



The Faraday Institution PhD Training Programme Course Guide

2020/2021



"Climate change is the defining challenge of this generation. The decisions we take now will influence the future of our planet and life on earth...We can only achieve the UK's ambitious net zero goal if we are powered by a highly motivated workforce... capable of delivering the most ambitious targets."

National Grid 2020*

The Faraday Institution is actively committed to attracting, nurturing and empowering a dynamic and diverse pool of talent for the fields of energy storage and battery technology who can creatively tackle the challenges facing society today. Central to this, is increasing the knowledge, skills and aspirations of researchers early on in their careers.

"The need for breakthroughs in energy storage research is evident as the UK races to lead the transition to fully electric. We are committed to nurturing the talent and developing the skills of the community who will lead this effort." Pam Thomas, CEO, Faraday Institution.

^{*} National Grid (2020) Building The Net Zero Energy Workforce

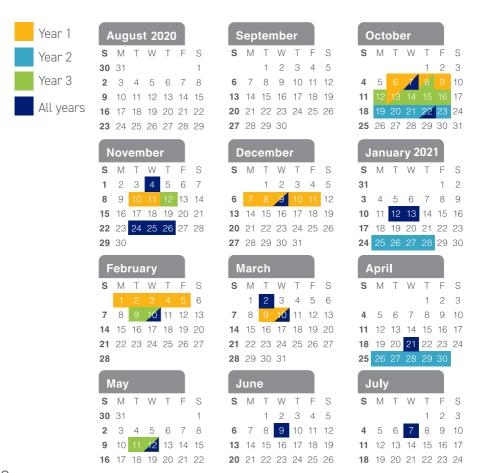
Faraday Institution

PhD Training Programme Overview - 2020/2021

Due to the constraints placed on face-to-face events in the light of the global pandemic, all training is planned to be delivered online for this academic year unless otherwise stated.

However, there is a chance that WMG Battery School February 2021 for the Year 1 cohort may run at the University of Warwick as a residential week, so please keep diaries clear accordingly.

It is our hope that industry tours can be arranged when guidance allows.



Faraday Institution

Year 1 PhD Training Programme

Welcome to the Faraday Institution's PhD programme in energy storage. The Faraday Institution aims to prepare its PhD research community for battery related careers in academia, industry, policy making and more, where they can not only participate in one of the most exciting research moments of our generation, but also be prepared to lead in the future. Faraday Institution PhD researchers will have access to networking opportunities, industry visits, mentorship, internships, as well as quality experiences that will further develop knowledge, skills, and aspirations. Further, participants in this programme will work on Faraday Institution research projects, alongside some of the best scientists and engineers in the UK, to solve pressing challenges in batteries and energy storage.

This programme of bespoke battery-related courses, delivered by experts in the field, ensures students are equipped with the in-depth knowledge and skills needed to maximise the potential of their research projects. The programme includes week-long training modules such as the "Battery Safety Course" and "WMG Battery School".

A range of battery-related industry talks provide PhD researchers with valuable insights into the application of battery technologies. These include insight about the research focused work of Nissan, research facilities at Warwick Manufacturing Group (WMG), Diamond Light Source as well as ISIS Neutron and Muon Source.

"Professional and career development are integral to enabling researchers to develop their full potential." Researcher Development Concordat 2019*

* Researcher Development Concordat (2019)



Tuesday 6th - Friday 9th October 2020

Welcome Interview Video Call (compulsory)

with Fran Long, Education and Training Co-ordinator

This is an opportunity to learn more about the Faraday Institution and the exciting training plans for the year ahead. It also enables the Faraday Institution to get to know each PhD researcher and understand their individual career aspirations. A video call will be scheduled with each participant during this week.

Tuesday 13th October 2020 14:00 - 15:00 Introductory Cohort Call (compulsory)

A chance to meet the rest of the cohort.

Tuesday 10th November 2020

Introduction to the Faraday Institution (compulsory)

Meet the FI HQ team and learn more about the research project portfolio.

Williams Advanced Engineering Talk

Gain industry insights from Rob Millar, Head of Electrical and Battery Systems at Williams Advanced Engineering and Expert Panel Member at the Faraday Institution. The Formula E battery was developed at Williams Advanced Engineering and participants will be able to discover more about how it propels cars to high speeds, yet still needs to be practical in terms of safety, aerodynamics, range and recharging times. Also hear about what a role as a battery engineer entails.



Wednesday 11th November 2020

STEM Ambassador Training 1 (compulsory)

with Fran Long (STEM engagement specialist) and Claire Hamnett (Science Learning Partnership)

STEM (Science, Technology, Engineering, Maths) Ambassador training will equip PhD researchers with the skills to share their research in relatable and engaging ways to a range of audiences, including young people, with the aim of inspiring the

next generation to consider careers in the field of energy storage and battery technology.

This will include receiving your own mini 'Faraday Fully Charged Battery Box' of resources for STEM outreach in collaboration with the Curiosity Box.





Monday 7th - Friday 11th December 2020 Battery Safety Course (compulsory)

Hosted online by Newcastle University

Lithium-ion batteries have become the industry standard for rechargeable batteries due to their high energy densities, long life, and competitive prices. They do, however, come with considerable safety issues as they contain flammable materials that may combust when cells fail. While safety protocols and risk mitigating processes are increasingly successful at avoiding failure, lithium-ion battery fires and accidents do occur, which is why a better understanding of the fundamentals of battery technology is essential to mitigate future incidents.

This course seeks to take its attendees, coming from a broad range of expertise and experience, through the science that underlies lithium-ion technology. From basic electrochemistry to module integration, battery system operation, typical methods employed to monitor and maintain system health, as well as the hazards and risks associated with incorrect battery management.

Monday 1st - Friday 5th February 2021

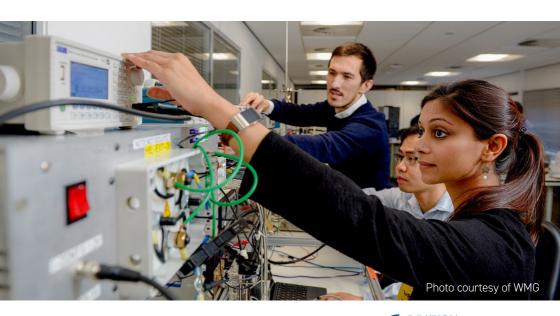
WMG Battery School (compulsory)

At Warwick University or online tbc

WMG will be sharing the knowledge and expertise of their world-class research and teaching staff. Delegates will learn about battery cell production

"It's the true wonder of science that can get people excited and get people to aspire." Dr Maggie Aderin-Pocock, Space Scientist

through lectures, live discussions and either practical lab sessions or pre-recorded demonstrations from the state-of-the-art battery, materials and pilot line facility.



Tuesday 9th - Wednesday 10th March 2021





with Fran Long (STEM engagement specialist) and Claire Hamnett (Science Learning Partnership)

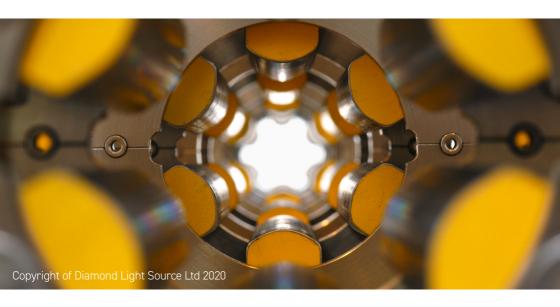
This two-day STEM Ambassador training course culminates with attendees presenting their research in creative, age-appropriate ways, to inspire pupils in schools about the race to electrify the UK and develop the next generation of batteries whilst raising STEM career aspirations. What better time to enthuse the next generation than British Science Week!

Tuesday 9th - Wednesday 10th March 2021 Virtual tours of Harwell Science & Innovation Campus

Newcastle University

The programme includes talks about research facilities on the Harwell Science & Innovation Campus:

- Diamond Light Source is the UK's national synchrotron and is one of the most advanced scientific facilities in the world. Its pioneering capabilities are helping to keep the UK at the forefront of scientific research. Faraday Institution Research Fellows use beamlines here as part of their battery research.
- ISIS Neutron and Muon Source is a world-leading centre for research at the STFC Rutherford Appleton Laboratory. The suite of neutron and muon instruments give unique insights into the properties of materials on the atomic scale.
- The Central Laser Facility (CLF) is one of the world's leading laser facilities with advanced, compact, tuneable lasers that can pinpoint individual particles, providing scientists from the UK and Europe with an unparalleled range of stateof-the-art laser technology.



"The massive investment in the battery industry is unprecedented."

Robert Llewellyn, The Fully Charged Shov



Faraday Institution

Year 2 PhD Programme

Energy storage technologies are at the centre of a global research and development race. The uptake of these disruptive technologies will have a significant impact on the marketplace, policy making, economics, and supply chain resource availability.

The prevailing theme of the Faraday Institution's second year of PhD programming is a "mini MBA" on energy storage and entrepreneurship. The principal objective is to prepare our researchers with the knowledge and skills required to contextualise the global, industrial, and policy aspects of energy storage in which their research has the opportunity to make an impact. Further, the training looks to give our researchers the necessary skills to become leaders in their own right—in academic, industrial, governmental and entrepreneurial settings—for the benefit of the researcher and the UK

Specific courses include personal development and strength identification, presentation skills, negotiations, leadership development, R&D project management, energy policy making, and entrepreneurship.

Monday 19th - Friday 23rd October 2020 Mini MBA Week 1 (compulsory)

Strength Profiling, with The Art of Work

Utilising Strengthscope, a tool and a methodology to enable participants to discover and develop strengths, this course will reveal the underlying qualities that energise each of us. By striking the

"Knowing yourself is the beginning of all wisdom." Aristotle

Aristotle, Greek philosopher

right balance between developing strengths and reducing performance risks, participants will learn how to achieve higher levels of resilience, confidence, engagement and success.

Specifically, this programme examines:

- Participants' unique combination of strengths and how to develop these to achieve exceptional results
- Positive ways of working that will improve confidence, motivation and success in any situation



Dynamic Presenter, by Body Talk

Participants will benefit from advanced techniques to increase their personal influence in order to give greater respect, build stronger relationships and grow rapport with the people with whom they work. These are skills that are transferable for academic and industry careers. This workshop, comprising sessions on theory, personal coaching, and purpose, offers tools to be more effective in daily interactions. Techniques will be outlined to improve personal impact in phone calls, one-to-one conversations, emails and important meetings.

Participants will be coached in delivering their knowledge and scientific content in an engaging and compelling way to a variety of different audiences. Topics covered will include:

- Dynamic and engaging communication
- · Presenting with confidence
- · Making scientific content and slides more engaging
- Storytelling
- · Engaging different audiences
- Understanding virtual communication

Online workshops, small group coaching sessions and assigned tasks will ensure personalised feedback and individual participant skills development.

In advance, participants will need to complete a survey and prepare a brief, 5-minute presentation. During the week there will be a video project.

"Believe in yourself, and make other believe in you and your ideas." Baroness Karren Brady, Business Leader



Negotiation Skills, Institution of Mechanical Engineers (IMECHE)

Researchers negotiate as part of everyday life, whether on the price of lab equipment, a pay rise or an extension to a deadline. This programme has been designed to provide researchers with an opportunity to learn tools and techniques for negotiating in a variety of internal and external scenarios.

Monday 25th - Thursday 28th January 2021 Mini MBA Week 2 (compulsory)

Project Management: Your PhD and Beyond with Skillfluence

This interactive workshop will explore the practical application of project management to research projects. Working through a project lifecycle we will explore:

- · How to work with collaborators and stakeholders to define project success
- How to effectively plan projects taking into account the iterative nature of research
- · How to pre-empt issues and risk manage the project
- How to assess progress and resolve issues with the project

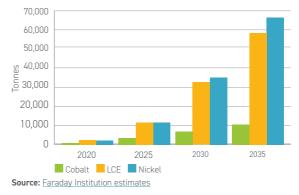
"Few inventions have changed our lives as much as the battery. I'm excited that more inventors and investors are being attracted to the quest to build a better one." Bill Gates, Entrepreneur & Philanthropist



The Global Market for Minerals Supply, Batteries and EVs with Benchmark Mineral Intelligence

In this session the global market for electric vehicles, the growing demand for battery cell production in the UK, and the need for a UK-based supply chain to support the industry will be discussed. The world's hunger for batteries will be translated into a minerals supply chain context, including concerns about human rights abuses, limited supply, and volatile markets.





Jaguar Land Rover (JLR)

An in-depth discussion with Dr Valentina Gentili, Advanced Battery Technical Specialist at Jaguar Land Rover and her research engineering team, to learn more about the company's innovations. JLR have committed to electrify all new models from 2020 and were first to market with their premium electric SUV, the Jaguar I-PACE, which won an unprecedented hat-trick of awards in 2019: World Car of the Year, World Car Design of the Year and World Green Car.

Cell prototyping with Dr Alex Roberts

Participants will explore the process of cell prototyping – the first step between lab discovery and cell manufacture, with Dr Alex Roberts of Coventry University, who is one of the Faraday Institution's Industrial Fellows.

Getting Social: A Guide to Social Media for Researchers with Skillfluence

A workshop that constantly evolves to take into account the fast-moving nature of social media and that features up to date case studies and examples. Displaying work on social media may be straightforward, but ensuring it is used to effectively promote the latest research and boost ones' professional researcher identity, is more challenging. This workshop takes participants through the main social media channels and looks at how to create short, sharp, sharable messages that foster meaningful interactions.

What the course will cover/learning outcomes:

- Using social media as a research tool
- Raising your profile with social media
- Twitter, LinkedIn, Instagram and Facebook
- · How and who to connect with

"Science is not finished until it is communicated."
Professor Sir Mark Walport,
Chief Executive UKRI

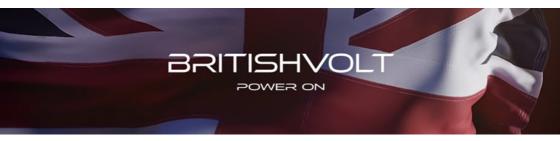


Johnson Matthey (JM) - Battery Materials

Battery technology is going through a period of transformation. The automotive industry is approaching a crucial tipping point. A once in a lifetime transformation of the automotive powertrain towards battery electric vehicles brings a future in which EVs are the norm closer every day. Consumers are looking to automotive OEMs to provide vehicles that meet their sustainability expectations while also hitting performance targets in terms of power, range or recharge rates. Cathode materials, like JM's next generation ultra-high energy density eLNO® and LIFE POWER® LFP, are the key to unlocking this puzzle. With the ever-increasing use of technology in every part of our lives, battery materials are equally important beyond automotive applications too. JM battery materials experts will share their cutting-edge work.

Britishvolt

Britishvolt is looking to lead the Lithium-ion, and beyond Lithium-ion, battery industry by implementing a sustainable, highly advanced manufacturing and business strategy to deliver on the exacting needs of its customers and assist in the acceleration of sustainable transport and the renewable energy sector. Attendees will learn more about the planned Gigasite manufacturing facility that will be one of the largest manufacturing plants in Europe, set on a 80+ hectare site that will also co-locate supply chain partners and green low carbon energy production. Keeping supply chains as short as possible and creating a vertically integrated business structure will ensure that costs are kept as low as possible, logistics chains are short and embedded CO₂ emissions are minimised.



UK Battery Industrialisation Centre (UKBIC)

Learn about UKBIC, a pioneering concept in the race to develop battery technology for the transition to a greener future. Part of the UK Government's Faraday Battery Challenge, the publicly-funded £130 million production development facility can be accessed by any organisation with existing or new battery technology – if that technology will bring green jobs and prosperity to the UK.

Monday 26th - Friday 30th April 2021

Mini MBA Week 3 (compulsory)

What's the Market Opportunity for my Research? With Imperial College London

Going from an Idea to a Business Model

This workshop will explore the techniques needed to take a potential business idea and turn it into an effective business model. Topics will include:

- · Creating a business model canvas
- Explaining the difference between market-pull and technology-push
- Recognising different types of innovations
- Designing a product or service that could be a potential business
- Analysing the competitive environment of your business
- · Analysing and evaluating your business model canvas

"Starting and growing a business is as much about the innovation, drive, and determination of the people behind it as the product they sell."

Elon Musk, Technology Entrepreneur



Commercialising your Business Model

Participants will have the opportunity to create a business model canvas to explore how their ideas will work as a potential business.

- Designing your own business models
- ${\boldsymbol \cdot}$ Systematically understand, design and differentiate new business models
- Facilitate innovative ideas for novel products and services
- Differentiate between product and business model innovation
- · Rapid prototyping of business models
- Understand principles of marketing, competitive advantage for new business models
- · Basics of entrepreneurial finance and introduction to financial forecasting template

○ How to Run a Research Lab.

The role of a research leader involves many different aspects from managing a lab, ensuring that health and safety is maintained, to promoting the work of the group ensuring that health and safety is maintained, to promoting the work of the group and growing the people they manage. This workshop will give individuals the skills, insights and tools they need to effectively lead a research lab and group.

On completion of this module, participants will have considered:

- Funding related responsibilities
- Frameworks for industrial collaboration
- Pathways to impact
- Articulating research challenges and visions
- Conflict resolution
- Health and safety
- · Group management and growth
- · Social media
- · Career development

"I find out what the world needs, then I go ahead and try and invent it."



Faraday Institution

Year 3 PhD Programme - 2020/2021

Equipping Faraday Institution PhD researchers with the knowledge and expertise needed to embark on successful careers (whether that be in academia, industry or policy making) is a key aim of the programme. At the heart of the Year 3 training is the development of the skills needed to secure and undertake a valuable internship.



September - November 2020

Career 101 (compulsory)

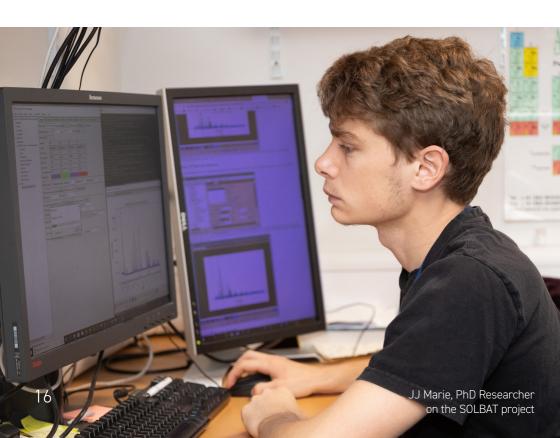
Individual coaching calls for each of the Year 3 Faraday PhD Researchers along with their supervisor and the Faraday Institution Education and Training Co-ordinator, to have a personalised review of their career development goals.

Thursday 8th October 2020 How to Complete Your PhD on time with Skillfluence (compulsory)

Participants learn a combination of project management, productivity and time management skills and methods applied specifically to the challenge of completing a high-quality PhD thesis on time with minimal stress and anxiety. The workshop addresses 'big picture' issues as well as providing specific productivity 'tips and tricks'. Participants will leave the workshop with increased confidence and optimism about completing their PhD thesis on time.

Specific areas to be covered include:

- · Starting well
- Designing for success
- Organising for efficiency
- · Project management
- Potential risk factors
- Understand the key steps in the process
- Time management essentials

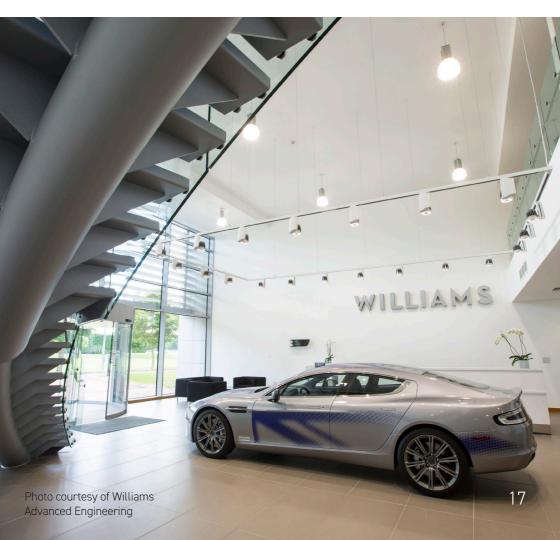


Monday 12th - Friday 16th October 2020

How to Gain Trust, Rapport and an Internship with Simantics (compulsory)

Faraday Institution PhD researchers have access to many industry contacts and are expected to facilitate their own internships. Their challenge lies in how to strike the right tone with their initial contact and how to confidently turn their first conversation into one of trust, rapport and the foundation of a good relationship, ultimately resulting in an offer.

The training comprises a range of whole group sessions, set tasks with written feedback and small group coaching dispersed throughout the week.



Thursday 12th November 2020

Remote Interview Training with Simantics (compulsory)

Having established connections in industry, Faraday Institution PhD researchers will face interviews for internships or jobs. For the foreseeable future these will be conducted remotely. While comfortable in their field of expertise, researchers also need a host of 'soft skills' to make the right impression on interviewers in a short time on a remote platform. This training addresses both the challenge of communicating comfortably and professionally on camera and also those typical interview challenges of nerve handling, not feeling authentically 'you', feeling stumped by a question, having nothing to say, or having too much to say.

The training day will include small group coaching to enable each participant to receive personalised guidance on their interview technique.

Tuesday 9th - Wednesday 10th February 2021

Thesis Writing with Scriptoria (compulsory)

This course aims to help early-career researchers improve the organisation, clarity, and style of their scientific writing. In this course we cover how to plan, develop and produce a well-written research thesis – with additional tips on how to adapt writing for journal articles. We focus on the writing skills that PhD researchers need to succeed: writing concisely, writing precisely, and using good style to engage an audience. The course also teaches participants the formal writing cycle (the process by which professional writers tackle a writing project), including how to properly edit and proofread text. Finally, we discuss several practical tips for using MS Word and reference manager software to make the writing process more efficient.

Topics covered include:

- What makes a good PhD thesis
- · Critiquing thesis text
- Effective data presentation
- · Writing clearly and avoiding common errors
- Improving your style and keeping your audience interested
- $\boldsymbol{\cdot}$ The writing and editing cycle
- Time-saving techniques in MS Word

"All scientists must communicate their work, for what is the point of learning new things about how the world works if you don't tell anyone about them?"

Jim Al-Khalili, Professor of Theoretical Physics

Tuesday 11th - Wednesday 12th May 2021

Grant Writing with Scriptoria (compulsory)

This course is aimed at early-career researchers who are beginning to write fellowship and research grants. In this course we cover how to plan, develop and write high-quality research proposals for relevant funding agencies for physics, science and engineering. The course takes participants through the process by which funders evaluate proposals and reviews examples of real proposals in an interactive session, discussing the positives and negatives of each part. Proposals are broken down by section to teach participants how to be clear and persuasive while remaining concise. A focus is placed throughout on communicating at the right level for the review panel, who may not be experts in the field.

Topics covered:

- How to find funding opportunities
- The proposal evaluation process
- Writing research proposals
- Adapting your text for non-specialists
- Critiquing real proposals
- · Generating proposal ideas and evidence



Additional Faraday Institution opportunities open to all Faraday researchers Thursday 22nd October 2020, 7:00 - 8:30pm Additional Faraday Institution training opportunities open to all Faraday PhD

Royal Institution Public Outreach Lecture (optional)

The Hunt for New Batteries, Professor Serena Corr, University of Sheffield

Sign up via the Royal Institution website

The Faraday Institution continues its relationship with the Royal Institution, a specialist in the dissemination of scientific content via public engagement events to capture the imagination and curiosity of the general population. Serena Corr, Principal Investigator of the Faraday Institution's FutureCAT project, and Professor in Functional Nanomaterials at University of Sheffield, will outline how the hunt is on for the next generation of batteries that will power electric vehicles and help the transition to a renewables-led future. She will outline the science behind the battery. discuss why researchers are hunting for new batteries materials and investigate what kind of tools they use to pave this pathway to discovery. A good opportunity for STEM Ambassadors to see science communication at its best.

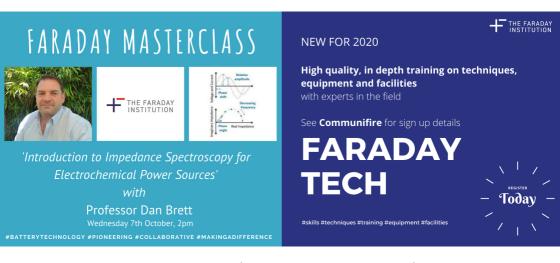


Faraday Masterclasses (dates subject to change)

Online webinars with expert presenters one Wednesday each month at 2:00pm.

- 2020 7th October, 4th November and 9th December
- 2021 13th January, 10th February, 10th March, 21th April, 12th May, 9th June and 7th July

Recordings of past sessions are available on Communifire, the Faraday Institution online platform.



Faraday TECH Courses (dates to be announced)

High quality, in-depth training on techniques, equipment and facilities with experts in the field.

Recordings of past sessions are available on Communifire.



Tuesday 24th - Thursday 26th November 2020

Faraday Institution Annual Conference 2020 - Virtual (compulsory)

Joining over 400 energy storage researchers and industry partners, this is an opportunity to hear from a range of expert presenters, interact with researchers at all levels and all projects, get the latest news about the research of the Faraday Institution and much more. The programme includes a day on the 24th, designed. especially for early career researchers.



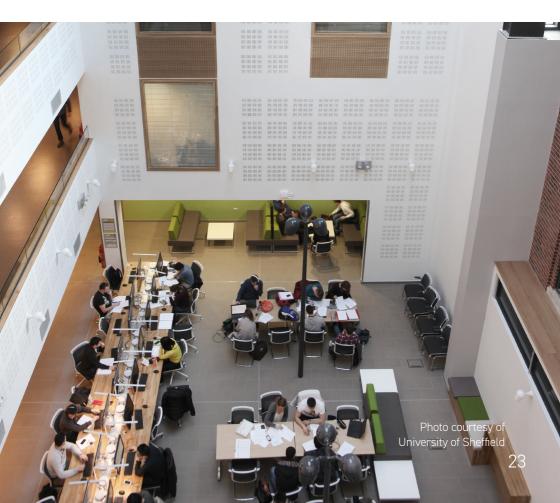
Tuesday 12th - Wednesday 13th January 2021

Energy Storage Conference (optional)

Hosted by the University of Sheffield

Join other early career researchers to explore the following:

- · Conference themes
- Mechanical/kinetic storage
- Transportation
- Built environment
- Thermal/chemical/thermochemical storage
- Grid scale storage/power management and control
- Electrochemical storage
- Social, policy and economics
- $\boldsymbol{\cdot}$ Energy systems and advanced tools



Tuesday 2nd March 2021
WISE Conference (optional)
York
Conference themes: Inclusive. Transformative. Driving sustainability.
In 2021, the UK needs inclusive growth AND transformative action the In 2021, the UK needs inclusive growth AND transformative action that delivers sustainability. Women and men working together to solve the challenges of the future. WISE campaign for gender balance in science, technology and engineering and highlight that:

- Inclusion delivers innovation
- Innovation delivers sustainability

· Inclusive STEM attracts and keeps the best talent

The Faraday Institution are members of WISE and fully supportive of the vision. Join with a dynamic community as well as hear from the Faraday Institution's Professor Serena Corr.





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