

Nathaniel J. Cooper

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University Assistant Professor in Industrial Sustainability

Sept 2023 – Present

Institute for Manufacturing, Department of Engineering, University of Cambridge, England, UK

- Director of the Nexus of Energy and Water Processes (NEWP) Lab, developing low carbon alternative technologies for sustainable transitions
- Advisor to three PhD students, and supervisor for two MS students
- Instructor for the class ‘Sustainable Manufacturing’, a master’s level class. Instructor for a section of Exposition (Communication Skills for Engineers), a first-year class. Instructor for Contemporary Issues in Manufacturing, a third-year class.
- Organized and supervised multiple industrial student projects, lasting from three days to six weeks
- Member of the Department of Engineering’s Equality, Diversity, and Inclusion Committee

RESEARCH EXPERIENCE

ASEE eFellows Postdoctoral Fellow

Sept 2021 – Aug 2023

Chemical and Environmental Engineering, Yale University, New Haven, CT USA

Supervisor: Dr. Menachem Elimelech

- Investigated technical and economic performance criteria for sustainable technologies at the water-energy nexus
- Designed an economic and process model to evaluate the feasibility of lithium recovery from brines and wastewaters
- Analyzed the benefits of distributed hydrogen production using wastewater over centralized production
- Wrote & submitted two proposals on resource recovery from water

Marie Curie ITN Experienced Researcher & Postdoctoral Research Associate

Mar 2017 – Aug 2021

Centre for Process Systems Engineering, Chemical Engineering, Imperial College London, London, England, UK

Supervisor: Dr. Nilay Shah

- Focus on design of a gigawatt scale hydrogen electrolyzer plant powered by intermittent wind energy for use in the Netherlands
- Design and optimize process and operational strategy of the electrolyzer plant to maximize financial performance while fulfilling demand using gPROMS and GAMS
- Investigate linear estimation techniques to improve biomass supply chain model accuracy
- Member of RENESENG project, process systems engineering for biorefineries and biofuels
- Assisted in developing supply chain network optimization (SCO) frameworks for use within biomass and biofuel industries in specialized software including GAMS
- Developed script-based tools for open-source GIS software, which extract key geographical data for use in supply chain network optimization studies and visualize results for strategic decision making and holistic result interpretation

Ph.D. Graduate Student

Sep 2012 – Sep 2016

Mechanical & Aerospace Engineering, University of California, Davis, Davis, CA

Advisor: Dr. Jae Wan Park

- Dissertation: Experimental Testing and Characterization of High-Power Flow Field PEM Fuel Cell Design Parameters

- Designed, performed, and analyzed experiments to answer fundamental research questions. Specific focus on impact of flow field design parameters on power output, pressure, permeability, and liquid water distribution
- Methodologies used include polarization testing, steady state testing, factorial experiment design, neutron imaging and flow field modeling
- Specialized equipment and software used include Arbin Fuel Cell Test Station and software, Neutron Imaging Facility (NIF) at NIST, neutron imaging at McClellan Nuclear Research Center, National Instruments data acquisition boards, Espec Environmental Chamber, MATLAB, Autodesk Inventor, SolidWorks, NI - Signal Express, COMSOL Multiphysics, Minitab

Undergraduate Researcher

Sep 2010 – May 2012

Chemical Engineering, Brown University, Providence, RI

Advisor: Dr. Indrek Külaots

- Investigated sorption potential of chars made from agricultural vegetal waste
- Performed analyses including measurement of mineral and organic content, computation of surface area, and measurement of pore volume using both nitrogen and mercury
- Made char in-house using the helium pyrolysis of agricultural waste (e.g., peach pits, wood chips)

NSF REU Student Researcher

Jun 2010 – Aug 2010

Mechanical Engineering, University of Connecticut, Storrs, CT

Advisor: Dr. Michael Renfro

- Maintained a flame research system and supported flame studies, including bluff-body blow-off and particle imaging velocimetry studies
- As a team member, contributed to the design and construction of a linear motion apparatus for a gas sampling device, and an experimental chamber for measuring resonance pressure

ACADEMIC TRAINING

University of California, Davis

2012 – 2016

PhD: Mechanical and Aerospace Engineering

Brown University

2008 – 2012

ScB: Mechanical Engineering

JOURNAL PUBLICATIONS

M. Worle, **N. J. Cooper**. Hydrogen for Alternative Process Heat in a Bivalent Heating System: Feasibility Assessment and Techno-economic Analysis. In Preparation.

K. Kozerke, **N.J. Cooper**. Industrial Wastewater Utilization for Gallium Recovery - A Circular Economy Approach in the Semiconductor Industry. In Preparation.

Z. Lan, **N.J. Cooper**, S. Yajuan, X Gaoxi. AI-Driven Carbon Footprint Prediction Using Historical LCA Data. In Preparation.

A. Day, C. Park, **N.J. Cooper**. Exploring the Optimal Plastic Credit Potential and Requirement for Nepal's Plastic Upcycling Start-Ups. Submitted.

19. K. Kozerke, **N.J. Cooper**. Techno-economic feasibility of gallium recovery from semiconductor wastewater. *Systems & Control Transactions: Proceedings of the 36th European Symposium on Computer Aided Process Engineering*. Accepted.

18. **N.J. Cooper**, B. Lee, S. Patel, L. Wang, P. Westerhoff, M. Elimelech. Viability Assessment of Lithium Recovery from Unconventional Saline Water Sources. *Desalination* 614, no. February (2025). DOI: 10.1016/j.desal.2025.119156.

17. M. Sharifzadeh, **N.J. Cooper**, H.v. Nordende, N. Shah. Operational Strategies and Integrated Design for Producing Green Hydrogen from Wind Electricity. *International Journal of Hydrogen Energy*. Volume 64 (2024) pp. 650-675. DOI: 10.1016/j.ijhydene.2024.03.237

16. B. Lee, L. Wang, Z. Wang, **N.J. Cooper**, M Elimelech. Directing the research agenda on water and energy technologies with process and economic analysis. *Energy & Environmental Science*. Volume 16, Issue 3 (2023) pp. 714-722. DOI: 10.1039/d2ee03271f

15. R. DuChanois, **N.J. Cooper**, B. Lee, S. Patel, L. Mazurowski, T. Graedel, M. Elimelech. Prospects of Metal Recovery from Wastewater and Brine, *Nature Water*. Volume 1 (2023) DOI: 10.1038/s44221-022-00006-z

14. L. Winter*, **N.J. Cooper***, B. Lee, S. Patel, L. Wang, M. Elimelech. Mining Nontraditional Water Sources for a Distributed Hydrogen Economy, *Environmental Science & Technology*. Volume 56 (2022) pp. 10577-10585. DOI: 10.1021/acs.est.2c02439

* Co-first authors

Featured by 7 news media: <https://acs.altmetric.com/details/132347438/news>

13. **N.J. Cooper**, C. Horend, F. Röben, A. Bardow, N. Shah. A Framework for the Design & Operation of a Large-Scale Wind-Powered Hydrogen Electrolyzer Hub, *International Journal of Hydrogen Energy*. Volume 7 (2022) DOI: 10.1016/j.ijhydene.2021.12.225

12. Y. Du, Z. Wang, **N.J. Cooper**, J. Gilron, M. Elimelech. Module-Scale Analysis of Low-Salt-Rejection Reverse Osmosis: Design Guidelines and System Performance, *Water Research*. Volume 209 (2021) Article 117936. DOI: 10.1016/j.watres.2021.117936

11. **N.J. Cooper**, A. Panteli, N. Shah. A Biomass Supply Chain Optimization Framework with Linear Approximation of Biomass Yield Distributions for Improved Land Use, *Proceedings of the ASME 2019 International Mechanical Engineering Congress and Exposition*. Volume 6: Energy (2019) ASME. DOI: 10.1115/IMECE2019-11399

10. **N.J. Cooper**, A. Panteli, N. Shah. Linear Estimators of Biomass Yield Maps for Improved Biomass Supply Chain Optimisation, *Applied Energy*. Volume 253 (2019), Article 113526. DOI: 10.1016/j.apenergy.2019.113526

9. P.A. Trotter, **N.J. Cooper**, P.R. Wilson. A Multi-Criteria, Long-Term Energy Planning Optimisation Model with Integrated on-Grid and off-Grid Electrification – The Case of Uganda, *Applied Energy*. Volume 243 (2019), pp. 288–312. DOI: 10.1016/j.apenergy.2019.03.178

8. **N.J. Cooper**, T. Smith, A.D. Santamaria, J.W. Park. An Electrochemical Performance Characterization Method for Comparing PEFCs of Varying Channel Dimensions, *ASME Journal of Electrochemical Energy Conversion and Storage*. Volume 15 (2018) Article 041006. DOI: 10.1115/1.4039789

7. S. Huo, **N.J. Cooper**, T.L. Smith, J.W. Park, K. Jiao. Experimental investigation on PEM fuel cell cold start behavior containing porous metal foam as cathode flow distributor, *Applied Energy*. Volume 203 (2017) Pages 101-114. DOI: 10.1016/j.apenergy.2017.06.028

6. **N.J. Cooper**, A.D. Santamaria, M.K. Becton, J.W. Park. Neutron radiography measurements of in-situ PEMFC liquid water saturation in 2D & 3D morphology gas diffusion layers, *International Journal of Hydrogen Energy*. Volume 42, Issue 25 (2017) Pages 16269-16278. DOI: 10.1016/j.ijhydene.2017.05.105

5. **N.J. Cooper**, A.D. Santamaria, M.K. Becton, J.W. Park. Investigation of the performance improvement in decreasing aspect ratio interdigitated flow field PEMFCs, *Energy Conversion and Management*. Volume 136 (2017) Pages 307–317. DOI: 10.1016/j.enconman.2017.01.005
4. **N.J. Cooper**, T. Smith, A.D. Santamaria, J.W. Park. Experimental optimization of parallel and interdigitated PEMFC flow-field channel geometry, *International Journal of Hydrogen Energy*. Volume 41, Issue 2 (2016) Pages 1213–1223. DOI: 10.1016/j.ijhydene.2015.11.153
3. A.D. Santamaria, M.K. Becton, **N.J. Cooper**, A.Z. Weber, J.W. Park, Effect of cross-flow on PEFC liquid-water distribution: An in-situ high-resolution neutron radiography study, *Journal of Power Sources*. Volume 293 (2015) Pages 162–169. DOI: 10.1016/j.jpowsour.2015.05.016
2. A. Santamaria, **N. Cooper**, M. Becton, J.W. Park. Experimental investigation of channel aspect ratio on interdigitated PEMFC performance, *SAE International Journal of Alternative Powertrains*. Volume 3 (2014) Pages 78–85. DOI: 10.4271/2014-01-1828
1. A.D. Santamaria, **N.J. Cooper**, M.K. Becton, J.W. Park, Effect of channel length on interdigitated flow-field PEMFC performance: A computational and experimental study, *International Journal of Hydrogen Energy*. Volume 38 (2013) Pages 16253–16263. DOI: 10.1016/j.ijhydene.2013.09.081

CONFERENCE PRESENTATIONS

- K. Kozerke, **N.J. Cooper**. Semiconductor Wastewater Valorization for the Recovery of Gallium: Process Design and Analysis. *2026 AIChE Annual Meeting*, Minneapolis, MN, November 2026. Submitted.
16. K. Kozerke, **N.J. Cooper**. Techno-economic feasibility of gallium recovery from semiconductor wastewater. *36th European Symposium on Computer Aided Process Engineering*, Sheffield, UK. June 2026, upcoming.
15. **N.J. Cooper**, B. Lee, S. Patel, L. Wang, M. Elimelech. A Techno-economic Analysis of Lithium Recovery from Unconventional Water Sources. *2022 AIChE Annual Meeting*, Phoenix, AZ, November 2022.
14. **N.J. Cooper**, C. Horend, N. Shah. Framework for the Design & Operation of Large-Scale Electrolysers. *2020 H2FC SUPERGEN Conference*, Nottingham, England, UK, February 2020. **Keynote Presentation**.
13. **N.J. Cooper**, A. Panteli, N. Shah. A Biomass Supply Chain Optimization Framework with Linear Approximation of Biomass Yield Distributions for Improved Land Use. *2019 ASME International Mechanical Engineering Conference and Exhibition*, Salt Lake City, UT, November 2019.
12. **N.J. Cooper**, A. Panteli, N. Shah. Improving the Location Robustness of Spatially Distributed Variables for Biomass Supply Chains Under Supply Uncertainty. *2019 AIChE Annual Meeting*, Orlando, FL, November 2019.
11. **N.J. Cooper**, A. Panteli, N. Shah. Development of Resource Mapping Tools for Biomass Supply Chain Optimisations. *Imperial College London Chemical Engineering Postdoc Symposium*, London, England, UK, April 2018.
10. **N.J. Cooper**, A. Panteli, N. Shah. Spatial Data Tools for Biomass Supply Chain Optimisation: For Simple Data Aggregation and Visualisation. *9th Edition of International Conference on Biofuels and Bioenergy*, Edinburgh, Scotland, UK, March 2018.
9. **N.J. Cooper**, A. Panteli, N. Shah. Map Data Extraction Tool for Biomass Supply Chain Optimization: Applied to Examine Optimization Sensitivity to Geographic Uncertainty. *7th International Symposium on Energy*, Manchester, England, UK, August 2017.

8. **N.J. Cooper**, T.D. Smith, A.D. Santamaria, J.W. Park. Method of Electrochemical Performance Characterization for Interdigitated PEFCs with Varying Flow Field Permeability. *7th International Symposium on Energy*, Manchester, England, UK, August 2017.
7. **N.J. Cooper**, A.D. Santamaria, M.K. Becton, J.W. Park. In-plane Neutron Radiography Study of the effect of Cross Flow on Water Distribution in The Gas Diffusion Layer. *ASME 2016 POWER & ENERGY*, Charlotte, NC, June 2016.
6. **N.J. Cooper**, T. Smith, A.D. Santamaria, J.W. Park. Experimental Performance Characterization of Polymer Electrolyte Fuel Cells with Varying Channel Dimensions. *ECS 229th Meeting*, San Diego, CA, June 2016.
5. **N.J. Cooper**, A.D. Santamaria, M.K. Becton, J.W. Park. Experimental investigation of Channel Aspect Ratio on interdigitated PEMFC performance. *SAE 2014 World Congress & Exhibition*, Detroit, MI, April 2014.
4. A.D. Santamaria, **N.J. Cooper**, M.K. Becton, J.W. Park. A study of Channel Dimension Effect on Performance of Interdigitated Flow Field PEM Fuel Cells. *AIChE 2013 Annual Meeting*, San Francisco, CA, November 2013.
3. A.D. Santamaria, **N.J. Cooper**, M.K. Becton, J.W. Park. Affect of Feature Dimensions on PEM Fuel Cell Performance Under Flow Fields Capable of Switching Between Parallel and Interdigitated Configurations. *ECS 224th Meeting*, San Francisco, CA. October 2013.
2. **N.J. Cooper**, I. Külaots. Agricultural Waste-Based Biochar Sorption Potential. *AIChE 2011 Annual Meeting*, Minneapolis, MN, November 2011.
1. **N.J. Cooper**, I. Külaots. Biochar Sorption Potential. *AIChE 2010 Annual Meeting*, Salt Lake City, UT, November 2010.

RESEARCH PROPOSAL WRITING

“Aqueous Chemistry Battery Supported Microgrid Optimisation for Renewable Energy Resources”, *European Research Council*, 2026. In progress.

“Building Renewable Energy Architectures with Digital Twins for Hydrogen Electrolysers”, *Engineering and Physical Sciences Resource Council (EPSRC)*, 2026. Submitted.

“Prospecting Wastewater for Element Recovery for Energy Storage Systems”, *EPSRC New Investigator Award*, 2025.

“Aqueous Zinc-Ion Batteries for Sustainable Renewable Energy Storage”, *Ayrton Challenge Programme*, 2024.

“Responsible Manufacturing of Materials and Technologies for a Sustainable Future”, *Engineering and Physical Sciences Resource Council (EPSRC) Manufacturing Hub*, 2024.

“Valorization of Brackish Groundwater ROC for Use in the Cement Industry”, *National Alliance for Water Innovation (NAWI)*, 2022. Whitepaper resulted in an invitation to submit a full proposal.

“A Techno-economic Analysis on Valuable Element Recovery”, *Nanosystems ERC for Nanotechnology Enabled Water Treatment (NEWT)*, 2022.

ASEE eFellows Postdoctoral Fellowship, *American Society for Engineering Education*, 2021. **Awarded**, 2022-2024.

RESEARCH ADVISING

PhD Advisor: “Circular Supply Network of Electric Vehicle Batteries.” Xinyan Li, Institute for Manufacturing, University of Cambridge, Cambridge, England, UK. February 2024 – present.

PhD Advisor: ““Remanovation” as IP Innovation: Strategies for Collaborative Remanufacturing in the Circular Economy.” Peize Li, Institute for Manufacturing, University of Cambridge, Cambridge, England, UK. January 2025 – present.

PhD Advisor: “Development of a 3D-Printable Hydrogel Scaffold with Dynamic Ionic Crosslinks for Enhanced Tissue Engineering and Drug Delivery.” Dick Firdaus, Institute for Manufacturing, University of Cambridge, Cambridge, England, UK. September 2024 – present.

MS Thesis Supervisor: “Techno-Economic Assessment of Power-to-Hydrogen-to-Power as a Seasonal Energy Storage Solution for Solar PV Farms.” Gereon Dohm, Institute for Manufacturing, University of Cambridge, Cambridge England, UK, March 2026 – present.

MS Thesis Supervisor: “The effectiveness of transition finance through regulatory pressure in the European manufacturing industry.” Isabelle Schindl, Institute for Manufacturing, University of Cambridge, Cambridge, England, UK. January 2026 – present.

MS Thesis Supervisor: “Concurrent recovery of gallium and hydrogen production from silicon fab plants to support the circular economy.” Kilian Kozerke, Institute for Manufacturing, University of Cambridge, Cambridge, England, UK. August 2025 – March 2026.

MS Thesis Co-advisor: “Techno-economic Design of a Gigawatt Scale Electrolyser System for Sustainable Hydrogen Production through Mathematical Optimisation,” Christian Horend, Dept. of Chemical Engineering, Imperial College, London, England, UK (co-advised with Nilay Shah). Jun – Dec 2019

Undergraduate Research Advising, supervised students Ahmed Khan, Jemal Hussein, Anahita Yazdi, and Josh Day in semester projects in the Fuel Cell Lab, Dept. of Mechanical Engineering, University of California, Davis, Sep 2012 – Sep 2016

TEACHING EXPERIENCE

Sustainable Manufacturing, Faculty Instructor, Institute for Manufacturing. University of Cambridge, Cambridge, England, UK (Lent 2024, 2025, 2026)

Group & Individual Projects, Faculty Supervisor, Institute for Manufacturing. University of Cambridge, Cambridge, England, UK (Easter 2024, 2026 Michaelmas 2024, 2025)

Contemporary Issues in Manufacturing, Faculty Instructor, Institute for Manufacturing. University of Cambridge, Cambridge, England, UK (Michaelmas 2024, 2025)

Exposition – Communication Skills for Engineers, Faculty Instructor, Department of Engineering. University of Cambridge, Cambridge, England, UK (Michaelmas 2024, 2025)

1st year Matlab Project, Teaching Assistant, Dept. of Chemical Engineering. Imperial College London, London, England, UK (Fall 2017)

Experimental Methods, Teaching Assistant, Dept. of Mechanical Engineering, University of California, Davis (Winter 2014, Fall 2014, Winter 2015, Fall 2015, Winter 2016, Spring 2016)

Engineering Graphics in Design, Teaching Assistant, Dept. of Mechanical Engineering, University of California, Davis (Fall 2013)

AWARDS & RECOGNITIONS

ASEE eFellows Postdoctoral Fellowship	2022
Marie Curie ITN Experienced Researcher	2017
1 st Place Detection of Nuclear Proliferation: Network Science Idea Challenge, Dept. of Energy	2014
3 rd Place Student Poster (Environmental Division), AIChE Annual Meeting	2011
2 nd Place Student Poster (Environmental Division), AIChE Annual Meeting	2010

PROFESSIONAL SERVICE

Session Chair, *Biomass, Biogas, Energy and Environment*. 9th Edition of International Conference on Biofuels and Bioenergy, Edinburgh, Scotland, UK, March 2018.

Session Chair, *Renewable Energy, Bioenergy, Energy and Environment, Algal Biofuels*. 9th Edition of International Conference on Biofuels and Bioenergy, Edinburgh, Scotland, UK, March 2018.

AD HOC REVIEWER

Nature Communications
Joule
Applied Energy
International Journal of Hydrogen Energy
International Journal of Physical Distribution & Logistics Management
International Journal of Heat and Mass Transfer
Journal of Energy Sources, Part A: Recovery, Utilization, and Environmental Effects
Applied Thermal Energy

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers (ASME)
American Institute of Chemical Engineers (AIChE)

PATENTS

I. Külaots, W. Trinh, **N.J. Cooper** (2011) "Biomass Conversion for Mercury Capture and Particulate Matter Control." US Provisional Patent #61511452.

INDUSTRY EXPERIENCE

Design Engineer Intern Summer 2011
Stanley Black & Decker / Adecco, New Britain, CT

- Designed parts for a machine used to test hammers to failure through repeated strikes on an anvil, without human intervention.
- Researched methods of reducing waste due to grinding in chisel production.

Geothermal Engineer Intern Summer 2009
CGH Energy (Renewable energy start-up), Tolland, CT

- Researched geothermal installation designs and requirements for residential homes.
- Performed calculations, prepared reports and web content, and made engineering recommendations for new geothermal systems.