# Dr. Trevor Barnes

Research Fellow | Energy Systems Researcher

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## Research Focus

I develop and apply system-level energy optimization models to help inform policy and business decisions. The results of my research include practical plans on how organizations should allocate spending to cost effectively meet emission targets. Specific research interests include near-term energy transitions, multi-sector energy analysis, sensitivity and uncertainty analysis, and open-research methodologies.

## Education

**PhD in Sustainable Energy Engineering** — *Vancouver, BC*
Simon Fraser University — *Jan 2021 - Sept 2026*

**BEng in Mechanical Engineering** — *Vancouver, BC*
British Columbia Institute of Technology — *September 2015 - May 2019*

## Experience

**Research Fellow** — *London, UK*
University College London — *October 2026 – Present*

- Energy systems researcher in the Bartlett School of of Environment, Energy and Resources
- Develop a decision-support modelling framework for critical mineral supply chains
- Integrate supply, trade and demand modules into the model to capture market dynamics
- Evaluate the UK's industrial resilience within global lithium markets

**Student Researcher** — *London, UK*
Google DeepMind — *March 2026 – August 2026*

- Develop pipelines to generate datasets suitable to train AC OPF machine learning models on
- Use graph neural networks to solve and evaluate AC OPF problems
- Evaluate machine learning model performance against traditional solvers for AC OPF problems
- Create data translation libraries to manage AC OPF data

**Research Assistant** — *Vancouver, BC*
Simon Fraser University — *Jan 2021 – Sept 2026*

- Researcher in the ΔE+ Research Group
- Develop energy system optimization models to support effective energy policy decisions
- Contribute to open-source energy modelling tools and packages

**Graduate Research Intern** — *Vancouver, BC*
Generac Power Systems — *April 2023 – April 2025*

- Quantitatively study electrification initiatives at a system level
- Develop open-source tools for energy system analysis
- Evaluate the impact of multi-sector demand response programs
- Provide suggestions on near-term emission target solutions

**Visiting Researcher** — *Stockholm, Sweden*
KTH Royal Institute of Technology — *Aug 2022 – Oct 2022*

- Visited the Department of Energy Technology at KTH
- Collaborate with researchers working on energy system modelling research
- Contribute to work on sensitivity analysis and software development

## Skills

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|---|---|
| **Programming** | Python, Git, Linux, Snakemake, Mathematical Programming, High Performance Computing |
| **Frameworks** | PyPSA, PandaPower, OSeMOSYS |
| **Energy Modelling** | Multi-Sector Analysis, GeoSpatial Analysis, Sensitivity and Uncertainty Analysis, Computational Workflows |
| **Soft Skills** | Technical Documentation and Communication, Research Process, Project Management, Open Science |

# Academic Contributions

## Journal Articles

[Under Revision] Unlocking Climate Finance Eligibility of Transmission Projects Using Energy Modelling
Jairo Quirós-Tortós, Jeeno George, Simone Osei-Owusu, **Trevor Barnes**, Will Blyth, Abhishek Shivakumar, Taco Niet
(2026). 2026. DOI: 10.5281/zenodo.21130109

[Under Revision] Near-Term Emission Targets Need Immediate Attention in the USA
**Trevor Barnes**, Kamran Tehranchi, Bradley Reinholz, Malcolm Metcalfe, Taco Niet
(2026). 2026. DOI: 10.48550/arXiv.2607.01471

Costs and Benefits of Transmission Investments in the United States under Different Policy Scenarios
Kamran Tehranchi, **Trevor Barnes**, Martha Frysztacki, Ines Azevedo
(Oct. 2026). 2026. DOI: 10.1088/1748-9326/aea586

Multi-Sector Demand Response for Cost Optimal Energy Transitions
**Trevor Barnes**, Kamran Tehranchi, Bradley Reinholz, Malcolm Metcalfe, Taco Niet
*PLOS Climate* (2026). 2026. DOI: 10.1371/journal.pclm.0000918

A Global Electricity Transmission Database for Energy System Modelling
Maarten Brinkerink, Gordon Sherman, Simone Osei-Owusu, Reema Mohanty, Aman Majid, **Trevor Barnes**, Taco Niet, Abhishek Shivakumar, Erin Mayfield
*Data in Brief* 54 (June 1, 2024) p. 110420. 2024. DOI: 10.1016/j.dib.2024.110420

otoole: OSeMOSYS Tools for Energy Work
**Trevor Barnes**, William Usher
*Journal of Open Source Software* (May 3, 2023) p. 5511. 2023. DOI: https://doi.org/10.21105/joss.05511

Global sensitivity analysis to enhance the transparency and rigour of energy system optimisation modelling
William Usher, **Trevor Barnes**, Nandi Moksnes, Taco Niet
*Open Research Europe* 3 (Feb. 13, 2023) p. 30. 2023. DOI: 10.12688/openreseurope.15461.1

Applying the open-source climate, land, energy, and water systems (CLEWs) model to Canada
Kamaria Kuling, **Trevor Barnes**, Abhishek Shivakumar, Maarten Brinkerink, Taco Niet
*Energy Strategy Reviews* 44 (Nov. 1, 2022) p. 100929. 2022. DOI: 10.1016/j.esr.2022.100929

OSeMOSYS Global, an Open-Source, Open Data Global Electricity System Model Generator
**Trevor Barnes**, Abhishek Shivakumar, Maarten Brinkerink, Taco Niet
*Scientific Data* 9.1 (Oct. 14, 2022) p. 623. 2022. DOI: 10.1038/s41597-022-01737-0

The role of U.S.-Canada electricity trade in North American decarbonization pathways
Sina Motalebi, **Trevor Barnes**, Le Lu, Benjamin Leibowicz, Taco Niet
*Energy Strategy Reviews* 41 (May 1, 2022) p. 100827. 2022. DOI: 10.1016/j.esr.2022.100827

## Conferences

Evaluating the Effictivness of Multi-Sector Demand Response in Energy Planning Models
**Trevor Barnes**, Kamran Tehranchi, Bradley Reinholz, Malcolm Metcalfe, Taco Niet
*International Energy Workshop* (June 2025). 2025

High Impact Options to Meet Near Term Emission Targets in the USA
**Trevor Barnes**, Kamran Tehranchi, Bradley Reinholz, Malcolm Metcalfe, Taco Niet
*Sensitivity Analysis of Model Output* (Apr. 2025). 2025

PyPSA-USA Sector; An Open-Source Energy System Optimizaion Model of the USA
**Trevor Barnes**, Kamran Tehranchi, Taco Niet
*Energy Modelling Hub Annual Forum* (Dec. 2024). 2024

Global Sensitivity Analysis in Energy System Modelling
**Trevor Barnes**, Will Usher
*OpenMod Meets USA* (Nov. 2023). 2023

CLEWs Global: An open source, open data Climate, Land, Energy, and Water systems model generator
Kamaria Kuling, Yalda Saedi, **Trevor Barnes**, Ashok Sunder Rajan, Taco Niet
*International Energy Workshop* (June 1, 2023). 2023

## White Papers

PyPSA-USA: A Flexible Open-Source Energy System Model and Optimization Tool for the United States
Kamran Tehranchi, **Trevor Barnes**, Martha Frysztacki, Ines Azevedo
(Dec. 2024). 2024. DOI: 10.2139/ssrn.5029120

OSeMOSYS step - a python package for modelling energy systems under limited foresight and with decision trees
Hauke T. J. Henke, **Trevor Barnes**, Will Usher
(Oct. 2024). Zenodo, 2024. DOI: 10.5281/zenodo.13373404

Cables to change the world
Aman Majid, Abhishek Shivakumar, Maarten Brinkerink, Thomas Kouroughli, Matt Gray, Isabella Suarez, **Trevor Barnes**, Handriyanti Diah Puspitarini
2023 URL: https://www.transitionzero.org/insights/interconnector-report-feo

Enabling Decarbonization with a Coordinated Gas-Electricity System
**Trevor Barnes**, Bradley Reinholz, Malcolm Metcalfe, Taco Niet
*Zenodo* (2022). 2022. DOI: 10.5281/zenodo.17009320

## Software Development

PyPSA USA
A PyPSA Model of the USA
Core Developer, URL: https://github.com/PyPSA/pypsa-usa

otoole
OSeMOSYS Tools for Energy Work
Core Developer, URL: https://github.com/OSeMOSYS/otoole

OSeMSOYS Global
A global power system model generator for OSeMOSYS
Core Developer, URL: https://github.com/OSeMOSYS/osemosys_global

## Workshops and Talks

4th Annual PyPSA User Meeting
**Trevor Barnes**
2026, Video Link

Macro Energy Society: Using the PyPSA-USA Model
**Trevor Barnes**, Kamran Tehranchi
2026, Video Link

Catalyst Cooperative: Open Energy Data for All
**Trevor Barnes**, Kamran Tehranchi
2025, Video Link

ECEMP Skills Workshop: Global Sensitivity Analysis
William Usher, **Trevor Barnes**
2022, Video Link

## Other Contributions

OSeMOSYS and FlexTool Trainer
2023, ICTP Joint Summer School on Modelling Tools for Sustainable Development

OSeMOSYS and FlexTool Trainer
2023, Energy Modelling Platform for Latin America and the Caribbean

OSeMOSYS Trainer
2021, Joint Summer School on Modelling Tools for Sustainable Development