waste Resource Management Research Group, Hamburg University of Technology
- **Sophie Lambin**, Co-Founder & Managing Director, Kite Global Advisors

- **Professor Oscar Landerretche**, Chairman of the Board of Directors, CODELCO
- **Bernice Lee**, Executive Director, Hoffmann Centre for the Sustainable Resource Economy, Chatham House
- **Professor Gary Leeke**, Chair in Chemical Engineering & Head of the Bioenergy and Resource Management Centre, Cranfield University
- **Karina Litvack**, Independent Non-Executive Director, Eni SpA
- **Professor Sir Chris Llewellyn Smith**, Director, Energy Institute, Oxford University
- **Dinah Louda**, Executive Director, Veolia Institute
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- **Professor Amir Rashid**, Associate Professor & Head of the Manufacturing and Metrology Systems Division, Royal Institute of Technology, Stockholm
- **Simon Ratcliffe**, Infrastructure and Climate Advisor, UK Department for International Development (DfID)
- **Markus Reuter**, Director, Helmholtz Association
- **Henry Sanderson**, Commodities Correspondent, Financial Times
- **Professor Walter Stahel**, Founder-Director, Product-Life Institute
- **Lord Nicholas Stern**, IG Patel Professor of Economics and Government; Chairman, Grantham Research Institute on Climate Change and the Environment; and Head of the India Observatory, London School of Economics
- **Davide Stronati**, Global Sustainability Leader, Mott MacDonald
- **Professor Martin Stuchtey**, Founder & Managing Partner, SYSTEMIQ Ltd
- **Professor Sangwon Suh**, Professor of Industrial Ecology, University of California, Santa Barbara
- **Elizabeth Surkovic**, Head of Policy, Resilience and Emerging Technologies, The Royal Society
- **Professor Mark Swilling**, Distinguished Professor of Sustainable Development, School of Public Leadership, University of Stellenbosch
- **Professor Ester Van der Voet**, Associate Professor, Institute of Environmental Sciences, Leiden University
- **Olivier Vidal**, CNRS-INSU Director of Research, Institut des Sciences de la Terre, University of Grenoble
- **Malcolm Waddell**, Delivery Manager - Electricals and Circular Business Models, WRAP (The Waste and Resources Action Programme)
- **Ken Webster**, Head of Innovation, Ellen MacArthur Foundation
- **Professor Charlotte Williams**, Professor of Inorganic Chemistry, Department of Chemistry, University of Oxford
- **Larry Yu**, Co-Founder & Managing Director, Kite Global Advisors
- **Professor Xianlai Zeng**, Associate Professor of Environmental Science and Engineering, School of Environment, Tsinghua University

Speaker & Moderator Biographies

Including Twitter handles, where available

Professor Ugo Bardi, Lecturer in Physical Chemistry, University of Florence @gelder52

Ugo Bardi is a lecturer in physical chemistry at the University of Florence, where he is engaged in research on sustainability and energy with a special view on the depletion of mineral resources. This research is at present supported by the European Union under the Horizon project MEDEAS. Ugo Bardi is a member of the Club of Rome and of the international scientific committee of ASPO (Association for the Study of Peak Oil). He is active in the dissemination of scientific results in sustainability and climate science on the blog Cassandra's Legacy. He is the author of numerous papers on sustainability and of the recent books *The Limits to Growth Revisited* (2011) and *Extracted – how the quest for mineral wealth is plundering the planet* (2014). A new book titled *The Seneca Effect: why growth is slow but collapse is rapid* was published by Springer in 2017.

Professor Sir John Beddington, Senior Adviser, Oxford Martin School & Professor of Natural Resources Management, University of Oxford

Professor Sir John Beddington is the Senior Strategy Adviser at the Oxford Martin School and Professor of Natural Resource Management at Oxford University. He also acts as a Non-Executive Director of the Met Office, a Trustee of the Natural History Museum and President of the Zoological Society of London, amongst other activities. After an academic career in the field of Applied Population Biology, John was elected Fellow of the Royal Society in 2001, appointed CMG in 2004, was awarded a Knighthood in 2010 and in June 2014 received The Order of the Rising Sun from the Japanese Government. He was from 2008 until 2013 the UK Government Chief Scientific Advisor (GCSA) reporting directly to the Prime Minister. As GCSA, he led on providing scientific advice to Government during the 2009 swine flu outbreak, the 2010 volcanic ash incident and the emergency at the Fukushima nuclear power plant in 2011. As GCSA, he was also responsible for increasing the scientific capacity across Whitehall by encouraging all major departments of state to recruit a Chief Scientific Adviser. He also directed the Foresight team which had the responsibility to look forward and assess implications for major challenges in the future.

Professor Dr Raimund Bleischwitz, Chair in Sustainable Global Resources, University College London and Deputy Director, UCL Institute for Sustainable Resources (UCL ISR) @BleischwitzR

Raimund Bleischwitz is Chair in Sustainable Global Resources at University College London (UCL), and Deputy Director at the UCL Institute for Sustainable Resources (UCL ISR). He is currently Principal Investigator of an international collaborative project on the circular economy in China (SINCERE), and participates in a number of EU projects on eco-innovation and raw minerals (Green.EU/Inno4SD, RECREATE, POLFREE, Minatura, Mica). He had previous positions at the Wuppertal Institute in Germany, at the College of Europe in Bruges (Belgium), at a Max Planck Institute, at the Institute for European Environmental Policy and in the German Bundestag; and fellowships at the Transatlantic Academy (TA) in Washington DC, at Johns Hopkins University (AICGS JHU) and in Japan (JSPS). Raimund has a PhD and a 'Habilitation' in economics. His research interests cover sustainable development, resource efficiency, the resource nexus, conflict minerals, international governance, the interface of policy and industry, and reflected in more than 200 publications. His recent book written with five international co-authors is *Want, Waste, or War? The Global Resource Nexus and the Struggle for Land, Energy, Food, Water and Minerals* (Routledge/Earthscan Publisher 2015).

Professor Jennifer Broadhurst, Associate Professor & Deputy Director, Minerals to Metals Initiative, University of Cape Town

Jennifer Broadhurst has more than 30 years research and development experience in the field of minerals beneficiation within various industry and academic organisations. Since joining the Department of Chemical Engineering at UCT in July 2001, she has been involved in a number of research and capacity development activities relating to the environmental and other sustainability issues of relevance to the coal-based power generation and primary metal production industry sectors. Such activities include leadership of the Minerals to Metals Initiative and Future Water institution, post-graduate student supervision, and the development and presentation of under-graduate (4th year) and post-graduate courses pertaining to mine water and waste issues and management. Professor Broadhurst is also currently actively involved in developing inter- and trans-disciplinary research capacity and is co-convenor of the new trans-disciplinary and multi-institutional Masters of Philosophy programme specialising in Sustainable Mineral Resource Development, as part of the Education for Sustainable Development in Africa initiative under the auspices of the United Nations University.

Jamie Butterworth, Founding Partner, Circularity Capital @jamebutterworth

Jamie Butterworth is one of the Founding Partners of Circularity Capital, a specialist investment firm supporting the growth and innovation of businesses operating in the circular economy. He was the former Chief Executive, and part of the team who founded the Ellen MacArthur Foundation, a global hub for circular economy innovation. Jamie has developed a deep understanding of how the circular economy drives value, working with a number of the world's leading brands to support them in successfully deploying circular business models. Jamie has also been instrumental in developing and launching the Circular Economy 100, a platform for multinationals, SMEs, academic institutions and municipalities to capture the commercial opportunities of the circular economy. Jamie is a visiting business fellow of Oxford University's Smith School for Enterprise and Environment and an expert advisor to the Global CleanTech 100.

Professor Georges Calas, Professor of Mineralogy, UPMC (Université Pierre et Marie Curie)

Georges Calas, Professor at Université Pierre & Marie Curie, is Chair of Mineralogy at Institut Universitaire de France. He was the 2014 - 2015 Chair "Sustainable Development – Environment, Energy, and Society" at Collège de France. He graduated from Ecole Normale Supérieure de Saint-Cloud- Lyon, became Professor at Université Paris Diderot in 1981 and now at UPMC, he is external professor at Ecole Normale Supérieure, and has been Cox Visiting Professor at Stanford; Scientific Advisor at the Ministry of Higher Education and Research and member of the Cabinet Research Council of the Ministry of Culture; President of the French Society of Mineralogy and Crystallography and Vice-President of the European Mineralogical Union; Chair of the Evaluation Committee of the CNRT "Nickel and its environment" in Noumea; a member of the Board of BRGM; Member of Academia Europaea; he is a Foreign Fellow of the Royal Society of Canada.

Dr Ben Caldecott, Director, Sustainable Finance Programme, Smith School of Enterprise and the Environment, University of Oxford @bencaldecott

Ben Caldecott is Director of the Sustainable Finance Programme at the University of Oxford's Smith School of Enterprise and the Environment. The Sustainable Finance Programme aims to be the world's leading centre for research and teaching on sustainable finance and investment. He is concurrently an Adviser to The Prince of Wales's Accounting for Sustainability Project, an Academic Visitor at the Bank of England, and a Visiting Scholar at Stanford University. Ben specialises in environment, energy, and sustainability issues and works at the intersection between finance, government, civil society, and academe, having held senior roles in each domain. Prior to joining the University of Oxford he was Head of Policy at investment bank Climate Change Capital, where he ran the company's research centre and advised clients and funds on the development of policy-driven markets.

Nick Cliffe, Innovation Lead for Advanced Materials, Manufacturing & Materials Team, Innovate UK @moriati23

Nick is an Innovation Lead in the Manufacturing & Materials team of Innovate UK, the UK's national innovation agency. He has a particular focus on resource efficiency, circular economy, sustainability and water - embedding these themes across Innovate UK strategy and competitions, helping innovators consider the wider environmental and societal drivers of their markets and supporting UK businesses in exploring new manufacturing methods and business models. Before joining Innovate UK Nick worked for Closed Loop Recycling, a large plastic bottle recycling business based in Dagenham, East London, where he managed various projects, including: regulatory approval for the food-contact status of recycled plastics; EU Framework 7 funded projects to develop a marker system to enable automatic identification of plastics by use; a joint project with Ecover and various other partners to create the first plastic commercial plastic bottle made from recovered marine plastic waste. Nick also worked for a spin-off consultancy business, Closed Loop Environmental Solutions, managing projects such as launching a range of on-site food composting machines in the UK and a large waste auditing programme for Heathrow Airport and various airlines to develop recycling options for both terminal and cabin waste.

Andrew Clifton, Sustainability Manager for Engineering & Design, Rolls-Royce

Andy Clifton is the Sustainability Manager for Engineering & Design at Rolls-Royce. He joined Rolls-Royce in 2005 as the Design for Environment Capability Owner after completing a research PhD at the Materials and Engineering Research Institute at Sheffield Hallam University. His primary role at Rolls-Royce is to lead the development of the company's engineering and design capabilities so that sustainability forms an integral part of all decision-making processes across all businesses and functions. He chairs various industry and collaborative working groups on the topic of sustainable design, which are leading the definition of new standards for best practice and sustainable business performance for the aerospace sector.

Professor Vernon Collis, Adjunct Associate Professor, Department of Civil Engineering, University of Cape Town

Professor Vernon Collis is a consulting engineer and architect specialising in integrated and adaptive sustainable systems design and construction in the building and civil engineering industries. His approach is based on inclusive and circular rather than throughput economic metabolisms. His design methodology includes a holistic, cradle-to-cradle built intervention, mapping systems from site to region to planet. This allows room for reflection by client and team and space for transdisciplinary design to happen, unlike conventional practice which is based on substitutional rather than transformative sustainable design. He is a process engineer-architect who maps and assesses available materials and local technologies ahead of design, rather than the conventional design-then-specify approach. This allows for the inclusion of underemployed, unskilled workers using appropriate and intermediate technologies. This is essential in a rapidly growing continent like Africa in which he works and has developed his methodology. Collis has designed and built 500+ projects, applying and developing his methodology in the mining, commercial, educational, infrastructural and housing sectors. He has been the contractor on many of his projects. He is also an advisor to Government on appropriate design processes, assessing how to address the problem of why sustainable design transformation is not happening in the delivery of hospitals, clinics and schools in South Africa. He is an adjunct Associate Professor at the University of Cape Town and is presently researching sustainable construction materials with the University's Concrete Materials and Structural Integrity Research Unit (Comsiru). He is also developing a methodology to integrate sustainability design into the teaching of civil engineering and architecture in order to address its absence or add-on approach in the conventional curricula.

Professor Steve Cowley, Acting Director, Oxford Martin School, University of Oxford

Professor Cowley was appointed Acting Director of the Oxford Martin School in June 2017. An international authority on nuclear fusion, Professor Cowley is a Fellow of the Royal Society and the Royal Academy of Engineering, and has recently completed two terms as a member of the Prime Minister's Council for Science and Technology. A former student of Corpus Christi, and the first scientist to hold the post of President there, Professor Cowley has taught physics at Princeton, where he received his PhD, and at UCLA and Imperial College London. From 2009 to 2016 he was Chief Executive of the United Kingdom Atomic Energy Authority (UKAEA). He has a lifelong interest in realising fusion power, and his other research interests include the origin of magnetic fields in the universe and explosive events in astrophysical and laboratory plasmas. In 2012 he was awarded the Glazebrook Medal by The Institute of Physics.

Stefano D'Agostino, Divisional Director, Schneider Electric @stefdago

Stefano D'Agostino is Divisional Director for Schneider Electric and member of the Ecobuilding leadership team in the United Kingdom. Stefano has over 10 years of experience in the buildings and energy management industry, helping customers developing, innovating and operating some of the most sustainable buildings in the Country. His experience spans multiple segments such as Healthcare, Education, Data Centres, Automotive and Financial Institutions. Stefano holds an MSc in Electronics Engineering and a PhD in Electrical Engineering from University of Naples "Federico II" (Italy), and a Masters in Business Administration from Manchester Business School.

Professor Paul Ekins, Professor of Resources and Environmental Policy & Director of the UCL Institute for Sustainable Resources, University College London

Paul Ekins has a PhD in economics from the University of London and is Professor of Resources and Environmental Policy and Director of the UCL Institute for Sustainable Resources at University College London. His academic work, published in numerous books, articles and scientific papers, focuses on the conditions and policies for achieving an environmentally sustainable economy. His book *Economic Growth and Environmental Sustainability: the Prospects for Green Growth* appeared in 2000. He was a Member of the European Resource Efficiency Platform and Vice-Chair of the previous European Environment Commissioner's Expert Economists' Group on resource efficiency. He is currently a member of the European Commission's High-Level Panel on the Deep Decarbonisation Transition Pathways Initiative. He is a member of UNEP's International Resource Panel (IRP), and was the lead author of the IRP's report on resource efficiency commissioned by the G7 governments and presented in Japan in 2016. In 1994 Paul Ekins received a Global 500 Award from the United Nations Environment Programme. In the UK New Year's Honours List for 2015 he received an OBE for services to environmental policy.

Antoine Frérot, Chairman & CEO, Veolia

Antoine Frérot is a graduate of the École Polytechnique (class of 1977), engineer at the Ponts et Chaussées corps and holds a doctorate from the École Nationale des Ponts et Chaussées. He started his career in 1981 as a research engineer at the Central Research Office for French Overseas Departments and Territories. In 1983, he joined the Center for Study and Research of the École Nationale des Ponts et Chaussées as a project manager and then served as assistant director from 1984 to 1988. From 1988 to 1990, he was Head of Financial Transactions at Crédit National. In 1990, Antoine Frérot joined Compagnie Générale des Eaux as a project manager and, in 1995, became Chief Executive Officer of CGEA Transport. In 2000, he was appointed Chief Executive Officer of CONNEX, the Transport Division of Vivendi Environment, and a member of the Executive Committee of Vivendi Environnement. In January 2003, he was appointed Chief Executive Officer of Veolia Eau, the Water Division of Veolia Environment, and Senior Executive Vice President of Veolia Environnement. In November 2009, he was appointed Chief Executive Officer, and in December 2010, Chairman and Chief Executive Officer of Veolia Environnement.

Franck Galland, Director, Environmental Emergency & Security Services

Franck Galland is considered as one of the leading French experts in strategic and security issues related to water. He also made extensive research on the vulnerabilities of critical infrastructures such as water supply systems. He is the author of three books and about 50 research papers published in reviews of international relations and defense. He spent 20 years working in the water industry and is currently the CEO of an engineering firm specialising in resiliency and contingency planning for utilities. Franck is also a reserve officer (rank: Lt-Colonel) serving as water advisor to the French MoD. He is a research associate at the Strategic Research Foundation (FRS, Paris) and among the 15 international experts of the High Level Panel for Water & Peace, a Swiss diplomatic initiative.

Professor Thomas Graedel, Clifton R. Musser Professor of Industrial Ecology, School of Forestry and Environmental Studies, Yale University

Thomas Graedel is Clifton R. Musser Professor of Industrial Ecology in the School of Forestry and Environmental Studies at Yale University. His research is centered on developing and enhancing industrial ecology, the organising framework for the quantification and transformation of the material resource aspects of the Anthropocene. His textbook, *Industrial Ecology and Sustainable Engineering*, co-authored with B. R. Allenby, was the first book in the field and is now in its third edition. His current interests include studies of the flows of materials within the industrial ecosystem, and of evaluating the criticality of metals. He was elected to the US National Academy of Engineering in 2002 for “outstanding contributions to the theory and practice of industrial ecology”, and is a member of the UNEP International Resource Panel.

Professor Dabo Guan, Chair Professor in Climate Change Economics, School of International Development, University of East Anglia

Professor Dabo Guan is a Chair Professor in Climate Change Economics at School of International Development, University of East Anglia, a Senior Member of St Edmund's College, University of Cambridge, and a Distinguished Professor at Tsinghua University, China. He served as a Lead Author for the 5th Assessment Report (AR5) of Working Group III, the Intergovernmental Panel on Climate Change (IPCC). He serves as a Subject Editor of Applied Energy. He has published over 100 articles, in journals such as Nature, Science, Nature Climate Change, Nature Geoscience and PNAS. He has recently received the PNAS Cozzarelli Prize 2014; has received the Leontief Prize three times and awarded the Philip Leverhulme Prize.

Christian Hagelüken, Director of EU Government Affairs, Umicore

Christian Hagelüken is Director of EU Government Affairs at Umicore. From 2003–2011 he was head of Business Development in Umicore's Precious Metals Refining business unit. Before, he held various management positions in the precious metals department of Degussa AG. Christian has contributed to numerous books, scientific journals and conferences with a focus on (precious) metals recycling, sustainable metals management and circular economy. He represents Umicore in policy initiatives, associations, expert groups and scientific panels, at the UNEP Resource Panel, the European Innovation Partnership on Raw Materials, the German Acatech working group on resources for energy applications, and the German National Platform for Electromobility. Christian holds university degrees in mining engineering and industrial engineering from RWTH Aachen, Germany, where he also received his PhD in 1991.

Fiona Harvey, Environment Journalist, The Guardian @fionaharvey

Fiona Harvey is an award-winning environment journalist for the Guardian. Prior to this, she worked for the Financial Times for more than a decade. She has reported on every major environmental issue, from as far afield as the Arctic and the Amazon, and her wide range of interviewees include Ban Ki-moon, Tony Blair, Al Gore and Jeff Immelt.

Professor Cameron Hepburn, Director, Economics of Sustainability, The Institute for New Economic Thinking at the Oxford Martin School @camjhpep

Professor Cameron Hepburn is Director of the Economics of Sustainability at The Institute for New Economic Thinking at the Oxford Martin School; Co-Director of the Oxford Martin Net Zero Carbon Investment Initiative; Co-Director of the Oxford Martin Programme on the Post-Carbon Transition and a Lead Researcher on Oxford Martin Programme on Integrating Renewable Energy. He is also Professor of Environmental Economics at the Smith School of Enterprise and the Environment and a Fellow at New College, University of Oxford. He has degrees in law and engineering, a doctorate in economics, and over 30 peer-reviewed publications in economics, public policy, law, engineering, philosophy, and biology. Cameron has advised governments (e.g. China, India, UK and Australia) and international institutions (e.g. OECD, UN organisations) on energy, resources and environmental policy. He is a member of the Economics Advisory Group (with Lord Stern and Professor Helm) to the UK Secretary of State for Energy & Climate Change. He served for almost a decade as a member of the Academic Panel, in the UK Department of Environment, Food and Rural Affairs and the Department of Energy and Climate Change. Cameron began his business career with work at oil multinational Shell, law firm Mallesons and then management consultancy McKinsey & Co. Cameron is now a founder-investor in the social enterprise and clean energy sectors. He has co-founded three successful businesses in environmental and energy finance and economics.

Ludwig Hermann, President, European Sustainable Phosphorus Platform; Technology Manager, Outotec GmbH & Co KG @LudwigHermann

Ludwig has 35+ years of experience as technology and business development consultant on three continents, was co-founder and long term CEO of ASH DEC Umwelt AG, is co-inventor of minerals/ ash decontamination, phosphorus recovery and energy efficiency technologies, author and co-author of several patents, reports, papers and book chapters on recovery of critical metals, nutrient recycling and energy generation from biomass. Ludwig is president and member of the board of the European Sustainable Phosphorus Platform (ESPP), Brussels, member of the scientific advisory board "Environment" of the Federal Institute for Materials Research and Testing, Berlin and member of the Resource Recovery Cluster of the IWA, International Water Association, The Hague.

Julia Hill, Chair, WRAP (The Waste and Resources Action Programme) @JulieEHill

Julie Hill has worked on environmental policy for over twenty five years. Her areas of particular expertise are waste and resources policy, biotechnology and sustainable buildings. As Director, and then an Associate of Green Alliance, she has developed the resources theme over a period of fifteen years, most recently chairing the Circular Economy Task Force. Julie has held a number of senior advisory posts in government and in commercial organisations. These include a total of fifteen years on government regulatory and advisory committees governing Genetically Modified Organisms (GMOs), and four years as Deputy Chair of the Agriculture and Environment Biotechnology Commission (AEBC), where she was responsible for the implementation of innovative approaches to public and stakeholder engagement. She has also served terms as Non-Executive Director of the Environment Agency for England and Wales, and of the Eden Project in Cornwall, and is presently an Independent Board Member of the Consumer Council for Water. She is also a Senior Fellow at the University of Surrey. Julie read English and Philosophy at Leeds University, and holds a Master's degree in Politics and Government of Western Europe from the London School of Economics, and a certificate in Ecology from the University of London. Her publications include *The Secret Life of Stuff* (Vintage, 2011) and the influential reports *Reinventing the Wheel* (Green Alliance 2011) and *A Zero Waste UK* (IPPR/ Green Alliance 2006).

Dr Graham Hillier, Strategy and Futures Director, Centre for Process Innovation (CPI)

Graham is the Strategy and Futures Director at the Centre for Process Innovation (CPI). He has a wide-ranging business career in technology development, innovation and strategy development. He joined CPI in 2004 and has developed and delivered its strategy of providing open access innovation services to companies of all sizes working in and with the process industries. The CPI businesses are focused on the scale up and proving of novel processes in: Industrial biotechnology and biorefining, Emerging electronic devices for digital

manufacturing, Biologics, Formulation and flexible manufacturing and Resource efficient manufacturing systems. Prior to joining CPI he was Director of Strategy and Planning for ICI's Petrochemicals, Plastics and Fertilizers Business before working for Corus as Construction Director. He also led a global programme in sustainable urban design and construction for World Steel. He has developed and delivered strategy for a wide range of organisations and was core member of the team that has created the UK's first Technology and Innovation Centre - The High Value Manufacturing Catapult. He was the organisation's first CTO and continues to work with it to develop the technology strategy to support the growth of UK High Value Manufacturing. Graham has a Degree in Metallurgy, PhD from the University of Cambridge and an MBA. He is a Chartered Engineer, a Fellow of the Institute of Materials, Minerals and Mining and a Fellow of the Royal Society of Arts, Manufactures and Commerce. He has been a Visiting Professor at Salford University and Teesside University. He has a particular interest in Resource Efficient Manufacturing Systems. He is also a member of the board of Northumbria University at Newcastle.

Dr David Humphreys, Principal, DaiEcon Advisors

David Humphreys is an independent mining industry consultant based in the UK. David was Chief Economist of mining company Rio Tinto, for eight years up to 2004, and Chief Economist of Norilsk Nickel, Russia's largest mining company, until the end of 2008. He has also been a non-executive director of Russian gold mining company, Petropavlovsk plc. Prior to entering the mining industry, David worked for nine years in UK government service, for six of these as an advisor on minerals policy. He has written and lectured extensively on the economics of the mining and metals industries. He is the author of some two hundred articles and papers and the book, *The Remaking of the Mining Industry* (published 2015). He has been a visiting scholar at the Colorado School of Mines, the Catholic University of Chile in Santiago, the Transatlantic Academy in Washington DC, and is an honorary lecturer at the University of Dundee. He has a PhD from the University of Wales.

Professor Aled Jones, Director, Global Sustainability Institute, Anglia Ruskin University @aledjones_gsi

Professor Jones is the inaugural Director of the Global Sustainability Institute (GSI) at Anglia Ruskin University. The GSI is an internationally recognised research institute, with a group of 40 individuals. Professor Jones' work in climate finance has been recognised by the State of California and he has received a key to the city of North Little Rock, USA. He is a Co-Investigator on the ESRC Centre for the Understanding of Sustainable Prosperity (CUSP), the AHRC Debating Nature's Value network and the EU H2020 MEDEAS project. He was lead author on the seminal report on resource constraints to the Institute and Faculty of Actuaries in 2013 and is now leading a team to build a global model to explore political fragility from resource crisis.

Dr Ben Jones, Managing Consultant, CRU

Ben is a managing consultant at CRU, a global consultancy specialising in metals and minerals, where he leads the multi commodity team within the management consultancy division. Prior to joining CRU, he was a principle economist at BG Group, a global oil and gas company, with responsibilities for forecasting macro energy demand and setting investment appraisal frameworks. Ben has also been an economist in the Fiscal Affairs Department of the IMF and a policy maker at the UK Treasury. He has a PhD in Economics from the University of Birmingham and an MPhil in Economics from the University of Oxford. He has published on topics relating to fiscal policy and resource economics in a range of international journals.

Sheila Khama, Practice Manager, Energy and Extractive Industries Global Practice, World Bank Group

As Practice Manager for the World Bank's Energy and Extractive Industries Global Practice, Ms Khama is responsible for a variety of programs in the Extractives unit, with a particular focus on East and Southern Africa, Latin America and the Caribbean, South Asia, Europe and Central Asia, and the Extractives Global Programmatic Support Trust Fund. Ms Khama joined the World Bank after serving as Director of the African Natural Resources Center at the African Development Bank (AfDB). In that role she helped African countries improve their development outcomes from natural resources. Prior to joining AfDB, Ms Khama worked for a think tank in Ghana, Anglo American Corporation Plc, De Beers Group and First National Bank of Botswana. A native of Botswana, Ms Khama holds an MBA from Edinburgh University Business School.

Dr Alexander King, Director, Critical Materials Institute, The Ames Laboratory, US Department of Energy

Alex King is the Director of the Critical Materials Institute – one of the US's Department of Energy four Energy Innovation Hubs. He holds degrees from the Universities of Sheffield and Oxford. He was a postdoc at Oxford and then M.I.T. before joining the faculty at Stony Brook University, where he also served as the Vice Provost for Graduate Studies. He has served as the Head of the School of Materials Engineering at Purdue

and the Director of DOE's Ames Laboratory. King is a Fellow of the Institute of Mining Minerals and Materials; ASM International; and the Materials Research Society. He was a Visiting Fellow of the Japan Society for the Promotion of Science in 1996 and a US Department of State Jefferson Science Fellow for 2005–06. Alex was the President of the Materials Research Society for 2002, Chair of the University Materials Council of North America for 2006–07, Co-chair of the Gordon Conference on Physical Metallurgy for 2006, and Chair of the APS Interest Group on Energy Research and Applications for 2010.

Richard Kirkman, Chief Technology and Innovation Officer, Veolia UK & Ireland

Richard is responsible for the planning and construction of new infrastructure to which Veolia has committed a £1 billion investment between 2012 and 2018. He also oversees the administration of commodities, such as energy (electricity and heat) and materials (recyclables and compost). Richard's technology team is focused on five main areas, namely thermal development, fuel and energy, MRF recycling, biological treatments and 'best in class' sector innovation. He has also led the introduction of new technology across Veolia's PFI/PPP infrastructure. Major initiatives include Veolia's new Southwark recycling facility which incorporates their first UK MBT recycling plant and the opening of pioneering treatment facilities in the West Midlands (Street Washings) Rainham, (Plastics Recovery) and Fareham (Solid Fuel Recovery). During his career with Veolia Richard has made a number of appearances on national radio and television explaining the latest developments in waste treatment technology including BBC Radio 4, BBC Breakfast and BBC Country File. Richard is an environmental engineer and joined the Veolia group via Dalkia in 1994, heading up European Research & Development after gaining operational experience in its municipal and commercial energy recovery operations.

Jan Klawitter, Principal, International Relations, Anglo American @KlawitterJan

Jan Klawitter received his first degree in Business and his second degree in International Relations from Universities in Germany, Spain and China. In 2007, he joined the World Economic Forum's Global Leadership Fellows program and headed up the Forum's Mining Industry Group. Prior to the Forum he worked in China for six years, first for a large FMCG company and subsequently mostly with the Ministry of Land & Resources. Since 2012, Jan has been with Anglo American, as their Government Relations Manager, with responsibility for stakeholder relations for corporate activities in the Far East as well as North America and corporate engagement with multilateral processes and institutions.

Jaakko Kooroshy, Executive Director, Global Investment Research Division, Goldman Sachs

Jaakko Kooroshy joined Goldman Sachs in 2014 as Executive Director in the Global Investment Research Division. As the European lead for GS SUSTAIN, his research focuses on long-term trends and related investment opportunities in global equity markets. Previously, Jaakko was a Research Fellow for Energy, Environment, and Resources at the Royal Institute of International Affairs, Chatham House. He has also been an analyst at The Hague Centre for Strategic Studies (HCSS) and a researcher at the School for Business & Economics at Maastricht University. He holds an MSc in International Relations from the University of Amsterdam, as well as a BSc in International Economics, and a BA in Social Sciences and History from Maastricht University.

Professor Kerstin Kuchta, Director, Waste Resource Management Research Group, Hamburg University of Technology

Kerstin Kuchta is Director of the Waste Resources Management research group at the Hamburg University of Technology and Full Professor at the Institute for Environmental Technology and Energy Economics. Kerstin Kuchta received her Diploma in Environmental Engineering at the Berlin University of Technology. She started her career as a researcher at Darmstadt University of Technology and finalised her PhD in 1997 in the field of recovery and utilisation of incineration ashes. From 2002–2010 she was Full Professor for Energy and Environmental Management at Hamburg University of Applied Science and Founding Dean of the Faculty of Engineering at the German–Kazak University (DKU) in Almaty, Kazakhstan. In 2010 she moved to Hamburg University of Technology to establish the new research field of waste resources. Her major research interests are recovery of rare earth elements and critical metals from secondary sources, such as e-waste, bottom ashes or industrial residues, bio economy and environmental sound waste management. Since 2014 she is Vice President of the board of trustees of the German waste management industry and leading several work groups in the field of resource recovery and sustainability on the regional, national and international level.

Sophie Lambin, Co-Founder and Managing Director, Kite Global Advisors @SoLambin

Sophie served as Director of Global Thought Leadership and External Affairs for PwC for seven years. In this role Sophie developed a new strategy for the firm's thought leadership activities. She also led the PwC's

Annual Global CEO Survey, managed the firm's strategic partnership with the World Economic Forum and orchestrated PwC's annual presence at Davos. Sophie recently served as Interim Communications Director for the World Business Council for Sustainable Development. In past roles, Sophie was the Publisher of European Business Forum and a management consultant at Coopers & Lybrand.

Professor Oscar Landerretche, Chairman of the Board of Directors, CODELCO

Chairman of the Board of Directors of CODELCO, Oscar has a career as an economist, teacher, researcher and a relevant player in the development of public policies in Chile. He began his career as an analyst at the Central Bank of Chile, but has been primarily an academic at the Faculty of Economics and Business at the University of Chile where he is a full professor. He was director and founder of the Master's in Public Policy at the University of Chile – developed jointly with the University of Chicago (2006–2010) and served as Director of the School of Economics and Business of the University of Chile (2012–2014) where he implemented a curricular reform that led him to participate in the CORE–ECON international curricular reform initiative. In the public sector, he was designated by President Bachelet as a member of the first Financial Committee of the Chilean Ministry of Finance (2007) to advise on the establishment of the investment system of the sovereign wealth funds. Later, he was appointed Executive Secretary of the Labour and Equality Presidential Advisory Council (2008), in charge of advising on labour market reforms and on the social protection system. Oscar has also been chief economist of two presidential campaigns. His most recent book is *Chamullo: Lo Público en la Era de la Posverdad* (Rumors: the public sphere in the age of post-truth) (2017). Previously he had published *Vivir Juntos. Economía, Política y Ética de lo Comunitario y lo Colectivo* (Living together: economics, politics and ethics of communities and collectives) (2016), and *El Chile que Viene: Ideas, Miradas, Perspectivas y Sueños para el 2030* (The Chile that is coming: ideas, views, perspectives and dreams for 2030) (2011), which he co-authored with President Ricardo Lagos. Oscar is an economist at the University of Chile and read for a PhD in Economics at the Massachusetts Institute of Technology (MIT).

Bernice Lee, Executive Director, Hoffmann Centre for the Sustainable Resource Economy, Chatham House @BerniceWLee

Bernice Lee is Executive Director at Hoffmann Centre on the Sustainable Resource Economy, Chatham House, United Kingdom. She was Director for Climate Change and Resource Security Initiatives at the World Economic Forum (2014–2016) and Research Director for Energy, Environment and Resources at Chatham House – Royal Institute of International Affairs (2007–2013). She was also a member of the Climate Change Advisory Board of the Children's Investment Fund Foundation, the Queen Elizabeth Academy of International Leadership and the External Review Committee of Royal Dutch Shell. Her work was covered in international media including the Financial Times, BBC, New York Times, Reuters, Bloomberg, Wall Street Journal, Foreign Affairs, Caijing and in the Harvard Business Review and the Americas Quarterly. Other professional experience include: Team Leader for the Interdependencies on Energy and Climate Security for the China and Europe Project; Policy and Strategy Adviser at the International Centre for Trade and Sustainable Development in Geneva; Policy Director at the Aga Khan Foundation (UK); Officer in the Strategic Planning Unit in the UN Secretary-General's office in New York; Warren Weaver Fellow at the Rockefeller Foundation; and Research Associate at the International Institute for Strategic Studies. Bernice holds degrees from the London School of Economics and Political Science and Oxford University, where she was a College Scholar for three years. Bernice was awarded an OBE for services to UK–China climate change cooperation in the Queen's New Year's Honours List in 2011.

Professor Gary Leeke, Chair in Chemical Engineering and Head of the Bioenergy and Resource Management Centre, Cranfield University

Professor Gary Leeke is Chair in Chemical Engineering and Head of the Bioenergy and Resource Management Centre at Cranfield University. His research interests lie in the areas of recycling enabling technologies and resource efficiency. He currently leads three government funded projects developing solutions to process waste plastic into value added products. He lead the EPSRC funded EXHUME project investigating the recycling of fibre reinforced composites. Gary sits on the Composites Leadership Forum Sustainability Working Group for Composites UK and is an adviser to UK industry and NGOs.

Karina Litvack, Independent Non-Executive Director, Eni SpA @litvack_

Karina serves on a number of boards and advisory bodies in the UK, Italy and the US, following a 25-year career in finance and investment management, where she developed a particular expertise in corporate governance, business ethics and sustainability. She serves as an Independent Non-Executive Director on the Board of Italian oil & gas company Eni SpA, where she is currently a member of the Control & Risks Committee

and the Sustainability & Scenarios Committee, having previously also been a member of the Compensation Committee. She also serves on the Board Directors of Business for Social Responsibility (BSR); the Global Advisory Council of boutique investment bank Cornerstone Capital Inc.; The Advisory Council of private equity firm Bridges Ventures; the Sustainable Development Advisory Panel of software group SAP; and the Transparency International-UK Advisory Council. Until 2013, Karina ran the Governance and Sustainable Investment activities of UK asset manager F&C Investments, focusing on equity research, shareholder activism and public policy engagement. Karina holds an MBA in Finance and International Business from Columbia University Graduate School of Business in New York and a BA in Political Economy from the University of Toronto.

Professor Sir Chris Llewellyn Smith, Director of Energy Research, University of Oxford

Chris Llewellyn Smith is Director of Energy Research at the University of Oxford; President of the Council of SESAME (Synchrotron light for Experimental Science and Applications in the Middle East), and a Visiting Professor in the Oxford Physics Department. He was Director of UKAEA Culham (2003-2008), with responsibility for the UK's fusion programme and for operation of the Joint European Torus (JET), Provost and President of University College London (1999-2002), Director General of CERN (1994-1998), and Chairman of Oxford Physics (1987-1992). After completing his Doctorate in Oxford he worked briefly in the Lebedev Physical Institute of the Academy of Sciences in Moscow, before spending periods at CERN and the Stanford Linear Accelerator Center, after which he returned to Oxford. As Director of UKAEA Culham he developed and vigorously promoted the 'Fast Track' approach to the development of fusion power, which was officially adopted by the European Commission. During his mandate as Director General of CERN the Large Hadron Collider (LHC) was approved, construction started, and major contributions from Canada, India, Japan, the Russian Federation and the USA were negotiated, and CERN's flagship Large Electron Positron collider (LEP) was successfully upgraded. As a theoretical particle physicist he worked mainly on the quark model and the theories of the strong and electro-weak forces, and how they can be tested experimentally. His contributions include developing ways to demonstrate the "reality" of quarks and gluons (the particles that transmit the strong force that holds quarks together) in highly inelastic electron and neutrino scattering experiments, and showing that mathematical consistency requires any theory of the weak interactions to be based on a spontaneously broken gauge theory. He was Chairman of the Council of the world fusion project ITER (2007-09), the Consultative Committee for Euratom on Fusion (2003-09), the Advisory Committee on Mathematics Education (2002-04), and the CERN Scientific Policy Committee (1990-92), and has served as a Vice President of the Royal Society (2008-10) and on numerous other national and international advisory committees, including the UK Prime Minister's Advisory Committee on Science and Technology (1989-92). His scientific contributions and leadership have been recognised by awards and honours in seven countries on three continents.

Dinah Louda, Executive Director, Veolia Institute

Dinah Louda has been Veolia Institute's Executive Director since January 2015. She is also an advisor on international relations to the CEO of Veolia, and a member of the Ethics Committee. At the helm of the Institute, Dinah Louda works to perpetuate and enrich the top-level dialogue developed between the Institute, Veolia, government agencies, the academic and scientific worlds, and NGOs. After obtaining a degree at the Institut d'Études Politiques in Paris and a masters in political science from Harvard, Dinah began her career as a journalist, working for several French and international newspapers and magazines from 1983 to 1991, notably for the French weekly Express and for the International Herald Tribune. In 1986, she became the France correspondent for Business International (later absorbed into The Economist Group). She left journalism in 1991 to specialise in corporate communication, joining the Victoire insurance group (now Aviva) as its European Communications Director, and subsequently as Director of Communication at Abeille Assurances until May 2002. She moved on to become Communications Director at Crédit Agricole Indosuez (an investment banking subsidiary), and then at Areva T&D. In 2006, Dinah joined Veolia as the Communications Director of Veolia Water and as a member of the Executive Committee. She also sits on the board of the French-American Foundation.

Nitesh Magdani, Group Director of Sustainability, Royal BAM Group @niteshmagdani

Nitesh is driven to ensure that BAM is recognised as a leader in sustainable built environments. His 13 years in architectural practice leading numerous sustainability-led high-profile projects has focused his commitment to designing for efficiency. Nitesh's focus is on strategic thinking, reinforcing business cases, and looking at the influence of sustainability through all key stages of a development. BAM are the only major contractor member of Ellen MacArthur Foundation's CE100. In conjunction with the CE100, BAM actively participate

to scale up circular economy thinking within the built environment. Nitesh strives to exceed customer expectations by delivering value over the life cycle of their assets. He is involved in several circular economy projects, as well as advising the Green Construction Board and LWARB on government policies. Nitesh co-authored a Circular Business Models in the Built Environment publication, together with Arup and the Ellen MacArthur Foundation.

Sigurd Mareels, Senior Partner, Brussels, McKinsey & Company @sigurdmareels

Sigurd is a senior partner in McKinsey's Brussels office. He is the Leader of the Mining Group of McKinsey. Since joining McKinsey in 1988, Sigurd has supported basic-materials clients in 50 countries on issues such as long-term business planning, corporate finance, investment strategy, technology development, benchmarking, international partnering, global plant reconfiguration, and restructuring. He spent several years based in São Paulo and Johannesburg before returning to his native Belgium. Among his recent projects, Sigurd has helped a global diversified mining company with its exploration strategy and advised a major resource group on the redesign of its corporate centre, including the benchmarking and reorganisation of administrative and technical-support functions. More broadly, he has undertaken a number of privatisation, valuation, and M&A projects in South America, Africa, Europe, and Asia, and advises mining-equipment and service providers on growth strategy and other topics. Sigurd has worked extensively on long-term price development for key commodities and recently contributed to an in-depth McKinsey survey of trends in global commodity markets. Earlier in his career, Sigurd worked as a researcher in thermodynamics and corrosion science for the National Science Foundation.

Professor Kazuyo Matsubae, Professor of Environmental and Energy Economics, Graduate School of Environmental Studies, Tohoku University @K_Matsubae

Kazuyo Matsubae is Professor of Environmental and Energy Economics in the Graduate School of Environmental Studies, Tohoku University, Japan. Professor Matsubae was trained as an econometrician and earned her PhD in economics at Waseda University in Japan. Specialising in the analysis of a sustainable material cycle, she has used the Input Output model based Material Flow Analysis in several case studies of agricultural nutrients including nitrogen and phosphorus, and critical metals including Ni, Cr, Mo and other steel alloying elements. Her current interest is the identification of supply chain risks through resource consumption from a life cycle perspective. She started her professional career at the Department of Metallurgy, Tohoku University, and spent a year as a visiting Associate Professor at the Sustainable Minerals Institute, at the University of Queensland, Australia. She is a board member of the Socio Economic Metabolism section in the International Society for Industrial Ecology (ISIE-SEM), serves on the scientific committee of the Phosphorus Recycling Promotion Council of Japan (PRPCJ) and is an Expert Adviser of the Waste and Recycling Subcommittee under the Industrial Structure Council for the Ministry of Economy, Trade and Industry, Japan.

Hans Eric Melin, Founder, Creation Inn @hanseric

Hans Eric Melin is the Founder of Creation Inn, a strategy consultancy specialising in circular business development with focus on energy storage. With over 10 years' experience from the battery recycling industry Hans Eric has been involved in the entire supply chain from manufacturing to reuse and recovery of batteries. Prior to founding Creation Inn, Hans Eric served as Vice President New Markets at Battery Solutions, the leading battery recycler in the US. He is a co-founder and former CEO of Refind Technologies which is the leading provider of automatic sorting solutions to the waste battery and electronics industry, using artificial intelligence to identify and classify end-of-life products. With a background in marketing strategy Hans Eric has previously also been advising companies and organisations in renewable energy, ecodesign and waste management. Hans Eric Melin has a BA in Communication Studies and Business Administration from University of Gothenburg in Sweden.

Simon Moores, Managing Director, Benchmark Mineral Intelligence @sdmoores

Simon Moores is the Managing Director of Benchmark Mineral Intelligence, an independent price assessment company for lithium, graphite and cobalt for the lithium ion battery supply chain. Simon has specialist knowledge in critical and strategic minerals and markets including graphite, lithium, cobalt, batteries, electric vehicles and China – sectors he has covered since 2006. He has specialised in the lithium ion battery supply chain, especially the upstream sector from mine to battery cell manufacturing and has visited numerous critical mineral mines and processing plants around the world. Benchmark Mineral Intelligence has advised some of the world's biggest actors in the lithium ion battery space from cell manufacturers, to electric vehicle producers to mining companies. In 2015, Simon and Benchmark advised Goldman Sachs on lithium and batteries in its Low Carbon Economy Report, and have worked with the likes of UBS, Deutsche Bank, CLSA, and Credit Suisse

on lithium ion battery supply chain roadshows. In addition, he launched subscription products, Benchmark Membership, price assessment services, Benchmark Data (Graphite and Lithium), and the annual global series of seminars, The Benchmark World Tour and industry conference, Graphite Supply Chain. Simon has a BSc in Geology with Geography from the University of Birmingham.

Edmund Nickless, Chair, International Union of Geological Sciences New Activities Strategic Implementation Committee, IUGS Councillor 2016–2020, International Union of Geological Sciences

Edmund is a geologist by training and has worked extensively on assessment of industrial mineral resources. From 1997 until his retirement in September 2015 he was Executive Secretary of The Geological Society of London. Previous to that, he held senior posts within the British Geological Survey, the then Science and Technology Secretariat of the Cabinet Office where he was environmental adviser, and the Natural Environment Research Council where he was responsible for research grants, training awards and UK participation in international programmes, principally the Ocean Drilling Program and its successors. Since 2013 he has chaired a group on behalf of IUGS promoting a new initiative, Resourcing Future Generations. He is a Fellow of the Geological Society of London, a Chartered Scientist, Chartered Geologist and European Geologist.

Dr David Peck, Manager, Manager, KIC EIT EU Raw Materials Programme, Delft University of Technology (TU Delft) & Manager, Leiden-Delft-Erasmus Centre for Sustainability (CfS) @peckds

David Peck researches and teaches in the field of critical materials and circular design. He is a manager of the tri-partite university partnership Leiden-Delft-Erasmus Centre for Sustainability (CfS). The CfS has a focus on resources, circular and cities. He is responsible for the funding opportunities in the centre. David is the university leader for the Ellen MacArthur Foundation pioneer university programme and is the representative for all the university faculties. He has also been a senior mentor for the Schmidt-MacArthur fellowship programme. He is manager for TU Delft in the KIC EIT Raw Materials, the 7 year+ EU programme on raw materials: sustainable exploration, extraction, processing, recycling, remanufacturing and substitution with a core focus on closing loops.

Jonathan Perry, Producer Responsibility Compliance Consultant, Dell

Jonathan joined Dell in May 2005 and has been responsible for producer responsibility compliance for Dell in the UK and other EMEA (Europe, Middle-East & Africa) countries. In his current role Jonathan monitors and supports developing producer responsibility legislation across EMEA and also projects in EMEA and globally relating to the circular economy, producer responsibility, data security, environmental policy and Dell's commitment to take back and recycling.

Pascal Peslerbe, Deputy Manager of 2EI, Development and Innovation Department, Veolia

Pascal Peslerbe has been working for Veolia since 1988 in various operational positions in France (Paris, Lyon) and in the Pacific area (French Polynesia, New Caledonia). He started as Advisor to the Managing Director of one of Veolia waste subsidiaries in Paris and pursued his career in different operational management tasks in the Rhone-Alpes Region for 7 years before being appointed Regional Director of the Group's activities in overseas territories (French Polynesia and New Caledonia) in 1997. There, he conceived and implemented two global waste treatment systems comprising recycling and industrial landfilling facilities while managing the collection and treatment of solid and liquid waste. He returned to France in 2004 to become Managing Director of the REP, Routière de l'Est Parisien, a subsidiary of Veolia Ile de France specialising in industrial landfilling and material and energy recovery. He was appointed Deputy Director General of Veolia Waste Ile de France in 2009 before becoming Head of Commercial Development and Innovation of Veolia Waste France in 2012, and member of Exco. With Veolia Corporate since March 2017, he is now Deputy Manager of 2EI, Veolia Corporate Development and Innovation Department, in charge of designing a digital platform to establish a circular and collaborative approach to the business of waste collection and recycling.

Professor Amir Rashid, Associate Professor and Head of the Manufacturing and Metrology Systems Division, Royal Institute of Technology, Stockholm

Amir Rashid is Associate Professor and head of the Manufacturing and Metrology Systems Division at the Department of Production Engineering in the Royal Institute of Technology (KTH), Stockholm. He has a PhD in Production Engineering and more than 15 years of experience in manufacturing industry. His initial research had a focus on productivity improvements in manufacturing processes and lately has shifted more to sustainability in manufacturing systems. His innovative ideas and concepts in the area of closed loop manufacturing were acknowledged at the European level through award of a R&D project named ResCoM. In his leadership, this four-year endeavour, in a consortium of 12 RTD and industrial partners from around

Europe, has succeeded in developing tools, methods and a decision support platform for facilitating the manufacturing industry in its transition from linear to circular systems. Amir Rashid is also leading a Circular Economy initiative by KTH (CE@KTH) where four schools of Sweden's largest technical university are collaborating to develop research and education in circular economy. This initiative also aims to provide a vibrant platform to collaborate with Swedish industry, policy makers, research and academic community in the field of circular economy.

Simon Ratcliffe, Infrastructure and Climate Advisor, UK Department for International Development (DfID)

Simon works as an Infrastructure and Climate Advisor at the UK's Department for International Development (DfID). He is concerned about the impact of resource scarcity, energy in particular, on developing countries. In the light of the increasing scarcity of key resources such as building sand, he believes that we need to radically rethink how we create livable built environments in rapidly growing cities in developing countries to accommodate newly urbanised people. He is also keen to find alternative energy pathways for developing countries to reduce their dependence on fossil fuels. He is an author of *Scenarios 2019 – Fragmentation or Renaissance: The inter-connections between oil depletion, climate change and global financial imbalances* for the South African Presidency's Scenario Planning. He was a member of the organising committee of the Global Energy Systems Conference in Edinburgh in 2013. He has an MSc from UCL and an MBA from Warwick University. He commissions research into energy challenges, such as the falling Energy Return on Investment and the vulnerabilities associated with the energy, food and water nexus.

Markus Reuter, Director, Helmholtz Association

Markus Reuter is Director of the Helmholtz Association (Freiberg, Germany) since September 2015. He was Chief Technologist with Ausmelt (Australia) and Director of Technology Management at Outotec (Finland) from 2006 to 2015 (Ausmelt acquired by Outotec in 2010). He was also with Mintek and Anglo American Corporation (South Africa). He was Professor at TU Delft (Netherlands) from 1996 to 2005. He holds honorary and adjunct professorships since 2005 at Technical University Bergakademie Freiberg (Germany); Aalto University (Finland); Central South University (China); and Melbourne University (Australia). He earned an honorary doctorate from the University of Liège (Belgium); D Eng. and PhD from Stellenbosch University (South Africa); and Dr Habil. from RWTH Aachen (Germany). His publications include *Metrics of Material and Metal Ecology* (Elsevier), co-editor and author of *Handbook of Recycling* (Elsevier) and lead author of the 2013 UNEP report *Metal Recycling: Opportunities, Limits, Infrastructure*.

Henry Sanderson, Commodities Correspondent, Financial Times @hjesanderson

Henry Sanderson is a reporter for the Financial Times in London. He previously worked as a Beijing-based reporter for Bloomberg News since April 2010. Prior to that, he was a reporter for the Associated Press in Beijing and Dow Jones in New York. He is a graduate of the University of Leeds (with a bachelor's in Chinese and English literature) and Columbia University (with a master's in East Asian Studies).

Professor Walter Stahel, Founder-Director, Product-Life Institute @ProductLife

Walter R. Stahel has been Founder-Director of the Product-Life Institute (Switzerland), the oldest established consultancy in Europe devoted to developing sustainable strategies and policies, since 1983. From 1986 to 2014, he was also Director of Risk Management Research of the Geneva Association. In 1971, he graduated from ETH Zurich with an MA in architecture; he has been a full member of the Club of Rome since 2013. Walter has been Visiting Professor at the Faculty of Engineering and Physical Sciences of the University of Surrey since 2005, and of l'Institut EDDEC de Université, HEC et Polytechnique de Montréal in 2016. He was awarded degrees of Doctor honoris causa by the University of Surrey (2013) and l'Université de Montréal (2016). In 1982, with 'The Product-Life Factor', he won a Mitchell Prize in Houston, TX. His books are *Jobs for Tomorrow, the Potential for Substituting Manpower for Energy* (1981) and *The Performance Economy* (2010).

Lord Nicholas Stern, IG Patel Professor of Economics and Government; Chairman, Grantham Research Institute on Climate Change and the Environment; and Head of the India Observatory, London School of Economics @lordstern1

Lord Stern is IG Patel Professor of Economics and Government at the London School of Economics as well as Head of the India Observatory (LSE) and Chairman of the Grantham Research Institute on Climate Change and the Environment. He is President-elect for the Royal Economic Society and is a member of the G20 Eminent Persons Group. He was President of the British Academy (July 2013 – July 2017) and was elected Fellow of the Royal Society (2014). He has held previous posts at universities in the UK and abroad. He was Chief

Economist at both the World Bank, 2000–2003, and the European Bank for Reconstruction and Development (1994–1999). Lord Stern was Head of the UK Government Economic Service (2003–2007) and produced the landmark Stern Review on the economics of climate change. He was knighted for services to economics in 2004, made a cross-bench life peer as Baron Stern of Brentford in 2007 and in June 2017, was appointed Companion of Honor for services to economics, international relations and tackling climate change. His most recent book is *Why are We Waiting? The Logic, Urgency and Promise of Tackling Climate Change*.

Daive Stronati, Global Sustainability Leader, Mott MacDonald @DaiveStronati

Daive has been the Global Sustainability Leader of Mott MacDonald since November 2012 reporting directly to the Chairman. Before, he was seconded for five years to Anglian Water and was instrumental in leading the company's low-carbon asset management strategy. Regularly invited speaker at conferences, he is the Chair of the Sustainability Leadership Team at the Institution of Civil Engineers; member of the Editorial Advisory Panel for the journal *Engineering Sustainability*; the MSc Management Business Advisory Board at Imperial College Business School; the Standard Committee of SuRe, Standards for Sustainable and Resilient Infrastructure at the Global Infrastructure Basel in Switzerland. He holds a Degree in Environmental Engineering, summa cum laude from the University of Trieste in Italy (1997) an MPhil in Engineering for Sustainable Development from the Cambridge – MIT Institute (2004); he attended the High Potentials Leadership Programme at Harvard Business School in Boston, US (2011).

Professor Martin Stuchtey, Founder & Managing Partner, SYSTEMIQ Ltd @MRStuchtey

Martin Stuchtey is the Founder and Managing Partner of SYSTEMIQ Ltd, a company that develops new markets and assets in the sustainability space. He has worked at McKinsey for 20 years, most recently as Director of the Center for Business and Environment. In 2006, Martin Stuchtey co-founded McKinsey's Sustainability Practice, working with numerous corporate, government and social sector clients on the challenges of climate change, water scarcity, ocean degradation and resource depletion at large. He is a Professor for Resource Strategy and Management at Innsbruck University. He is an initiator of the 2030 Water Resources Group, a long-time strategic advisor to the World Economic Forum and the author of *A Good Disruption – Redefining Growth in the Twenty-first Century*. Martin Stuchtey served as a company commander in the German Alpine forces and worked as a geologist in Southern Africa. He holds a BSc Hons degree in economic geology/mineralogy from Rhodes University (South Africa), a Masters in business economics from WHU – Otto Beisheim School of Management (Germany), an MBA from Lancaster University (UK) and a PhD in regional economics from the Technical University of Dresden.

Professor Sangwon Suh, Professor of Industrial Ecology, University of California, Santa Barbara

@suhustainable

Sangwon Suh is Professor in Industrial Ecology and Director of the CLiCC Program, a university-industry partnership for understanding chemicals' environmental and human health implications. Professor Suh was trained as an environmental engineer and earned his PhD in industrial ecology at Leiden University in the Netherlands. His research focuses on the sustainability of the human-nature complexity through understanding materials and energy exchanges between them. Over the past twenty years, he contributed to the theoretical foundations and practical applications of life cycle assessment (LCA) and industrial ecology. Professor Suh was appointed as a member of the International Resource Panel (IRP) by the United Nations Environmental Programme (UNEP) and served as the Coordinating Lead Author of the Assessment Report 5 by the Intergovernmental Panel on Climate Change (IPCC). He received the McKnight Land-Grant Professorship, Leontief Memorial Prize and the Richard Stone Prize, the Robert A. Laudise Medal and Distinguished Teaching Award.

Elizabeth Surkovic, Head of Policy, Resilience and Emerging Technologies, The Royal Society

Before joining the Royal Society in 2016, Elizabeth Surkovic was the Deputy Director for Science at the Government Office for Science. Her responsibilities ranged across the entire Government policy portfolio from bee health to nuclear power. She and her team worked with Government Departments ensuring that science had been well used in any one area, resolving disagreements between Departments and leading on the investigation of issues of scientific merit and producing reports for use in policy development. Prior to this she worked in the Cabinet Office and the Better Regulation Executive where she led a Bill on better regulation, and in Defra where she worked on chemical management. The most notable element of that was negotiation of the REACH Regulation. Prior to becoming a civil servant she worked in the chemical industry for 15 years. Her core function there was to work on chemical regulation. She is by training a biochemist and graduated from Birmingham.

Professor Mark Swilling, Distinguished Professor of Sustainable Development, School of Public Leadership, University of Stellenbosch @MarkSwilling

Mark Swilling is Distinguished Professor of Sustainable Development in the School of Public Leadership, University of Stellenbosch; Academic Director of the Sustainability Institute and Co-Director of the Stellenbosch Centre for Complex Systems in Transition. He co-authored with Eve Annecke *Just Transitions: Explorations of Sustainability in an Unfair World* (Tokyo: United Nations University Press, 2012), co-edited with Adriana Allen and Andreas Lampis *Untamed Urbanism* (New York and London: Routledge), co-edited with Josephine Musango and Jeremy Wakeford *Greening the South African Economy* (Cape Town: Juta) and is a member of UNEP's International Resource Panel acting as Coordinator of the Cities Working Group. In 2016 Mark was Advisor to the Curator of the International Architecture Biennale Rotterdam (IABR). His most recent project is as convenor of the State Capacity Research Project on the dynamics of state capture in South Africa.

Professor Ester Van der Voet, Associate Professor, Institute of Environmental Sciences, Leiden University

Ester van der Voet is an Associate Professor at Leiden University's Institute of Environmental Sciences, CML. Her area of expertise is Industrial Ecology. Within the field of Industrial Ecology, she specialises in methodology development: life-cycle assessment, material flow analysis, substance flow analysis, natural resource accounting, and indicator development. These methodologies she applies in different topical areas, in recent years especially in the fields of the bio-based economy and the circular economy, with a focus on metals and scenario development. She has initiated two MSc programs in Industrial Ecology: a program between Leiden University and TU Delft, and an international program of Leiden, Delft, Graz University and Chalmers University in Sweden. She has conducted many research projects for the EU and in other international consortia. She is a member of UNEP's International Resource Panel, where she is active in the workstreams of global metal flows and environmental impacts.

Olivier Vidal, CNRS-INSU Director of Research, Institut des Sciences de la Terre, University of Grenoble

Olivier is CNRS-INSU Director of Research at the Institut des Sciences de la Terre, Grenoble. After a PhD in experimental mineralogy, he specialised in the thermodynamic and kinetic modelling of mineral reactions with various applications in the fields of Earth geodynamics, storage of radioactive waste, sequestration of CO₂ and natural hydrogen production. He has been scientific coordinator of the European network ERA-MIN on the industrial handling of non-energy raw materials. Since then, he has been conducting research on the interactions between mineral resources, energy and economy. His research is presently focused on the mineral resources-energy nexus in connection with the transition toward low-carbon energy, and on the dynamic modelling and coupling of demand-reserve-primary production-recycling-cost-price and environmental impacts at the global scale.

Malcolm Waddell, Delivery Manager - Electricals and Circular Business Models, WRAP (The Waste and Resources Action Programme) @WRAP_Mal

Malcolm leads on WRAP's Electrical Programme and development of circular business models across products and services. This includes the ESAP (electrical and electronics sustainability action plan) voluntary commitment. He manages the development of the programme which will demonstrate how industry can be transformed through the successful implementation of profitable circular efficient business models. This also involves managing REBus, an EU LIFE + funded project, which is testing the methodology of how businesses and their supply chains can develop and implement resource efficient business models and the CRM Recovery project which develops collections and recovery methods to recover critical raw materials. Malcolm has worked for WRAP for over ten years and has worked in developing large scale European projects. He was previously a project manager leading on construction logistics and utility sectors. He also led the development of various construction product resource efficiency action plans. Prior to WRAP, Malcolm worked in logistics as a National Operations Manager for a major retailer's electrical returns process and as a business development manager.

Ken Webster, Head of Innovation, Ellen MacArthur Foundation @CircularEconKen

Ken has worked with the Ellen MacArthur Foundation since January 2010. He has a background in economics education and environmental issues. His latest book is *The Circular Economy: A Wealth of Flows* (June 2015) which relates the connections between systems thinking, economic and business opportunity and the potential for a circular economy. He is a Visiting Fellow at Cranfield University, an Honorary Teaching Fellow at the School of Management at the University of Bradford and a major contributor to their MBA Innovation, Enterprise and the Circular Economy.

Professor Charlotte Williams, Professor of Inorganic Chemistry, Department of Chemistry, University of Oxford

Charlotte Williams is a Tutorial Fellow in Inorganic Chemistry at Trinity College and a Professor of Inorganic Chemistry in the Department of Chemistry, University of Oxford. She has a BSc and PhD (2001) both from Imperial College London. Her PhD studies were supervised by Professors Vernon Gibson FRS and Nick Long and she developed new homogeneous catalysts for olefin polymerization. She was a postdoctoral researcher at the University of Minnesota (2001–02) working with Professors Bill Tolman and Marc Hillmyer on lactide polymerization catalysis. Following this she moved to Cambridge University (2002–03) to work with Professors Andrew Holmes FRS and Richard Friend FRS on organometallic conjugated polymers for light emitting devices. In 2003, she was appointed to the academic staff at Imperial College London as firstly a lecturer (2003), EPSRC Advanced Research Fellow (2005–11), Senior Lecturer (2007), Reader (2009) and Professor of Polymer Chemistry and Catalysis (2012). She moved from Imperial College to Oxford in 2016. Her research involves making and studying new catalysts and materials, often polymers, for applications such as plastics, elastomers, electronics, medicine and catalysis. Her research in polymerization catalysis involves the preparation and study of new metal complexes as homogeneous polymerization catalysis. She is particularly interested in using renewable resources and catalysis to make polyesters, polycarbonates, polyethers and other oxygenated copolymers.

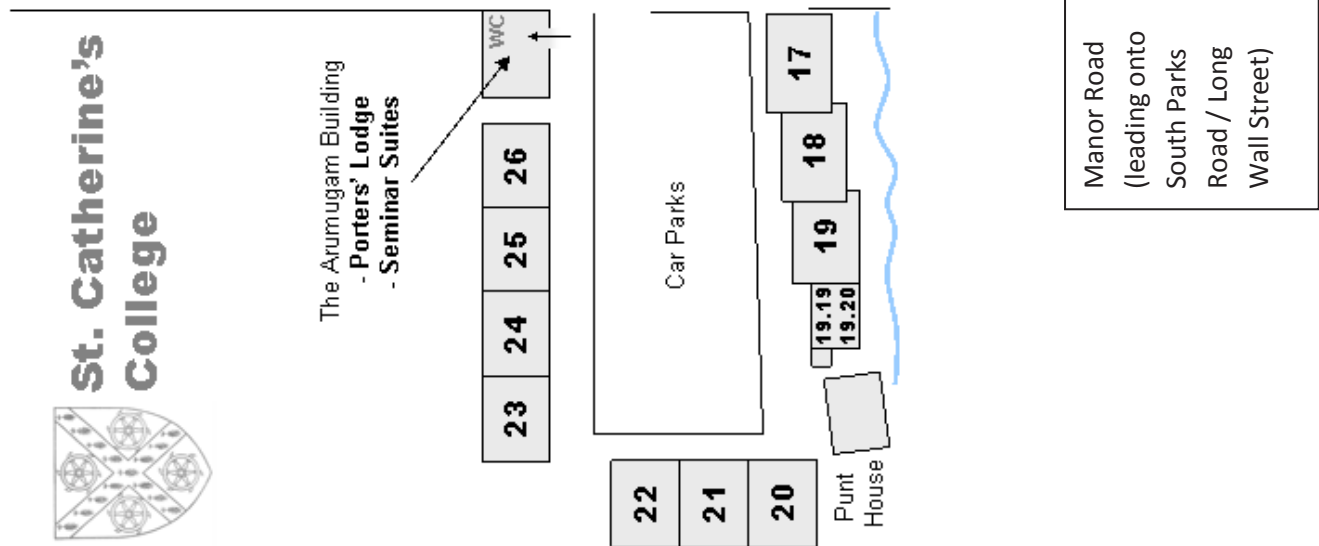
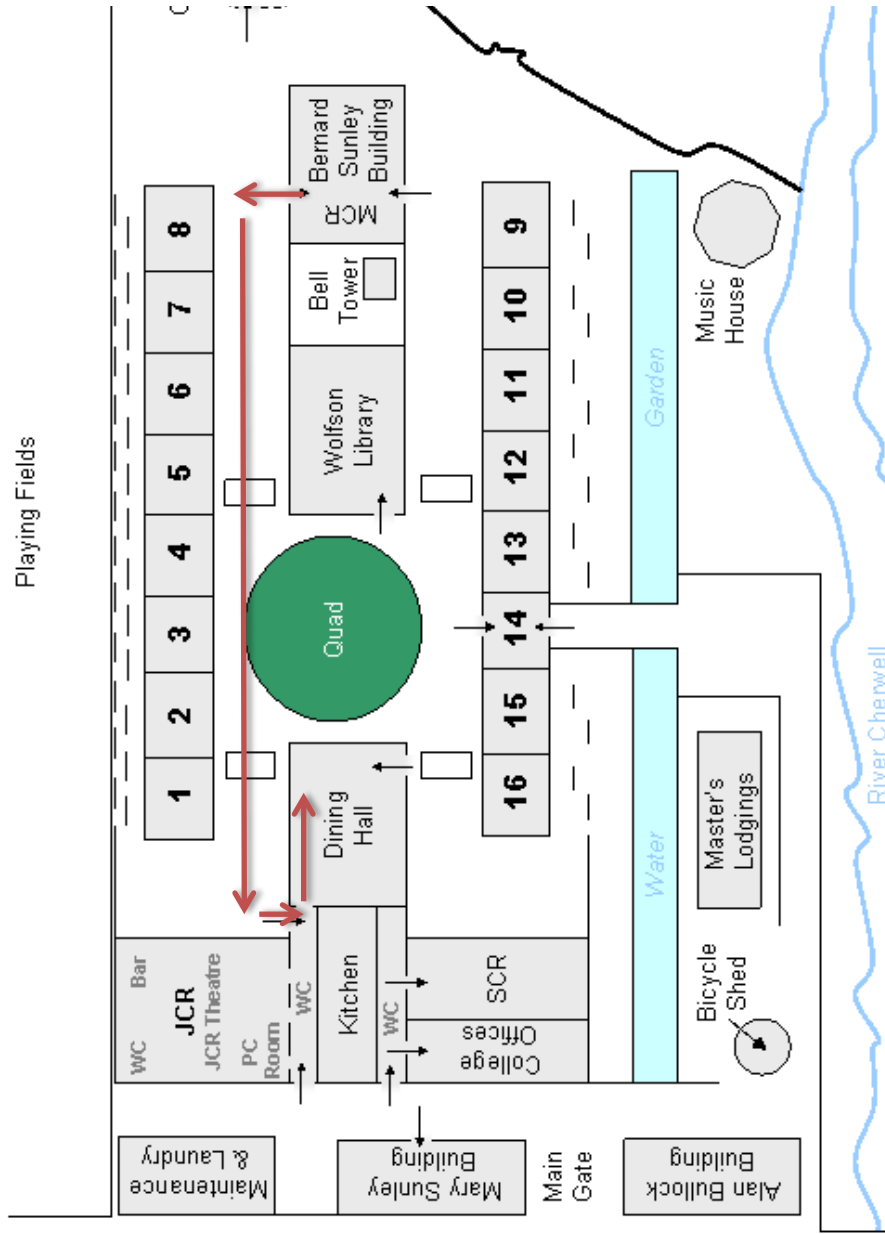
Larry Yu, Co-Founder & Managing Director, Kite Global Advisors @laryu

Larry is Managing Editor of the Milken Institute Review and was formerly Executive Editor of strategy+business, published by Booz & Co, and Global Thought Leadership Fellow for PwC. Larry's writing has appeared in Sloan Management Review. He has also ghost-written two books on corporate governance by one of the world's leading advisors to boards and CEOs, and features in Harvard Business Review. He has provided research and editorial consulting to McKinsey & Co. and MIT's Sloan School of Management.

Professor Xianlai Zeng, Associate Professor of Environmental Science and Engineering, School of Environment, Tsinghua University

Xianlai Zeng studied urban mining, metal sustainability, and circular economy as Associate Professor at Tsinghua University. He worked for four years as a lecturer at the Environmental Management College of China, and two years as a Postdoctoral Research Fellow in Tsinghua University, Technical Advisor of United Nations Development Programme (2015), visiting staff of Coventry University (2012), and Visiting Professor at Macquarie University (2017). Regarding urban mining, he established the method to measure the recyclability and recycling of e-waste, and developed many key pilot processes to recover metals. Regarding metal sustainability, he also established some methods to identify the sustainable utilization of metals (e.g. lithium, cobalt, nickel, lead, gallium). In waste recycling and circular economy areas, Professor Zeng has published around 100 articles, patents, and books. He is Editorial Board member of four international journals, and Deputy Secretary-General, Circular Economy Branch of Chinese Society for Environmental Sciences in China.

Map to dining hall



Nov 2

8.30-9.15	Registration and welcome coffee <i>Registration - Porter's lodge; Coffee - Bernard Sunley Building Foyer</i>
9.20-9.30	Opening remarks <i>Venue: Lecture Theatre</i>
9.35-9.55	Perspectives: Resource availability in the 21 st century <i>Venue: Lecture Theatre</i>

TOPIC 1: What materials are key for a low-carbon future? Exploring the implications of the transition to a low-carbon economy on primary resource demand

10.00-11.15	What materials for a low-carbon future? <i>Venue: Lecture Theatre</i>		
11.15-11.45	Break - <i>Bernard Sunley Foyer</i>		
11.45-12.45	Basic materials in tomorrow's climate-friendly cities <i>Venue: Room A</i>	Powering the future: energy storage minerals <i>Venue: Lecture Theatre</i>	Critical metals in high technologies: managing complexity <i>Venue: Room C</i>
12.45-14.15	Lunch - <i>Dining Hall</i>		
14.15-15.15	Copper and aluminium in the low-carbon world <i>Venue: Room C</i>	Low-carbon technologies: resource scarcities, surpluses and uncertainties <i>Venue: Lecture Theatre</i>	Fertilizers, yields and resource depletion: phosphates and the need for a productive agriculture in Europe <i>Venue: Room D</i>

TOPIC 2: Managing the impacts of extractive industries in a new low-carbon resource landscape. Will the extraction of primary resource fulfil rising demand?

15.30-16.45	Primary resource availability in a low-carbon transition <i>Venue: Lecture Theatre</i>		
16.45-17.00	Break - <i>Bernard Sunley Foyer</i>		
17.00-18.00	The paradox of extraction and energy consumption in a low-carbon world <i>Venue: Lecture Theatre</i>	The water-land-resource nexus <i>Venue: Room C</i>	Financing sustainable resource availability <i>Venue: Room D</i>
18.30-19.45	Lord Stern's Public Lecture - <i>Towards a low-carbon future</i> <i>Venue: South School, Examination Schools, 75-81 High Street</i>		

Nov 3

8.30-9.00

Welcome coffee
Bernard Sunley Building Foyer

TOPIC 3: Disruption in resource availability: the case for the circular economy

9.00-10.00	The case for the circular economy <i>Venue: Lecture Theatre</i>		
10.05-11.05	Scaling up recycling of complex products <i>Venue: Lecture Theatre</i>	The reach of closed loop recycling and remanufacturing <i>Venue: Room A</i>	Eco design in the built environment <i>Venue: Room C</i>
11.05-11.30	Break - <i>Bernard Sunley Foyer</i>		
11.30-12.30	E-Waste: policies to foster the circular economy <i>Venue: Room D</i>	Plastics in a zero-carbon world <i>Venue: Room C</i>	Technological and scientific innovation in circularity <i>Venue: Lecture Theatre</i>
12.30-13.00	Special address and closing remarks <i>Venue: Lecture Theatre</i>		

