Madeline Macmillan, Ph.D.

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ENERGY AND ENVIRONMENTAL ECONOMICS, INC.   San Francisco, CA
Senior Consultant

Dr. Madeline Macmillan supports E3's Integrated System Planning practice area, with a specific expertise in capacity expansion modeling and analysis, helping clients achieve greenhouse gas reduction and reliability goals at minimized economic cost. She is a key developer in RESOLVE, E3's resource planning tool for optimizing long-term generation, and has contributed to a refactoring of the model to increase the spatial resolution. She also implements PLEXOS from top to bottom, including data development for E3's market price forecasts with a focus on the ERCOT and WECC forecasts.

Madeline joined E3 after earning a doctorate in Advanced Energy Systems from the Colorado School of Mines, where her research focused on the development of uncertainty-informed energy system planning methods for improved climate resilience. While at Mines, Maddie also worked as a researcher at the National Renewable Energy Laboratory (NREL) where she advised energy system planning efforts in remote and disaster-prone areas of the United States with national security implications. Prior to graduate school, she earned a bachelor's degree in environmental engineering from North Carolina State University.

Select E3 projects include:

Pasadena Water and Power, Long-Term Capacity Expansion (2024-ongoing). Developed a comprehensive PLEXOS model to explore a variety of opportunities and scenarios to refurbish, retire, or enhance a large gas plant with a goal of increasing clean energy generation and reducing market dependence in Pasadena.

Confidential Energy Research Organization, Offshore Wind Study (2024 – ongoing). Identified and analyzed market opportunities for offshore wind in eastern Canada using PLEXOS. Developed a long-term nodal model, including data review, cleaning, and development, to understand the system's response to offshore wind under various minimum build, transmission expansion, and electrification load scenarios.

California Public Utilities Commission (CPUC) Integrated Resource Plan (IRP) (2024 – ongoing). Supported the CPUC in a wide variety of workstreams in its administration of the state's IRP program. Modeled scenarios, updated E3's workflow, interpreted results, and prepared public results from the analysis. Helped develop the zonally disaggregated RESOLVE model to capture more granularity, align better with SERVM, and streamline post-processing needs in the busbar mapping process. Developed and updated interconnection and transmission constraints for increased model scope. Researched, analyzed, and wrote content supporting the 2025 inputs and assumptions process and the 2025-26 busbar mapping report.

Confidential Utility, Reliability Study (2024). Conducted a reliability study in Colorado through the 2030s using E3's RECAP model, modeling 1D curves to better inform the effective load carrying capacity (ELCC) of renewable resources for planning, implementation, and the client's capacity expansion portfolio.

ASCEND ANALYTICS   Boulder, CO
Optimization Development Engineer   August 2023 – December 2023

- o Developed mixed integer linear program optimization models to advise renewable and battery operations across different market conditions to maximize revenue
- o Contributed to stochastic formulations to improve model efficiency and dispatch decisions

NATIONAL RENEWABLE ENERGY LABORATORY   Golden, CO
Graduate Researcher   January 2020 – December 2023

- o Added REopt capabilities to consider resilience and the impacts of climate change on long-term energy system planning, design, and dispatch
- o Expanding the REopt formulation to consider stochastic climate scenarios over multiple years
- o Working directly with customers to advise on life cycle cost impacts of adding energy generation assets to microgrids to support mission-critical services
- o Advancing open-source solver capabilities within ReEDS, improving the model's accessibility

Researcher   August 2019 – December 2019
SULI Intern   June 2019 – August 2019

- o Contributed computer program development to a new NREL tool, Cambium
- o Used future marginal electricity prices to better assess renewable technologies
- o Improved REopt battery storage degradation modeling in a mixed integer linear programming formulation

Education

Colorado School of Mines   Golden, CO
Ph.D., Advanced Energy Systems   December 2023

North Carolina State University   Raleigh, NC
B.S., Environmental Engineering   May 2019