Constance Crozier

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Research Interests

FUTURE POWER SYSTEMS GRID OPTIMIZATION MACHINE LEARNING HUMAN-IN-THE-LOOP

Education

2016-2020 **D.Phil** in Engineering Science, ***University of Oxford***

Thesis: The Impact of Domestic Electric Vehicle Charging on Electricity Networks

Advisor: Professor Malcolm McCulloch

2012-2016 **M.Eng** in Engineering Science (First Class), ***University of Oxford***

Thesis: Bayesian Non-Parametrics for the War in Afghanistan

Advisor: Professor Michael Osborne

Academic Positions

2020-pres **Postdoctoral Associate**, *University of Colorado Boulder*

Advisor: Professor Kyri Baker

Topic: Developed winning code for the ARPA-E Grid Optimization competition

2019-2020 **Technical Energy Specialist**, *Department of Business, Energy & Industrial Strategy*

Team Lead: Dr. Ian Llewellyn

Topic: Research for policy makers regarding electric vehicles and energy storage

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Prizes & Awards

2022 Rising Star in EECS, *UT Austin* (Selective workshop for underrepresented genders in academia)

2021 Outstanding Postdoc Award, *CU Boulder* (University-wide award, two given annually)

2021 ARPA-E Grid Optimization Competition Challenge 2 Prize Winner (**$140,000** prize)

2020 Winner of UK Power Networks Charge Challenge (Data science competition, solo entrant)

2017 Best Presentation at Manchester Energy and Electrical Power Systems Workshop

2015 Gibbs Prize for Best Part B Project, *University of Oxford* (Best research project out of 150 students)

2014 Overall Winner at Intern Hackathon, *Metaswitch Networks* (Around 40 interns in teams of 3)

2014-2016 Academic Scholarship, *Christ Church (University of Oxford)*

Grants

Funded ($450k total)

2022-2024 **Fast and robust strategies for large-scale mixed-integer SCOPF**
PI: Javad Mohammadi, Co-PIs: Kyri Baker, **Constance Crozier**
Budget: **$400,000**, Funding organization: *ARPA-E*.

2021-2022 **Predicting Binding Constraints using Physics-Informed Deep Learning**
PI: Kyri Baker, Co-PI: **Constance Crozier**
Budget: **$23,090**, Funding organisation: *Solea*.

2021-2022 **Efficacy and equity of demand response programs across socioeconimic groups**
PI: Kyri Baker, Co-PI: Barry Mather, Collaborator: **Constance Crozier**
Budget: **$25,000**, Funding organisation: *Renewable and Sustainable Energy Initiative*.

2021-2022 **Electric vehicle adoption and associated impacts on infrastructure and society**
PI: Kyri Baker, Co-PIs: Cristina Torres-Machi, Amy Javernick-Will, **Constance Crozier**
Budget: **$8,500**, Funding organisation: *RISE Seed Grant - University of Colorado, Boulder*.

Submitted (S) or Unfunded (U)

2022-2025 **Locational Demand Response for Equitable and Sustainable Electricity Networks** (S)
PI: Kyri Baker, Co-PI: **Constance Crozier**
Budget: **$369,275**, Submitted to: *NSF Civil Infrastructure Systems*.

Publications

Ordered reverse chronologically, my author position is highlighted in **bold**, mentored students denoted by underline. Open access versions are posted at: https://constancecrozier.github.io/pubs/

Journal articles - Published

[j.13] **C. Crozier**, K. Baker, The effect of renewable electricity generation on the value of cross-border interconnection, *Applied Energy*, 2022.

[j.12] A. Pigott, **C. Crozier**, K. Baker, Z. Nagy, GridLearn: multiagent reinforcement learning for grid-aware building energy management, *Electric Power Systems Research*, 2022.

[j.11] **C. Crozier**, K. Baker, B. Toomey, Feasible region-based heuristics for optimal transmission switching, *Sustainable Energy, Grids and Networks*, 2022.

[j.10] **C. Crozier**, C. Quarton, N. Mansor, D. Pagnano, I. Llewellyn, Modeling of the ability of a mixed renewable generation electricity system with storage to meet consumer demand, *Electricity*, 2022.

[j.9] K. Collett, S. Hirmer, H. Dalkmann, **C. Crozier**, Y. Mulugetta, M. McCulloch, Can electric vehicles be good for Sub-Saharan Africa?, *Energy Strategy Review*, 2021.

[j.8] **C. Crozier**, T. Morstyn, M. McCulloch, Capturing diversity in electric vehicle charging behaviour for network capacity estimation, *Transportation Research Part D: Transport and Environment*, 2021.

[j.7] **C. Crozier**, T. Morstyn, M. McCulloch, The opportunity for smart charging to mitigate the impact of EVs on the GB transmission and distribution systems, *Applied Energy*, 2020

[j.6] **C. Crozier**, M. Deakin, T. Morstyn, M. McCulloch, Co-ordinated electric vehicle charging to reduce losses without network impedance information, *IET Smart Grid*, 2020.

[j.5] T. Morstyn, **C. Crozier**, M. Deakin, M. McCulloch, Electric vehicle smart charging with battery voltage awareness using second-order cone programming, *IEEE Transactions on Transport Electrification*, 2020.

[j.4] **C. Crozier**, M. Deakin, T. Morstyn, M. McCulloch, The case for bi-directional charging of electric vehicles in low voltage distribution networks, *Applied Energy*, 2020

[j.3] K. Collett, M. Byamukama, **C. Crozier**, M. McCulloch, Energy and transport in Africa and South Asia, *Energy and Economic Growth*, 2020.

[j.2] **C. Crozier**, D. Apostolopoulou, M. McCulloch, Mitigating the impact of personal vehicle electrification: A power generation perspective, *Energy Policy*, 2018.

[j.1] J. Cao, **C. Crozier**, M. McCulloch, Optimal design and operation of a low carbon community based multi-energy systems considering EV integration, *IEEE Trans. of Sustainable Energy*, 2018.

Journal articles - Under review

[j.14] **C. Crozier**, A. Pigott, K. Baker, Robust and Privacy Preserving Demand Response for TSO-DSO Coordination, *Submitted to: IEEE Transactions on Smart Grid.*

Peer reviewed conference papers

[c.11] **C. Crozier**, K. Baker, Data-driven probabilistic constraint elimination for accelerated optimal power flow, *IEEE PES General Meeting*, 2022.

[c.10] **C. Crozier**, A. Pigott, K. Baker, Spatial arbitrage through bidirectional electric vehicle charging, *IEEE PES General Meeting*, 2022.

[c.9] M. Li, Y. Du, J. Mohammadi, **C. Crozier**, K. Baker Numerical comparisons of linear power flow approximations: optimality, feasibility, and computation time, *IEEE PES General Meeting*, 2022.

[c.8] A. Pigott, **C. Crozier**, K. Baker, Z. Nagy, GridLearn: multiagent reinforcement learning for grid-aware building energy management, *Power Systems Computation Conference*, 2022.

[c.7] **C. Crozier**, K. Baker, Y. Du, M. Li, J. Mohammadi, Data driven methods for contingency filtering in security constrained optimal power flow, *International Conference on Probabilistic Methods Applied to Power Systems*, 2022.

[c.6] **C. Crozier**, K. Baker, Optimal sizing of an energy storage portfolio considering multiple timescales, *IEEE PES General Meeting*, 2021.

[c.5] M. Deakin, **C. Crozier**, T. Morstyn, D. Apostolopoulou, M. McCulloch, Stochastic hosting capacity in distribution networks, *IEEE PES General Meeting*, 2019.

[c.4] **C. Crozier**, M. Deakin, T. Morstyn, M. McCulloch, Incorporating charger efficiency into electric vehicle charging optimization, *Innovation in Smart Grid Technologies (ISGT) Europe*, 2019.

[c.3] L. Han, T. Morstyn, **C. Crozier**, M. McCulloch, Improving the scalability of a prosumer cooperative game with k-means clustering, *IEEE PowerTech*, 2019.

[c.2] **C. Crozier**, D. Apostolopoulou, M. McCulloch, Clustering of usage profiles for electric vehicle behaviour analysis, *Innovation in Smart Grid Technologies (ISGT) Europe*, 2018.

[c.1] **C. Crozier**, D. Apostolopoulou, M. McCulloch, Numerical analysis of national travel data to assess the impact of UK fleet electrification, *Power Systems Computation Conference*, 2018.

Invited Talks

Large scale low carbon electricity networks with human-in-the-loop

Mar 2022 Imperial College London

Mar 2022 Boston University

Feb 2022 Massachusetts Institute of Technology

Feb 2022 Temple University

Developing scalable algorithms for the arpe-e grid optimization competition

Jan 2022 University of Oxford Energy and Power Group Seminar

Dec 2021 Newcastle University Optimization Group Webinar [Link]

Oct 2021 INFORMS Annual Meeting

Oct 2021 ARPA-E Gird Optimization Competition Outreach Event

The impacts of electric mobility on the power grid

Oct 2017 Oxford Institute for Energy Studies Workshop on Electric Vehicles and Public Policy

Sep 2017 Warwick Manufacturing Group Catapult Energy Storage Conference

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Mentored Students

2022 Calla Winner, *Undergraduate Research Assistant, University of Colorado Boulder*

2020-2022 Aisling Pigott, *PhD Student, University of Colorado Boulder*

2021-2022 John Montagu, *Masters Student, University of Colorado Boulder*

2020-2021 Meiyi Li, *PhD Student, Carnegie Mellon University*

2020-2021 Yuhan Du, *Masters Student, Carnegie Mellon University*

2019 Lyn Yeoh, *Undergraduate Research Assistant, University of Oxford*

Teaching Experience

2021 Guest Lecturer, University of Colorado Boulder, *Grid Connected Systems*

2020 Project Assessor, Carnegie Mellon University, *Energy Transport and Storage*

2017-2019 Stipendiary Lecturer, Christ Church (Oxford), *Electrical Engineering and Mathematics*

» Delivered weekly tutorials to 1st and 2nd years on mathematics and control systems topics

2018-2019 Stipendiary Lecturer, Mansfield College (Oxford), *Electrical and Information Engineering*

» Delivered weekly tutorials to 1st and 2nd years on various electrical engineering topics

2017-2018 Teacher, Department of Engineering Science, University of Oxford, *Signal and Image Analysis*

» Taught 24 student class, including setting practice exam and assisting with practical exercise

2016-2017 Lab Demonstrator, Department of Engineering Science, University of Oxford *Microcontrollers*

» Helped run a five day laboratory where students designed microcontroller-based projects.

Industry Experience

2018-pres Consultant Research Scientist, *Various*

» Developed and integrated power flow physics into energy trading algorithm

» Built cost optimization for smart hot water tanks to respond to LMPs

2018 Data Scientist Intern - Route planning for autonomous vehicles, *Five AI*

2015 Control Engineering Intern - Automated submarine operations, *Rolls-Royce Nuclear*

Professional Service

2022 Session Chair, *International Conference on Probabilistic Methods Applied to Power Systems*

2021 Session Chair, *INFORMS Annual Meeting*

2017-pres Reviewer, *IEEE TSG, TPWRS, TTE, PESGM, PES Letters*

Outreach & Engagement

2020-pres Write and manage a personal science communication blog, which has had over 40,000 views.

2020-pres Created animated graphs for Twitter posts that have attracted 600,000+ views.

2019 Helped create a series of challenges designed to help students teach themselves to code in Python.

2019 Filmed video series showing an undergraduate engineering interview with over 75,000 views.

2018 Ran an engineering workshop for school leavers as part of Christ Church Horizons program.

2015-2016 Access and academic affairs officer at Christ Church – co-ordinated outreach and the open day.

Coding Languages

Expert: Python, MATLAB

Advanced: C++, SQL, Javascript

Proficient: C, Julia