Imperial College London

Grantham Institute
Climate Change and the Environment
An Institute of Imperial College London

Grantham Institute's tenth anniversary year

2017–18

Outlook

a decade of difference

Foreword

This year we celebrate the Grantham Institute's first decade at Imperial. We embark on an ambitious programme for the years ahead and we reaffirm our commitment to climate change and environment research, education and advocacy.

In 2007, the Grantham Foundation for the Protection of the Environment made the visionary decision to support an Institute at Imperial to provide a vital global centre of excellence for research and education on climate change.

Today the Grantham Institute is established as an authority on climate and environmental science and works with nearly 200 Imperial staff who are making an impact across academia, industry, NGOs and governments. In the last year, Institute members and affiliate members met with organisations from 26 countries, discussed their work in the media over 80 times, and published over 500 scholarly scientific articles.

In this report you will read examples of our advocacy efforts. You will learn about Imperial research projects underpinning our evidence-based science and engagement with policy makers. You will find stories about the students and staff, who are the researchers and entrepreneurs actively addressing the challenges facing the world. You will read about innovative collaborative programmes like our MSc Climate Change, Management and Finance, in partnership with Imperial College Business School, and a programme called *Greening Imperial*, focused on delivering sustainability enhancements on our campuses and maximising the effectiveness of our efforts to inform policy.

As we look toward the next ten years we see an increasingly urgent need for the Grantham Institute. Imperial's mission is to achieve *enduring* excellence in research and education for the benefit of society. We are responding to a global need for discoveries and innovations to benefit the world today and for generations to come. Our mission is more important than ever and we thank our friends, donors and collaborators for their support. ■

Professor Alice P. Gast
is President of Imperial
College London

Contents

INTRODUCTION FROM THE CO-DIRECTORS

PROFESSOR JOANNA HAIGH, CBE, FRS, AND PROFESSOR MARTIN SIEGERT, FRSE
Co-Directors of the Grantham Institute – Climate Change and the Environment

We are proud to be leading the Grantham Institute into its second decade as an influential thought leader and trusted partner in climate change and environmental action. This tenth anniversary edition of Outlook is filled with examples of how innovative people here at Imperial College London are advancing our vision for a sustainable, resilient, zero-carbon society.

The world has changed significantly since 2007, when the Institute was founded. Imperial academics were key movers in drawing up the UK Climate Change Act of 2008, and establishing the independent Climate Change Committee, which closely advises the UK Government.

Back in 2009, co-ordinated international action on global warming lost traction when climate change talks in Copenhagen broke up without resolve. But following growing evidence of the effects of global warming from researchers, and redoubled efforts by international agencies and campaigners, negotiators put aside many of their differences to agree plans for greenhouse gas emission reduction and economic reparations in Paris in 2015. Emerging leadership from within China and a range of regional bodies elsewhere is now giving rise to new economic models based on low-carbon innovations, critically bolstered by private businesses and financiers.

We have seen public action peak around environmental issues that touch our lives. Outcry at the tragedies of plastic pollution in our ocean, poor urban air quality, and flooding from land altered by human activities has been a major driver for new environmental legislation. Imperial researchers are actively informing policies that balance environmental and economic needs, whilst delivering extra benefits in global challenges like security, health and human rights.

Looking back also helps us think forwards and ask what the next ten years will bring. Our modelling predicts a boom in increasingly cheap and available technologies like renewable energy, electrical energy storage, and devices for environmental monitoring and clean up. But the growing human population will leave a more noticeable mark on our climate and environment, so the urgency to take action continues.

And, how will the Grantham Institute help Imperial to meet the needs of society? Overcoming the pressures of political and economic uncertainty means evolving the ways that we engage, and reaching out to more people. Be part of the solution by feeding us your questions and challenges, and tell us what we should prioritise over the next decade.

This year, why not introduce someone new to the Grantham Institute? Sign up to our mailing list and join us at one of our tenth anniversary events that will be happening throughout the year. ■

“Looking back also helps us to think forwards”

HIGHLIGHTS OF 2016–17

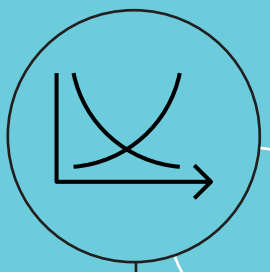
The Grantham Institute is celebrating ten years as a world-leading authority on climate change and the environment. Here are some of the highlights of the past year, showing how Imperial College London has contributed towards our vision for a sustainable, resilient, zero-carbon society.

© JODY KINGZETT

1 Cleantech pioneers cash in on green innovation

For more than a century, Imperial College London has been the place where leading businesses and entrepreneurs are born. In 2012, Imperial built on its track record of success by founding the Imperial Climate-KIC-sponsored Cleantech Start-Up Accelerator. By March 2017, this project had created 34 new low-carbon, or 'cleantech' businesses, and raised $115 million (USD) of investment while generating more than 300 jobs.

Read more: Stimulating innovation (p9) Skipping Rocks Lab (p7) and GrowUp Urban Farms (p9)



2 Report shows coal and oil demand to peak by 2020

Imperial research showed a boom in the popularity of solar panels and electric cars could spark irreversible changes in the energy sector within three years. By 2020, the global demand for coal and oil could peak and start to decline, according to a report co-authored with the independent think-tank the Carbon Tracker Initiative. *Expect the unexpected: The disruptive power of low-carbon technology* warns that fossil fuels may lose 10 per cent of market share within a decade.

3 Short film shows Institute's vision for a low-carbon future

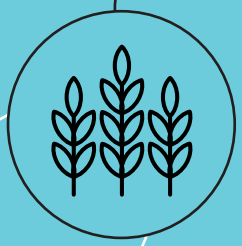
A new animation encourages the public to think about how technologies can help to create a future without greenhouse gas emissions. In 'The Future We See', a mother highlights the challenges and opportunities of tackling climate change in a letter to her daughter. The film was launched at an event with former United Nations chief climate diplomat Christiana Figueres, and leaders from business and industry.

Watch: **http://bit.ly/FutureWeSee**

4 South Kensington gets a new efficient power plant

Imperial's South Kensington Campus, which houses some of the most energy-hungry equipment in all of London, has installed a new combined heat and power plant. One the largest of its kind in central London, the plant generates electricity on site and captures the majority of waste heat to warm buildings, produce hot water and generate steam for autoclave facilities.

Read more: Greening Imperial (Ones to watch, p17)



5 Climate-friendly food production initiative launches at Davos

A project designed to draw over a million farmers into sustainable global food supply chains was announced at the World Economic Forum. The WINnERS project, led by Imperial academics, aims to insure farmers against crop loss caused by weather hazards and climate change. The project is initially being rolled out with 50,000 newly insured farmers in Tanzania and will be available across Sub-Saharan Africa by 2020.

6 Climate scientists become better communicators

A the Grantham Institute we believe that sharing knowledge about climate change is a moral responsibility that helps society become more environmentally responsible and resilient. Over a hundred researchers joined the Grantham Institute and Royal Meteorological Society to hear communications experts share their top tips on translating climate change science to a wider audience. Advice included telling authentic personal stories, creating striking visual aids, and using clearly explained analogies, all in a timely fashion to have maximum effect.

Read more: Media highlights (p22)

READ MORE
IMPERIAL'S GREEN ENTERPRISES RAISE $115 MILLION (USD) OF INVESTMENT WHILE GENERATING MORE THAN 300 JOBS (HIGHLIGHTS, P4)

STIMULATING

INNOVATION

© JODY KINGZETT

Imperial College London is a hotbed for the creation of new ideas and solutions to intractable challenges. It creates the perfect combination of innovative thinking, judicious risk-taking and collaboration, in one of the world's most creative cities.

Global warming will be averted, and its worst effects avoided, by a combination of new technologies and effective use of established technologies. Partnerships between Imperial academics and forward thinking businesses are hastening development, deployment and dissemination of successful low-carbon innovations.

Education programmes and mentoring networks run by the Grantham Institute provide students, postgraduates and early career researchers with the inspiration and know how to turn basic research into commercial projects that create environmental benefits.

Imperial has nurtured many small business ideas into viable projects, and then supported them through the first tranche of external investment to prototype products and test offerings. Such activities have been fundamental in shaping the leaders of the future who combine technological and digital skills, with a business mind-set and a passion for tackling environmental problems.

More support for innovation is still needed. The Grantham Institute is developing plans for new spaces at Imperial where academics will mingle with businesses and policymakers to co-design environmental solutions, build business cases and help young enterprise flourish. ■

SKIPPING ROCKS LAB

PROFILE

Lise Honsinger, Chief Operating Officer and Chief Financial Officer

Skipping rocks, also known as skimming stones, is the the art of bouncing flat stones across the surface of water. This is precisely the image that Skipping Rocks Labs wanted to conjure up for its first product Ooho, a fully biodegradable drink container (pictured left).

"Skipping rocks conjures up that perfect image of something that looks like magic, but is based on pure science," says **Lise Honsinger**, who leads business development for the startup.

Part of the Climate-KIC accelerator programme founded by the European Institute of Innovation & Technology (EIT), Skipping Rock Labs certainly made a splash with Ooho, the edible packaging made of seaweed and plants.

Ooho went viral on social media in April, raising £850,000 in just over three days on crowdfunding site Crowdcube.

"People are very aware of the issue with plastic waste, and there were just no solutions out there," Honsinger said. And the material requires significantly less carbon dioxide and energy to produce than an equivalent polyethylene terephthalate plastic bottle or cup.

Based at Imperial's new technology incubator at White City Campus, Ooho was invented by Rodrigo Garcia Gonzalez, an award-winning product designer, and Pierre Paslier a former packaging engineer at L'Oreal, after meeting on the College's Innovation Design Engineering Masters ■

GREEN IDEAS ON SHOW AT WHITE CITY INNOVATION SHOWCASE

Imperial's technology entrepreneurs exhibited their green ideas to the innovation community at the 'Meet the Cleantech Pioneers' event in March 2017. The event took place at the Translation and Innovation Hub at Imperial's White City Campus, a dedicated space for turning world-leading research into new products and services. Investors and business leaders came to meet PhD student innovators and start-up companies supported by Imperial's Climate-KIC Accelerator, who are developing low-energy and sustainable 'clean' technology – or cleantech – in London.

Six PhD student projects on display were part of the Innovating for Sustainable Development programme. Over ten weeks, the programme supported start-ups, corporates, NGOs and policymakers to make contributions to sustainable development by partnering with research students from top institutions including Imperial, UCL and the Universities of Reading and Surrey. Using the framework of the United Nations' Sustainable Development Goals, the programme covered challenges such as eradicating poverty, being responsible consumers, improving access to clean water and sanitation, and clean and affordable energy. ■

READ MORE
PROFILE OF PHD STUDENT PARTICIPANT GERALDINE SATRE BUISSON (TRAINING AT IMPERIAL, P21)

F1 TECH TESTED IN BID TO MAKE TRUCKS MORE EFFICIENT

The technology used in Formula One racing to recover energy from braking will be installed in trucks as part of a forward-thinking pilot project. The aim is for the technology to make heavy goods vehicles, which account for 30 per cent of UK road carbon dioxide emissions, more fuel efficient and environmentally friendly by reducing pollution and noise levels.

The trial will involve the installation of a kinetic energy recovery system on 20 heavy goods vehicles used by Sainsbury's supermarkets and Howdens Joinery Co to deliver their goods to stores across the UK.

Imperial's **Dr Marc Stettler** said: "There has been a rising awareness and growing number of drivers switching to hybrid and all-electric vehicles. However, the freight industry still relies heavily on diesel combustion engines. It's vital that we find commercially viable options for the industry that are affordable and have the potential to dramatically reduce the amount of carbon dioxide and air pollutants emitted on our roads." ■

© MANDY-ZAMMIT

TURNING WASTE WATER INTO A TASTY PROFIT

Imperial alumnus **Kate Hofman** and her business partner **Tom Webster** have turned water recycling into profit. They have created an 'aquaponics' farm in Beckton, east London that combines freshwater fish farming with hydroponics to cultivate salad leaves.

Hofman and Webster's business, GrowUp Urban Farms, aims to feed city-dwellers with ingredients produced on unused urban space and with a low environmental impact. Tilapia, which are popular in Asian cuisine, can be shipped to London from thousands of miles away. Now they are being farmed in the Capital and the waste water they create provides an ideal environment for growing herbs and baby leaf salad.

Demand for the produce is high with the farm selling to a variety of restaurants and shops, and to consumers via an online farmers' market. ■

Ones to watch

1

Eight social entrepreneurs from Imperial have been featured in the 2017 Forbes 30-under-30 Europe list. The list from US business magazine Forbes celebrates 300 of Europe's boldest young entrepreneurs. One of those recognised is **Charlotte Slingsby**, a graduate of the Innovation Design Engineering course. She is the founder of Moya Power, an innovative system for harvesting wind power. Moya, which means wind in the South African Xhosa language, works by collecting and putting together tiny amounts of wind energy using small individual filaments attached to a clear plastic sheet.

2

Imperial PhD researcher **Jiajun Cen** and his colleagues won the 2016 Herman Wijffels Innovation Award for inventing a battery that can store electricity using water and salt. Energy collected from renewables such as solar and wind can be intermittent, and must either be stored or wasted. This issue is growing as renewable sources become more widely used. However, traditional batteries are toxic, expensive and unsafe. Cen's 'Blue Battery' is environmentally friendly, affordable, safe and scaleable. Cen is a student on the Science and Solutions for a Changing Planet Doctoral Training Partnership programme.

3

To celebrate its tenth anniversary, the Grantham Institute is offering ten teams of early-stage entrepreneurs the chance to kick start their green business idea with a €10,000 grant. Successful teams will enter Imperial's Cleantech Accelerator programme, which is funded by Climate-KIC, and is the largest incubation community of its kind in the world. The programme offers coaching with experienced professionals, business masterclasses, free incubator work-space as well as the opportunity to win an extra €50,000 for business development.

SHARING

INFORMATION

Science representatives from 14 nations met experts from Imperial to discuss some of the headline environmental issues ahead of the United Nation's Marrakech climate conference (COP22) in November 2016.

READ MORE
READ MORE: DIPLOMATS CONFER AHEAD OF UN CLIMATE SUMMIT (P13)

Imperial College London's mission is to achieve enduring excellence in research and education in science, engineering, medicine and business for the benefit of society. The Grantham Institute supports this mission by using expertise and evidence to influence decisions about climate change and other environmental challenges.

The Policy and Communications team present primary research, reviews and analysis, with messages tailored for different audiences. This year's publications include new pocket-sized pamphlets on the environmental challenges associated with Britain's exit from the European Union, and detailed briefings on the prospects for deploying low-carbon technologies.

High quality events bring stakeholders together to discuss the latest evidence for policy, identify where new research is needed, and plan actions. Whilst the majority of these take place at Imperial, the Grantham Institute is taking experts to new audiences, for example, the new Science in the City series which reaches out to financiers in City firms.

Inspiring infographics, visualisations and short films, are taking the Grantham Institute message to audiences online. Professional network LinkedIn is the latest channel to carry announcements, events and news about Imperial's climate change and environmental work. This year, Imperial experts have also contributed to the news media on topics from ocean plastics to President Trump's climate controversy (see media highlights page 22). ■

HELEN APSIMON, CBE

PROFILE

Professor of Air Pollution Studies, Centre for Environmental Policy

Professor Helen ApSimon works at the interface between science and policy. "The way science has been used in developing air pollution legislation and transboundary agreements is fascinating," she says.

Professor ApSimon serves on DEFRA's Air Quality Expert Group, and in June was invited to chair the new independent Heathrow Air Quality Expert Review group to provide advice on the UK's ability to comply with legal air quality requirements while delivering a third runway.

A renowned authority, Professor ApSimon's research in air pollution sprung out of modelling studies of nuclear accidents, and diversified into international issues such as acid rain and air pollution in Eastern Europe.

She has worked at Imperial for more than 30 years, and is optimistic that the air we breathe will be less polluted in ten years' time. "The technologies we need for better air are available and there's a will to do it," she says.

Professor ApSimon founded and currently chairs the Air Pollution Research In London (APRIL) network, which circulates and brings important research to the frontline, and she is part of Imperial's Air Quality Network.

Her work is highly interdisciplinary, linking science and policy development. "I feel that it is essential to communicate science in a special way for policymakers." ■

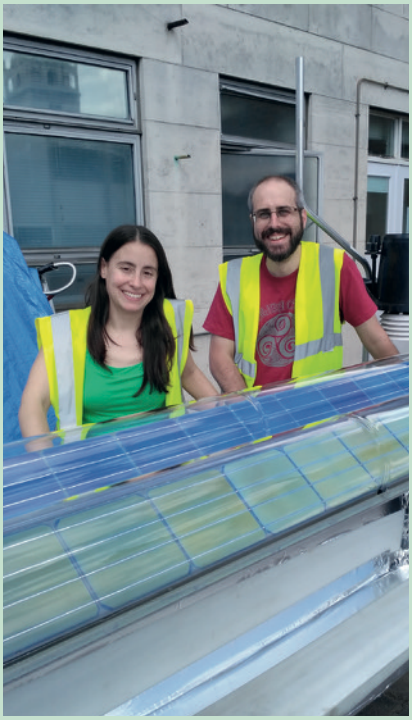
BRIEFING: THE ADVANTAGES OF SOLAR HEAT

Technologies that harness the sun's energy to produce a heating or cooling effect, have a unique potential to meet the increasing global demand for energy, according to a new briefing.

At a launch event hosted by the Grantham Institute, co-author **Dr Alba Ramos Cabal** presented the paper. She said: "Our findings underline the importance of developing and deploying clean and sustainable future energy sources, in particular to satisfy the demand for heating and cooling from an increasingly urbanised global population." A hundred policymakers and industry representatives attending the event added their perspectives on the role for solar heat technologies in a changing energy market.

Dr Ramos Cabal gave an overview of a demonstration solar-thermal system that she and colleagues in the Physics and Chemical Engineering departments have installed on an Imperial rooftop. The paper's authors argue that a drive to meet national and international environmental objectives could drive solar thermal's entry into the energy market. ■

READ MORE
GRANTHAM INSTITUTE BRIEFINGS CAN BE VIEWED ONLINE AT WWW.IMPERIAL.AC.UK/GRANTHAM/PUBLICATIONS OR HARD COPIES CAN BE REQUESTED BY EMAILING GRANTHAM@IMPERIAL.AC.UK



DIPLOMATS CONFER AHEAD OF UN CLIMATE SUMMIT

Science representatives from 14 nations met experts from Imperial College London to discuss some of the headline environmental issues ahead of the United Nation's Marrakech climate conference (COP22) in November 2016.

Diplomats heard presentations on the latest science on emissions, climate and health, and the importance of evidence-based policy, and had the opportunity to engage with Imperial academics during lively group discussions (pictured previous page).

The briefing was organised by Imperial's International Relations Office and the Grantham Institute, in partnership with the London Diplomatic Science Club, which brings together science attachés from London's embassies and high commissions.

Introducing the event, Imperial's Associate Provost, **Professor Maggie Dallman**, emphasised Imperial's global outlook and its strengths in producing the interdisciplinary research needed to address issues such as climate change. "Through events such as these we seek to become a trusted interface for academia, government and industry; playing a role in informing policy-makers, as well as translating our research into viable solutions for societal benefit," she said. ■

CHANGING MONSOON POSES THREAT TO FOOD SECURITY

Climate change is a threat to food farming in India but it can be mitigated with the right policies, according to a new Grantham Institute briefing paper. It explains how India's success in achieving food security could be undone by an increasingly variable monsoon. The annual monsoon supplies 80% of India's total annual rainfall but it has shown increasing variability, including extreme droughts, and flooding linked to changes in climate and land cover.

Co-author **Dr Bhopal Pandeya** has been working in neighbouring Nepal, promoting citizen science schemes that encourage farmers to manage groundwater as a shared, public resource. "I took the opportunity to disseminate our research outputs," he says. Dr Pandeya held workshops with Nepal's Department of Hydrology and Meteorology, international charities Practical Action, Oxfam, Red Cross Society, and various local NGOs.

Another co-author **Dr Wouter Buytaert** is taking the paper's advice to prevent over-exploitation of groundwater resources to policy makers at the United Nations Educational, Scientific and Cultural Organisation (UNESCO) conference Knowledge Forum on Water Security and Climate Change in October 2017. ■

BREXIT'S OPPORTUNITIES AND CHALLENGES

The Grantham Institute has responded to the UK's planned exit from the European Union by investigating the range of threats and opportunities posed to climate change. In a series of discussion papers, experts used evidence to explore the future of carbon trading schemes, the European energy market, and the UK's potential to lead climate change diplomacy post-Brexit.

'The UK post-Brexit: a leader in climate change diplomacy?' explains that Brexit is no barrier to the UK continuing as a trailblazer in environmental policy, and that it creates opportunities to establish agreements that encourage sustainability and climate change commitments. It also says that the UK must continue to work with the EU on mitigation targets, dedicated institutions and technology transfer.

In 'Carbon pricing in the UK post-Brexit: tax or trade?' researchers describe how the UK could build on its carbon pricing history as well as consider staying in the EU emissions trading system. The third paper in the series, 'Interconnectors, the EU Internal Electricity Market and Brexit', outlines why and how the UK should encourage continued investment in electricity connections between the UK and EU. ■

Ones to watch

4

A new book by Grantham Institute Senior Policy Fellow **Neil Hirst** will give a comprehensive account of global energy policy. The Energy Conundrum will provide evidence gathered from government, industry, academia and NGOs. Readers will step into the shoes of government energy ministers for two hypothetical countries with very different circumstances and try their hand at making their own policies. It will be available from January 2018.

5

The Grantham Institute has launched a new series of 'Science in the City' lectures, where different businesses host Imperial academics for a short talk and discussion on the science behind environmental challenges and solutions. In May 2017, Research Fellow **Dr Tamaryn Napp** delivered a lecture on the technologies needed to achieve a low-carbon future to ING Bank staff and in June, physicist **Dr Ned Ekins-Daukes** and Grantham PhD student **Philip Sandwell** visited Bank of America Merrill Lynch to discuss solar power and economic growth.

6

A newly funded project will investigate the impact of farming practices on insect populations in two island communities in the Maldives. Soneva Fushi island supports a small amount of subsistence farming with high levels of pesticide use, while Soneva Jani is home to a larger area of agricultural production with lower use of pesticides. Led by **Dr Richard Gill**, the research will monitor invertebrate numbers and compare this with data on pesticide use. The project will also identify new, sustainable methods for farmers to target pests.

CREATING

NETWORKS

The Grantham Institute works with Imperial College London academics to build bridges to policymakers, business people, non-governmental organisations and others, to share insight and stimulate discussion. Face-to-face meetings give decision-makers the opportunity to talk openly with top academics about their most pressing challenges, and all parties grow in their understanding. Recently activities have connected experts in engineering, science, health and business with the UK Government's National Infrastructure Commission, financiers at ING Bank and Bank of America, and civil servants working on energy and environmental issues.

The Institute convenes inter-disciplinary networks around key environmental and climate issues, to enable better academic collaboration. These fleet-footed groups are driven by the desire to address a topical global challenge, such as air quality or plastic pollution. Fledgling networks come together to assess a need, then may go on to create new research collaborations and stimulate longer-running conversations between their members and external organisations who have a stake in the issue.

Researchers and their non-academic partners can develop deeper understanding of their respective pressures and cultures by experiencing the other's working environment. A new scheme invites experts to become Grantham Research Fellows, and experience Imperial's world-class academic environment whilst carrying out new research in partnership with the Institute (see profile below). ■

EARTH DAY: TACKLING DANGEROUS AIR POLLUTION

On Earth Day 2017, the Grantham Institute joined forces with Imperial's Energy Futures Lab and Institute of Global Health Innovation, to launch a paper on ways to tackle air pollution. The new paper identifies key pollutants for global and regional climate change, and makes recommendations to set new standards for tools to measure the impact of emissions worldwide.

The paper's author, **Dr Apostolos Voulgarakis**, has examined which pollutants are key in changing climate and weather, and how much emissions from different global regions affect air pollution levels for everyone. Dr Voulgarakis who is part of Imperial's Air Quality Network, recommends new standards for comparing the environmental impact of pollutants such as sulfur dioxide, black carbon and tropospheric ozone from fossil fuels used for transport, industry and heating.

The launch event, 'Air pollution: what is the scale of the problem and what can be done about it?', which brought together campaigners, legislators and experts in global health, energy and environment, also featured a keynote speech from Elliot Treharne, Air Quality and Hydrogen Manager at the Mayor of London's Office. ■

WATCH
WATCH HOW THE EVENT WAS INTERPRETED IN A LIVE ILLUSTRATION: HTTP://BIT.LY/EARTHDAYAIRPOLLUTION

STUDENTS QUIZ RESEARCHERS ON IMPROVING GLOBAL HEALTH

In June 2017, world-renowned experts convened for a panel discussion on global tracking initiatives that can help tackle health issues created by climate change. The event was held in association with the Grantham Institute and hosted by the Lancet Countdown, an organisation dedicated to tracking progress in health and climate change and reporting annually in *The Lancet* Journal.

A group of Imperial students, who are all part of the Science and Solutions for a Changing Planet Doctoral Training Partnership, used the event to carry out a survey. They asked the audience about the cross-discipline collaborations they had already forged, and new collaborations needed to face up to the challenge that climate change presents to human health. Their results showed that the majority of participants had already established connections across some disciplines, such as energy with economics and business; or medicine and health with ecology, biodiversity and biology. However, the audience expressed the concern that many of these existing connections remain relatively weak and said they wanted to engage with people from much more diverse disciplines such as between health and ecology. ■

READ MORE
BLOG BY PHD STUDENTS:
HTTP://BIT.LY/
PLANETARYHEALTHCOLLABORATION

PROFESSOR YUFENG YANG

PROFILE

Research Professor of the Energy Research Institute (ERI) of the National Development and Reform Commission (NDRC) of China

An expert in analysing energy systems and policy, **Professor Yufeng Yang** joined the Institute as a Grantham Research Fellow in June 2017. After 35 years of rapid development and growth, his home country of China is still facing serious environmental challenges. In some areas, pollution levels are dangerously high, and ecosystems are deteriorating as a result.

"Effective solutions to regional environmental issues like air pollution, water pollution and ecosystem deterioration are driving local clean and sustainable development," he says, but the benefits of mitigating climate change will be felt across the globe and limited international progress has been made over the last ten years.

Professor Yang's Fellowship affords him the opportunity to exchange ideas with London-based academics, and sound out new opportunities for collaboration within China. He envisages a solution in which world-class engineers come together to share knowledge, and develop sustainable, smart infrastructure that can shape our burgeoning global cities.

He says "Densely settled urban living can become cheaper and less environmentally damaging by securing access to water and electricity supply, reducing flood risks, and preserving abundant green space for city dwellers.

"Human health is inherently intertwined with climate change, and basic services like public transportation, housing, electricity, water and sanitation." ■

FINANCING THE FUTURE THROUGH RESPONSIBLE INVESTMENT

A pair of Imperial students launched a Responsible Investment Club for like-minded people who want to help drive the transition to a low-carbon economy. The Club will also consider sustainability and ethical issues in investment portfolios.

Sarah Clements and **Nick Spooner** are both studying for a Master's in Climate Change, Management and Finance at Imperial. They launched the Club at an event co-hosted with the Grantham Institute that discussed the impact of climate change on financial markets, and how investors could best prepare for the macroeconomic changes the transition will bring. An expert panel, which included **Mark Campanale** from the think-tank Carbon Tracker Initiative alongside representatives from a range of investment firms, spoke at the event. It attracted a wide range of professionals – from those involved in the fossil fuel industry, to members of global development banks and government representatives. ■

READ MORE
BLOG ABOUT THE EVENT: HTTP://BIT.LY/RESPONSIBLEINVESTMENTBLOG

GRANTHAM AFFILIATES BRUSH UP THEIR INTERVIEW SKILLS

In April 2017, ten Imperial experts were quizzed on camera about topical issues relating to their work. During a practical session with specialist media trainers, **Dr Michele Jackson** learned how to get across key points in a live interview about her freshwater warming experiment, and **Dr Sheridan Few** (pictured) practiced communicating succinct positive messages about technologies for storing electrical energy.

As a window onto climate and environmental research at Imperial, the Grantham Institute proactively showcases and supports the work carried out by academics across the College. The Grantham Institute Affiliate network is an active community of researchers whose work and interests align with the mission of the Institute, and who benefit from access to funding opportunities and support provided by the Institute, including project management and media training. ■

Ones to watch

7

Imperial is launching a network to tackle the growing problem of plastic accumulating in the world's oceans, a key research theme for the Grantham Institute. Plastic pollution can harm marine life in a variety of ways; from animals becoming entangled in large pieces, to poisoning animals when smaller pieces are consumed. Led by **Dr Arturo Castillo Castillo**, the Ocean Plastic Solutions Network brings researchers together to tackle the issue with science, engineering and societal solutions. Follow the network on Twitter: **@OceanPlastic_IC**

8

Imperial Provost, **Professor James Stirling**, has announced a new College-wide project that will look at Imperial's sustainability across four areas: how it runs its campuses, the impact of research, the impact through education, and engagement with policy makers. Professor Stirling said Imperial is 'committed to being as efficient and effective as we can be in the running of our estate'. **'Greening Imperial'** will begin by creating an evidence-based strategy and a set of recommendations covering these areas.

9

Imperial experts are advising the Government's National Infrastructure Commission (NIC). The Commission was set up in 2015 to analyse the UK's long-term economic infrastructure needs including; energy, transport, sewerage, flood defences and digital and communications. Following a meeting in late 2016 to showcase Imperial's academic and technical strengths, environmental technology expert **Professor Nick Voulvoulis** is advising the Commission on water management. Imperial's Emeritus Professor David Fisk was appointed as a Commissioner to the NIC in April 2017.

Clementine Chambon is bringing electricity to Indian villages

***Clementine Chambon** is a final-year PhD student in Imperial's Department of Chemical Engineering. Her research focuses on the production of liquid fuels and useful chemicals from waste biomass resources, which is funded by an Imperial College London President's PhD Scholarship, in partnership with the Grantham Institute and Climate-KIC. She is co-founder and CTO of Oorja, a company that develops locally run renewable energy systems.*

Tell me about your research at Imperial.
I have been researching how to cost-effectively convert agricultural waste into useful energy sources, such as biofuels, chemicals and electricity. I also spend a lot of time outside my PhD looking into the economics of biomass technologies for rural electrification.

What is your entrepreneurship idea?
My research in bioenergy at Imperial took me to the Climate-KIC entrepreneurship workshop in the summer of 2013. That's where, with Amit Saraogi, we developed the seed concept for Oorja.

Our aim is to provide clean, reliable and affordable energy access to bottom-of-the-pyramid off-grid communities in rural India. Initially, we focused on using agricultural waste as a fuel to generate electricity. Since then we have adopted a hybrid generation model using biomass and solar photovoltaic panels.

At the moment we are acting as a project developer of mini-grids, starting in Uttar Pradesh where we just built our first solar-powered system. These are systems ranging between ten to 40 kW, to power small businesses, irrigation pumps and low income households.

"Powering small rural businesses creates jobs and improves livelihoods"

How are you making a difference to people in India?
Powering small rural businesses creates jobs and improves livelihoods. By catering to schools and health centres, we can improve access to healthcare, allow children to use computers, and provide basic services such as lighting at home, which can have a massive impact on people's productivity, income and safety.

Rather than being just an energy provider, however, we take a whole ecosystem approach by providing training programmes to build capacity into the community for setting up new businesses and to bring new technical skills.

How has the environment at Imperial empowered you to do this?
Being in a university environment around people who are trying new things – not all in a commercial way – has been beneficial. The Grantham Institute network has been hugely helpful in connecting us to researchers working on energy access and also to established companies made up of Imperial alumni who set up off-grid clean energy businesses, such as BBOXX, Meshpower and Solaris Offgrid. ■

Mark Burgman
takes the helm at Imperial's Centre for Environmental Policy

***Professor Mark Burgman** came to Imperial to be Director of the Centre for Environmental Policy in February 2017. The energetic Australian has worked as a consultant ecologist and research scientist in Australia, the United States and Switzerland during the 1980s before returning to academic life in 1990. He is Editor-in-chief of the journal Conservation Biology, and enjoys living the high life in London.*

Tell us about your current research.
I am studying how scientists reason in a large project funded by the US Office of National Intelligence. They are interested to know why people make geopolitical mistakes, why their reasoning led them to certain conclusions, how they weigh evidence, and so on.

Scientists' ability to make judgements about facts is the fabric by which science communicates with policy. Many of the questions policymakers ask scientists are unknowable, some because they are in the future, and others because we don't have the time or resources to collect the data – so we go and ask somebody. And those judgments are treated as if they were data, and indeed often they have greater credibility than data.

How is this related to your expertise and to the Centre?
I'm a conservation biologist, and the kinds of uncertainties we face when we make judgements about threatened species are identical to those that confront policymakers making geopolitical judgements. Mistakes are never totally avoidable. We simply want to reduce their frequency and severity.

If we can expose our judgments to data and cross-examination, then our abilities to make those judgements will improve substantially. The first three people I've hired here are a psychologist, a philosopher – an epistemologist – and a mathematician. This is the space in which the Centre aspires to sit – between science and its application.

What is the Centre doing well?
We have some incredible individuals, who are doing wonderful research. We also have a Master's programme in environmental technology that is exceptionally well regarded. Seven hundred alumni came from 40 countries to celebrate its 40th anniversary last year. They have had an amazing impact on the world and we would like to mirror that across the department.

Are you enjoying living in London?
It really is a special place. We have spent the last 25 years in Melbourne, which is a great city to live in, but central London offers something completely different. The West End shows are just fabulous. Everyone can act and they are so well produced. I still run and pole vault. I go up to Bedford once a week to train, and use the Imperial gym most other days. ■

TRAINING AT IMPERIAL

Taught postgraduate courses

Master's courses at Imperial teach new technical skills, and thinking about concepts and methods more critically and more deeply. We place great emphasis on the integration of our Master's level courses with our world class research portfolio. Search Imperial's postgraduate prospectus online for courses from public health and tropical biology, to future energy and innovation design engineering. **www.imperial.ac.uk/study**

Focus on: MSc Climate Change, Management and Finance
Our Industry partners and employers are demanding graduates with both practical business skills, such as finance and economics, as well as knowledge of the challenges of sustainability and climate change. Students on this one-year programme delivered by the Grantham Institute and Imperial College Business School learn from leading practitioners and world-class faculty how to put the latest academic thinking and business and climate change strategies into practice. ■

SEREF ATASER

PROFILE

MSc Climate Change, Management & Finance

Chartered Accountant **Seref Ataser**, who completed his undergraduate in Biochemistry with Management at Imperial in 2011, was drawn to the multi-disciplinary learning in this Master's. "Other courses I considered seemed to be either business or climate science. This was a good mix of the two," he said.

Having previously worked as an auditor at accountancy firm KPMG, Ataser feels he will be well equipped to help catalyse behaviour change and contribute to a more sustainable world after completing the course in September 2017.

"My mission now is to drive consumers and companies to become more sustainable by helping facilitate change of their everyday actions" he said.

GÉRALDINE SATRE BUISSON

PROFILE

Science and Solutions for a Changing Planet DTP

Géraldine Satre Buisson is a multi-disciplinary PhD student in climate change policy and science communication at Imperial's Science Communication Unit and the Grantham Institute.

"I'm working on the types of stories that we use to explain climate change science, and then how we can tell better stories to push for ambitious climate change policies," she explained. "It's about using stories as devices to convince people to act."

As well as her busy research schedule, Satre Buisson took part in the DTP programme's Challenge Team training, which promotes cross-disciplinary training and collaboration among PhD students on projects that tackle contemporary issues and translate research challenges. Her team worked on bees and pollinators, such as bats, which culminated in that staging of interactive workshops for children at Imperial Festival in May (pictured right).

Beyond bees – why pollinators matter: Science and Solutions for a Changing Planet DTP students devised workshops and activities to engage the public at Imperial Festival, as part of their cross-disciplinary Challenge Team training.

PhD opportunities

Imperial seeks to train postgraduates to tackle society's big challenges in a way that harnesses academic study, talent and imagination, brought together in government-funded PhD training centres. Search online for more information about Centres for Doctoral Training (CDTs) and Doctoral Training Partnerships (DTPs) involving Imperial, which are funded by the UK's Economic and Social Research Council (ESRC), Natural Environment Research Council (NERC), and Engineering and Physical Sciences Research Council (EPSRC):

- EPSRC CDT in Nuclear Energy
- EPSRC CDT in Fuel Cells and Their Fuels
- EPSRC CDT in Future Power Networks and Smart Grids
- EPSRC CDT in Quantitative Non-Destructive Evaluation
- EPSRC CDT in Sustainable Civil Engineering
- EPSRC CDT in Mathematics of Planet Earth
- EPSRC STREAM Industrial Doctoral Centre for the Water Sector
- ESRC London Interdisciplinary Social Science DTP
- NERC CDT in Science for Humanitarian Emergencies and Resilience
- NERC CDT in Oil & Gas
- NERC CDT in Quantitative and Modelling Skills in Ecology and Evolution
- NERC Science and Solutions for a Changing Planet DTP

Focus on: Science and Solutions for a Changing Planet

The world-class research conducted during an Imperial College London PhD is the foundation for students on the Science and Solutions for a Changing Planet Doctoral Training Partnership, a (NERC)-funded PhD Programme.

Bespoke training and team projects put research into a broader societal perspective and gives this multidisciplinary cohort of over a hundred students the necessary skills and experience of creating impact beyond academia. Students' primary research falls within NERC's remit including marine, freshwater, atmospheric and polar sciences, and Earth observation. The programme draws on Imperial's six core research partners and a network of public and private sector organisations, in a collaborative, influential and driven community. The partners are: British Geological Survey, Centre for Ecology & Hydrology, Royal Botanical Gardens Kew, Met Office, Natural History Museum, and the Zoological Society of London.

Each year 15 fully-funded studentships are advertised by the Grantham Institute and 15 other Imperial PhD students from different disciplines align with the programme. ■

MAKING HEADLINES

Grantham Institute and Imperial College London climate and environment experts appeared as part of 81 different stories in the print, broadcast and online media in 2016–17.

To discuss a media appearance, journalists should contact Communications Manager **Simon Levey**: s.levey@imperial.ac.uk.

Journalists with urgent enquiries outside of office hours, call the duty media officer: 07803 886248.

Water, food and energy all under threat

Grantham Institute co-director **Professor Joanna Haigh** presented an episode of the BBC World Service 'The Compass: Economic Tectonics' programme. In it she explored humankind's most fundamental resources – water, food and energy – investigating how all three are affected by the Earth's changing climate.

Among those she interviewed was Imperial College Business School's Assistant Professor of Economics, **Dr Mirabelle Muûls**, who explained how, in a globalised economy, an event such as a flood on the other side of the world, can disrupt the supply chain for companies closer to home. She said that industries as varied as finance and insurance, tourism and manufacturing will all need to be prepared for the effects of climate change.

LISTEN
THE COMPASS: ECONOMIC TECTONICS
WWW.BBC.CO.UK/PROGRAMMES/P04XM40Q

Exhorting the benefits of tidal power

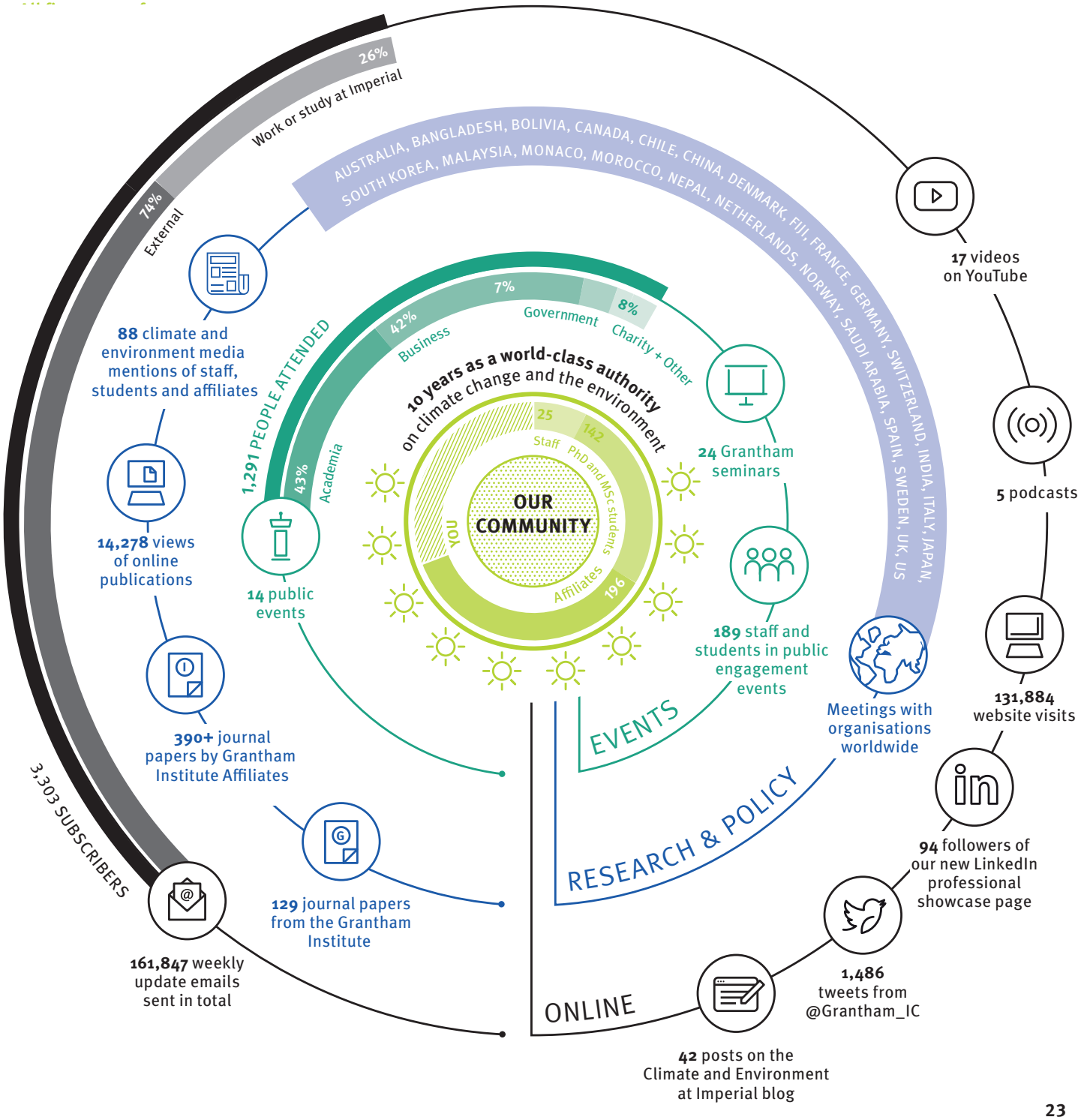
In January 2017, former Energy Minster Charles Hendry urged the UK Government to agree a subsidy deal for a pioneering tidal lagoon in Wales. The Tidal Lagoon Power company have proposed building a breakwater across Swansea Bay, using the tide to turn 16 hydro turbines to generate enough electricity for 150,000 homes. Imperial's **Dr Robert Gross** told the Independent: "Tidal lagoons are expensive to build but could provide electricity almost indefinitely. If they can be financed cheaply over the long term their electricity works out quite cheap too."

Trump announcement disappointing but not disastrous

When President Donald Trump announced the United States' intention to withdraw from the Paris Agreement on climate change, Grantham Institute spokespeople were on hand to provide expert comment to media. Co-director of the Institute, **Professor Martin Siegert** told BBC News that the decision would not kill the deal but that the US would become isolated in a global low-carbon economy, if it persisted in investing in fossil-fuels.

Meanwhile, **Professor Joanna Haigh**, told Sky News: "All the other countries, including the big polluters – China, EU, India and now Russia, are saying they will fulfil their Paris commitments and that they will carry on the right path."

A YEAR IN THE LIFE OF THE GRANTHAM INSTITUTE **2016–2017**



Get involved

The Grantham Institute at Imperial College London is celebrating ten years as a world-leading authority on climate change and the environment. Think what has changed in the last decade, and what the world could be like in another ten years.

Work with us
Partner with Imperial College London academics who focus on some of the most important, relevant and timely questions.

Sign up to our weekly mailing list of news, events and opportunities. Visit www.imperial.ac.uk/grantham/get-involved or email us at grantham@imperial.ac.uk

Come to one of our events
Join our mailing list to hear about research seminars and public lectures delivered by leading figures from research, business and government.

Study with us
See pages 20–21 or visit our website to find out more about Master's and PhD training programmes at Imperial College London.

Engage with our students
Become an education partner and offer a secondment or opportunity to our brightest students.

Become a Grantham Affiliate
Imperial staff can access funding opportunities, studentships and other support through our Affiliates scheme.

Follow us online
Stay up to date with the latest activity on Twitter and LinkedIn, or sign up to our mailing list.

Tell us your story
Do you have memories of the Grantham Institute in our first decade? What should we be focusing on in the next ten years? What kind of world do you want to see? Email us your thoughts.

Support us
If you would like to offer support or discuss the role you could play in helping Imperial achieve its goals, please contact Kelly Kent on 020 7594 1829 or Lauren Welch on 020 7594 9899.

Grantham Institute
Climate Change and the Environment
An Institute of Imperial College London

South Kensington Campus
Imperial College London
London SW7 2AZ, UK

T: +44 (0)20 7594 9666
E: grantham@imperial.ac.uk
W: www.imperial.ac.uk/grantham
Tw: @Grantham_IC

Designed and typeset by Soapbox, www.soapbox.co.uk