



# The Faraday Institution PhD Training Programme Course Guide

# 2019/2020





**“Professional and career development are integral to enabling researchers to develop their full potential. Researchers must be equipped and supported to be adaptable and flexible in an increasingly diverse global research environment and employment market.”**

Researcher Development Concordat, Sept 2019\*

**The Faraday Institution is actively committed to attracting, nurturing and empowering a dynamic and diverse workforce for the fields of energy storage and battery technology.**

\*<https://www.vitae.ac.uk/policy/concordat>

# Faraday Institution

## Year 1 PhD Programme – 2019 / 2020

Welcome to the Faraday Institution's PhD programme in energy storage. The Faraday Institution aims to prepare its PhD research community for careers in academic and/or industrial research 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 residential training modules such as the "Battery Safety Course" in Newcastle and "WMG Battery School" in Warwick.

A range of battery-related industry tours provide PhD researchers with valuable insights into the application of battery technologies. These include research-focused tours of Williams Advanced Engineering, Nissan, Hyperdrive and research facilities at Warwick Manufacturing Group (WMG), Diamond Light Source, and ISIS Neutron and Muon Source.



**"We are committed to developing a dynamic and diverse pool of talent as we raise the next generation of battery scientists and engineers."**

Neil Morris



**Tuesday 7 – Friday 11 October 2019**

**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 is also an opportunity for the Faraday Institution to get to know each student better and understand career aspirations. A video call will be scheduled individually with each participant during this week.

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**Wednesday 6 - Thursday 7 November 2019**

**STEM Ambassador Training 1 (compulsory)  
with Fran Long (STEM engagement specialist) and Claire  
Hamnett (Science Learning Partnership)**

**The Faraday Institution, Quad One, Becquerel Avenue,  
Harwell Campus, Didcot, OX11 0RA**



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.

**To include a tour of Williams Advanced Engineering**

As part of the tour of Williams Advanced Engineering, participants will gain insights from Rob Millar who heads up the battery and electronics programmes there, and who is a member of the Faraday Institution's expert panel. At Williams, participants will be able to discover more about the Formula E battery that propels cars to speeds of up to 225kph, yet still needs to be practical in terms of safety, aerodynamics, range and recharging times. In addition, participants of the tour will get a behind-the-scenes tour of the Williams workshop and the Heritage Collection.

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The Faraday Institute, Harwell, Oxfordshire

**Sunday 8 – Friday 13 December 2019**

## **Battery Safety Course (compulsory)**

**Newcastle University**

Lithium ion batteries have become the industry standard for rechargeable storage devices, yet they have higher energy densities and include materials that are more flammable than legacy batteries. While many safety protocols have been put into place, lithium-ion battery fires and accidents do occur and present risks that can be mitigated if the technology is well understood.

The course seeks to take attendees, with a broad range of expertise and experience, from basic electrochemistry through to the science and technology of lithium ion batteries, including typical methods employed to monitor these devices and the hazards and risks associated with their use and abuse.

**Year 2 Faraday Institution PhD researchers will be in Newcastle at the same time; there will be a number of networking opportunities including some evening gatherings.**

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**Monday 9 December 2019**

## **Electrochemistry and battery safety lectures with experts in the field**

**Newcastle University**

- Professor Paul Christensen (Prof of Pure & Applied Electrochemistry, Newcastle University and Co-Investigator on the ReLiB project)
- Gareth Taylor (Evince Technology)
- Simon Kirsopp (Tyne & Wear Fire & Rescue Service)
- Dr Pierrot Attidekou (Newcastle University)
- Dr Oliver Heidrich (Newcastle University)
- Mr. Jonas Carsten (Underwriters' Laboratories)

Participants will both deepen and broaden their understanding of applied electrochemistry in this field, including specific battery types, characterisation techniques and battery safety issues that will set their research projects in a wider context.



YEAR 1

**Tuesday 10 December 2019**

## **Lectures on battery safety and infrastructure**

**Newcastle University**

- Dr Colin Herron (Zero Carbon Futures)
- Mike Swindells (Envision AESC Battery Plant)
- Professor Paul Christensen (Newcastle University)
- Martin Feeny (Energy Systems Expertise Technician, Newcastle University)
- Dr Simon Lambert (Newcastle University)
- Dr Shirley Coleman (Newcastle University)

(Evening event)

### **An audience with Phil Blythe**

**Chief Scientific Advisor for the Department of Transport**

**The Boiler House, Newcastle University**

Dr Colin Herron, Managing Director of Zero Carbon Futures, will interview Phil Blythe (Chief Scientific Advisor for the Department for Transport (DfT) and Professor at Newcastle University) for an engaging discussion regarding changes in the UK's transport policies as the UK decarbonises. This will be an opportunity to engage Prof Blythe on questions of how science influences policy in the UK and what other efforts DfT will be making to ensure the UK is ready to go fully electric.

**Wednesday 11 and Thursday 12 December 2019**

## **Vehicle Architecture & Safety**

**Gateshead College**

The objective of the day will be practical hands on training and lectures, covering:

- Whole vehicle system
- Chargers
- Battery
- Inverters
- Motors

The course includes lectures followed by component/vehicle examination. The session will also cover safe working with an EV.

## **Tours of Nissan MUK Plant, Zero Carbon Futures, Hyperdrive and Connected Energy**

Nissan Motor Manufacturing UK (NMUK) in Sunderland is one of the biggest car-manufacturing plants in the UK. Here Faraday Institution PhD researchers will get a behind-the-scenes tour of the plant and watch the Nissan Leaf coming off the production line, seeing the result of battery technology developments first-hand.

**Friday 13 December 2019** (morning)

## **Course reflection and evaluation**

**Lit & Phil Library, 23 Westgate Rd, Newcastle upon Tyne NE1 1SE**



**Tuesday 14 and Wednesday 15 January 2020**

**STEM Ambassador Training 2 (compulsory)  
with Fran Long (STEM engagement specialist) and Claire  
Hamnett (Science Learning Partnership)**

**The Faraday Institution, Quad One, Becquerel Avenue, Harwell  
Campus, Didcot, OX11 0RA**



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



## **Tour of Harwell Science & Innovation Campus**

The programme includes visits to research facilities on the Harwell Science & Innovation Campus:

- Diamond Light Source is the UK's national synchrotron, one of the most advanced scientific facilities in the world, and its pioneering capabilities that 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 which can pinpoint individual particles, providing scientists from the UK and Europe with an unparalleled range of state-of-the-art laser technology.

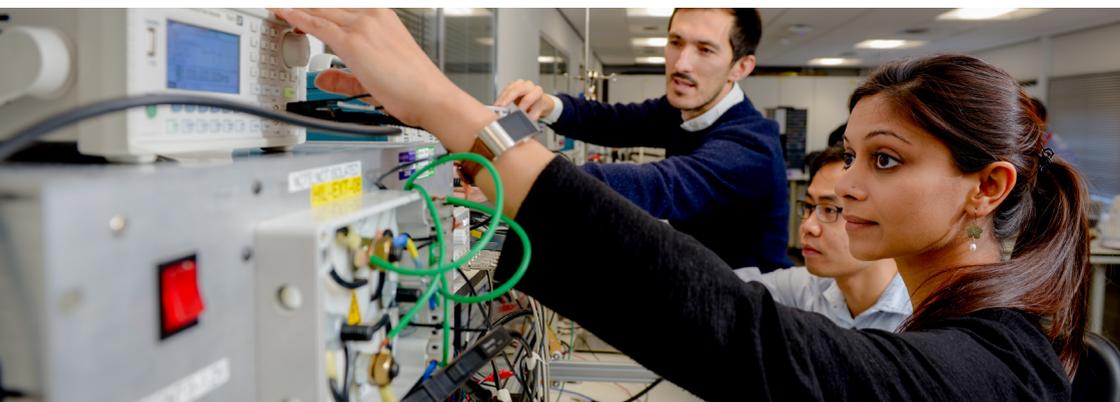
**Monday 10 - Friday 14 February 2020**

## **WMG Battery School** (compulsory)

**Arden, Warwick Conference Centre, Kirby Corner Road, Coventry CV4 8AH**

WMG are hosting this Battery School at their Energy Innovation Centre (EIC) to share the knowledge and expertise of WMG's world-class research and teaching staff. Delegates will learn about battery cell production through lectures and practical lab sessions at the state-of-the-art battery, materials and pilot line facility—the largest of its kind in the UK.

**Year 2 Faraday Institution PhD researchers will be in Warwick at the same time creating further networking opportunities.**



**Wednesday 11 - Saturday 14 March 2020**

## **The Big Bang Fair** (compulsory)

**Halls 17-20 at the NEC, Birmingham, West Midlands, B40 1NT**



**The Big Bang**  
UK Young Scientists & Engineers Fair

The Big Bang UK Young Scientists & Engineers Fair is the largest celebration of science, technology, engineering and maths (STEM) for young people in the UK. The Fair is an award-winning combination of exciting shows, interactive workshops, hands-on activities and careers information from STEM professionals. It aims to show young people (primarily aged 7-19) the exciting and rewarding opportunities out there for them with the right experience and qualifications, by bringing classroom learning to life. Being part of the Faraday Institution team gives PhD researchers practice at conveying their research in a relatable way to a diverse audience. Having attracted over 80,000 visitors in 2019, The Big Bang Fair is made possible thanks to the collaborative efforts of over 200 organisations.

# Faraday Institution

## Year 2 PhD Programme – 2019 / 2020

Energy storage is at the centre of a global research and development race. As a disruptive technology, however, it has dimensions that resonate in 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 develop our researchers with 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.



**Tuesday 10 September 2019**

### **'The Future of Mobility' panel discussion (optional)**

**Royal Institution, 21 Albemarle St, Mayfair, London W1S 4BS**

How will the electrification of transport change how we move around in the world of the future? How will people engage with future transportation systems and how will that affect how people live their lives? Will autonomous vehicles be a common means of transportation; on road, at sea and in the air? These questions and many more will be answered by our panel of experts in this event supported by the Faraday Institution.

This event is the final of a three-part public outreach series entitled **'The Batteries are Coming!'**

**Thursday 26 - Friday 27 September 2019**

## **Sandhurst STEM Careers Fair (optional)**

**Royal Military Academy Sandhurst, Camberley, Surrey, GU15 4PQ.**

The purpose of the event is to showcase to 11-16 year-olds the wide range of careers available in STEM and inspire future generations of scientists, technicians, engineers and mathematicians. Faraday Institution participants will put their STEM ambassador training to use, meeting with students to inspire them to consider careers in the energy storage and battery technology field.



**Friday 25 October 2019**

## **Fully Electric Engagement Programme (optional)**

**Edgbaston Park Hotel and Conference Centre, 53 Edgbaston Park Road, Birmingham B15 2RS**

This programme is run in conjunction with SEO London and the Faraday Institution and is designed to inspire undergraduate students from backgrounds historically under-represented in STEM to consider careers in the field of energy storage and battery technology. Members of our PhD researcher community will be invited to present on their careers, lessons learned, challenges and to demonstrate excitement about battery research alongside our industry partners.

**“The massive investment in the battery industry is unprecedented.”**

Robert Llewellyn,  
The Fully Charged Show



**YEAR 2** **Monday 18 - Wednesday 20 November 2019**  
**The Faraday Institution Conference and Review Meeting**  
(compulsory)

**Warwick Conference Centre, The Slate, Coventry CV4 7SH**

Along with 200 other energy storage researchers, participants will attend the Faraday Institution review meeting. Session topics include intellectual property, lessons learned from international large-scale energy storage collaborative projects, industry perceptions on state-of-the-art battery technologies, economic and market studies completed by the Faraday Institution, research project updates, and an introduction to the new set of Faraday Institution research projects launched this autumn.

There will be opportunities for networking, discussions with early-career researchers, and presenting research via posters or talks.

**Monday 18 November 2019**

**‘Compass for Life’ leadership development** (compulsory)

**Warwick Conference Centre, The Slate, Coventry CV4 7SH**

Floyd Woodrow, one of the youngest people ever to have been selected for the elite SAS, and a renowned speaker on leadership and performance coaching, will guide us through a one-day coaching experience.

Woodrow leads a values-based transformational coaching service for elite international athletes, corporate teams and academia. He brings together a unique approach that unifies the best aspects of leadership training currently available into a simple, concise, and effective framework. It complements all current leadership methodology by aligning them with each “cardinal” so that everyone can have a compass for life that works for them as an individual, family, team or organisation.



Warwick Conference Centre, The Slate, Coventry

**Sunday 8 - Thursday 12 December 2019**

## **Residential Week 1 (compulsory)**

Newcastle University

**Monday 9 December 2019**

### **Strength profiling**

**Phil Mardlin, 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 getting the balance right 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

**Year 1 Faraday Institution PhD researchers will be in Newcastle at the same time; there will be a number of networking opportunities including some evening gatherings.**

**“Knowing yourself is the beginning of all wisdom.”**  
Aristotle

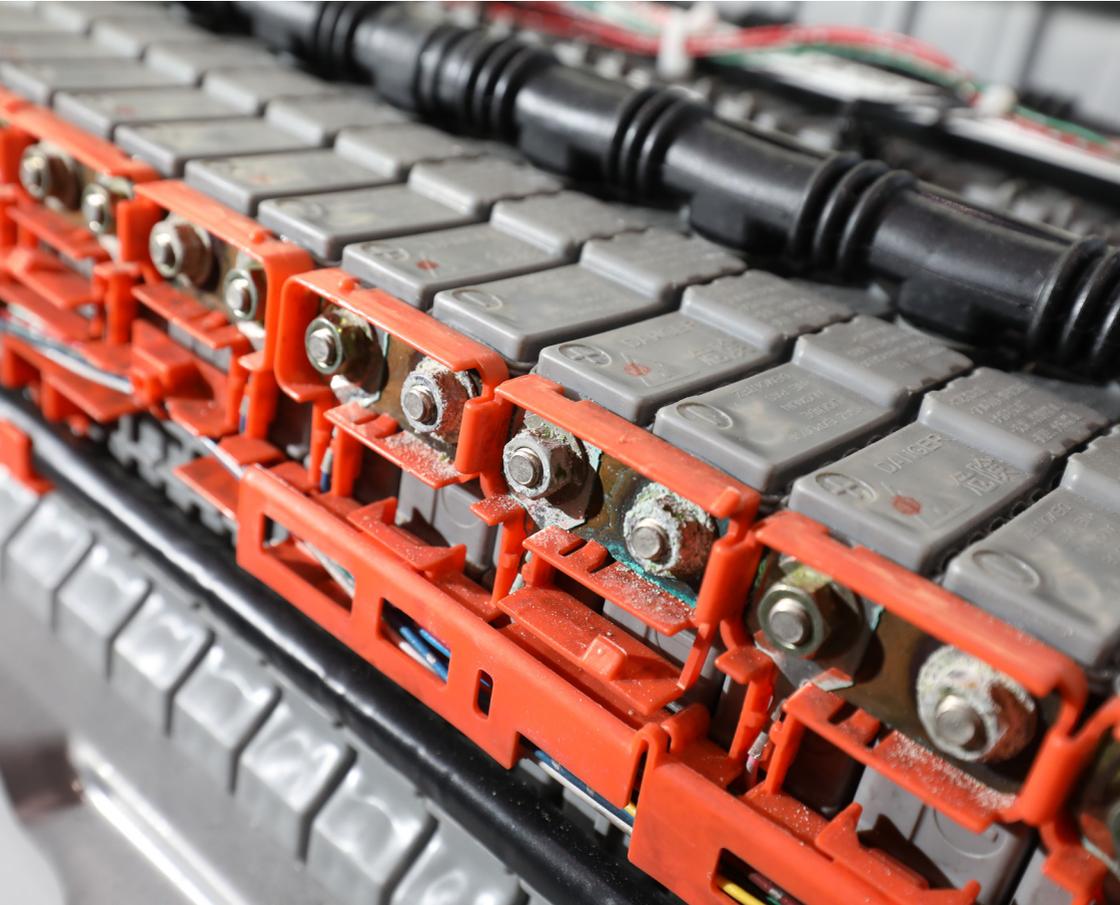


**Tuesday 10 December 2019**

## **Impact and Influence, 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, with techniques to improve personal impact in phone calls, one-to-one conversations, emails and important meetings.

In advance, participants will need to complete a survey and prepare a brief, 5-minute presentation.



**Tuesday 10 December 2019** (evening session)

## **An Audience with Phil Blythe**

### **Chief Scientific Advisor for the Department of Transport**

Dr Colin Herron, Managing Director of Zero Carbon Futures, will interview Phil Blythe (Chief Scientific Advisor for the Department for Transport (DfT) and Professor at Newcastle University) for an engaging discussion regarding changes in the UK's transport policies as the UK decarbonises. This will be an opportunity to engage Prof Blythe on questions of how science influences policy in the UK and what other efforts DfT will be making to ensure the UK is ready to go fully electric.

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**Wednesday 11 December 2019**

## **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. The course provides an opportunity for participants to practise these new skills and receive feedback on negotiation styles and preferences. Participants will leave the programme with a renewed confidence in seeking win-win outcomes in negotiations.

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**Thursday 12 December 2019**

## **Tour of Envision AESC Battery Plant**

Nissan's global battery business, including the plant in Sunderland that produces lithium-ion batteries for the Nissan Leaf, was sold in 2019 to Envision AESC. It is now a standalone entity with an annual turnover in excess of £300m. Participants will take a tour inside the battery cell production facility. This is a unique opportunity to see first-hand the commercial production of EV battery cells.

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**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



**Monday 10 - Wednesday 13 February 2020**

## **Residential Week 2** (compulsory)

Warwick Conference Centre, Arden, Kirby Corner Road, Coventry CV4 8AH

**Monday 10 February 2020** (Morning session)

### **Dynamic Presenter Masterclass, BodyTalk**

**Arden**

This course provides an opportunity to increase presence, credibility, and gravitas for pitches, meetings and presentations. Participants will:

- Script talks to make ideas and presentations more memorable, with examples including the formula used by Steve Jobs, to tell a story that compels people to listen
- Discover a complete spectrum of dynamic communication choices needed, to adapt and flex presentation style for each event, audience and message, to create a lasting and effective impact
- Use advanced storytelling techniques that make a message stick, as used by highly paid speakers to ensure that people fully engage with ideas from start to finish, creating a vision people remember

**“Believe in yourself, and make others believe in you and your ideas.”**  
Karen Brady



(Afternoon session)

### **The global market for minerals supply, batteries and EVs**

**Simon Moores, Managing Director, Benchmark Mineral Intelligence Ltd**

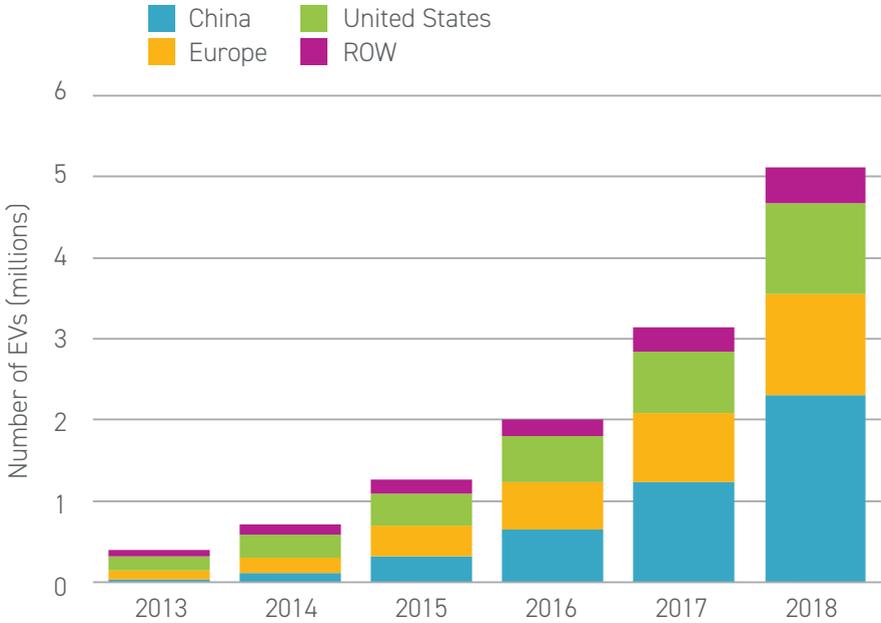
**Stephen Gifford, Head of Economics and Market Insights,**

**The Faraday Institution**

In this session, Moores and Gifford will discuss 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. Moores will also place the world's hunger for batteries into a minerals supply chain context, including concerns about human rights abuses, limited supply, and volatile markets.

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## Global stock of electric vehicles



Source: International Energy Agency, Global EV Outlook 2019

**Tuesday 11 February 2020**

## Project Management for Researchers (led by IMECHE)

**Arden**

This one-day course provides an introduction to project management for researchers who provide vital support within projects and who would like to learn how to manage their own project in the future. The programme is ideal for those who wish to take more control of their own work and contribute more effectively to the success of their projects and their organisation.

The emphasis is on practical, hands-on techniques to use immediately, and there will be opportunities to practise them during the course.

**Wednesday 12 February 2020** (Morning session)

## **Tour of Jaguar Land Rover (JLR), Coventry**

A behind-the-scenes tour of JLR will include a discussion with the 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.

(Afternoon session)

## **Tour of UK Battery Industrialisation Centre (UKBIC)**

### **Discussion with Isobel Sheldon, Head of Business Development**

Opening in 2020, UKBIC is part of the UK government's Faraday Battery Challenge. Through focused capabilities UKBIC will enable industry, via open access, to scale up and commercialise advanced technologies central to the development and manufacture of batteries, initially for the automotive sector but with wider application.

Participants will receive an insider's look at this new facility and will have the opportunity to meet with Isobel Sheldon, Head of Business Development at UKBIC.

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## **Spring 2020**

### **Undergraduate attraction challenge (compulsory)**

#### **Home university**

We know the positive influence peers, lecturers, supervisors and experts at one's own university have in inspiring future study and research in a particular field. Our PhD researchers will organise and present at an attraction event for undergraduate students at their home university, to inspire undergraduates to consider careers in energy storage and battery technology research. This is an opportunity to showcase available programmes such as summer internships and PhD positions.

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**Monday 20 - Thursday 23 April 2020**

**Residential Week 3** (compulsory)

**What's the market opportunity for my research?**

Imperial College London, South Kensington, London SW7 2AZ

**Monday 20 April 2020**

**Enterprising Skills and Entrepreneurial Attributes**

**Dr Helal Ahmed**

**Imperial College London**

Having an enterprising mind- and skillset will help anyone succeed in a career, whether in business, academia or other areas. This workshop will explore these concepts, how they link with being an entrepreneur, how well they describe the participants; and how this can be developed by a PhD researcher.

On completion of this workshop, participants will be able to:

- Identify key skills and attributes required to become an enterprising and entrepreneurial person
  - Analyse barriers to developing enterprising skills and entrepreneurial attributes and how they can be overcome
  - Identify key competencies linked to superior performers
  - Identify opportunities to develop enterprising skills and entrepreneurial attributes
  - Analyse and evaluate their own enterprising skills and entrepreneurial attributes using a SWOT analysis
- 



Tuesday 21 April 2020

## Business Model Innovation

Dr Rahul Bansal

Imperial College London

This workshop will allow participants to develop a potential business idea either from their own PhD research projects or an entirely new idea that would solve an energy related problem. Initially participants will generate ideas and then analyse and evaluate a few of them. Afterwards they will create a business model canvas to explore how their idea will work as a potential business.

On completion of this workshop, participants will be able to:

- Recognise the difference between market-pull and technology-push
- Design a product or a service that could be a potential business to solve a problem
- Recognise there are different types of innovations
- Create, analyse and evaluate a business model canvas



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

Thomas Edison



**Wednesday, 22 April 2020**

## **How to Run a Research Lab**

**Dr Billy Wu and Dr Greg Offer**

**Imperial College London**

The role of a research leader involves many different aspects from managing a lab, ensuring that health & 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 be able to:

- Analyse research challenges and create overarching visions
- Understand and apply different approaches for research group management/ growth
- Evaluate authentic performance
- Understand legal requirements for health and safety, and create a framework for a safe and efficient lab environment

(Late afternoon, one-hour)

## **Roundtable Discussion with Energy Entrepreneurs**

**Imperial College London**

Participants will be able to engage in an open discussion with a set of Faraday Institution Entrepreneurial Fellows, who have been provided with Faraday Institution funds to enable them to take their lab discovery and to commercialise it. Topics will include risk taking and the path to becoming an entrepreneur, the challenges of evolving an energy-related research project for further development, and the opportunities for funding a business idea. A representative from the clean-tech start-up company Brill Power will also share their first-hand experience.

**An early evening reception will follow.**

**“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



**Thursday 23 April 2020** (Morning session)

## **Audience with Rt Hon Sir Oliver Letwin MP**

**House of Commons tbc**

In an engaging discussion with prominent UK leader Sir Oliver Letwin, participants will have the opportunity to discuss how the UK forms energy policy, particularly how the intersections of science, energy and government work together to make national change. This is a unique opportunity to explore careers in science policy within government.

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**Tuesday 9 - Thursday 11 June 2020**

## **Pop-up Think Tank (UK Energy Research Centre)** (compulsory)

**Venue tbc**

Energy is a vital part of everyone's lives. There are complex energy issues that do not have one obvious solution - technological or otherwise.

In partnership with UKERC, the Faraday Institution will be hosting a "pop-up think tank," pulling together PhD-level energy researchers from across the United Kingdom, including those working externally to the Faraday Institution. The objective of the multi-day workshop will be to harness the intellectual abilities of the UK's next generation of energy researchers to think laterally and imaginatively about difficult energy issues. The best ideas will be presented to policymakers and practitioners, who are in a position to put them into action. This event will focus on a specific intractable issue where energy storage may play a solution.

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**YEAR 2 July 2020 tbc**

## **Energy Storage CDT Conference (optional)**

**Location tbc**

This conference, organised by the CDT (Centre for Doctoral Training), has been running since 2016 and all researchers in the energy storage community in the UK and internationally are invited to attend and discuss progress on energy storage research and applications in the power and energy sectors.

The conference covers all technology classes, as well as demonstrators and deployment at grid/city scale, transportation, social acceptability and policy, with sessions in the following topics:

- Storage for transportation
- Built environment storage
- Thermal/chemical/thermochemical storage
- Grid scale storage/power management & control
- Electrochemical storage
- Socio-political aspects for storage
- Energy systems & advanced tools

<http://www.energystorage-cdt.ac.uk/>

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**Tuesday 14 - Wednesday 15 July 2020**

## **Annual Student Conference in Metallic Materials (optional)**

**University of Sheffield, The Diamond, 32 Leavygreave Rd, Sheffield S3 7RD**

Students from around the UK with interests in all aspects of metallic materials are welcome to take part in this annual conference.

The aims are to provide students with an opportunity to present their work in a supportive environment and encourage students to establish links with other students, academics and industrialists throughout the UK.

<http://www.metallicscdt.co.uk/national-student-conference>

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#### CONTACT

Fran Long  
Education and Training Co-ordinator  
fran.long@faraday.ac.uk  
www.faraday.ac.uk  
01235 425134  
07741 853067



THE FARADAY  
INSTITUTION



**INDUSTRIAL  
STRATEGY**

UK Research  
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