

JACQUELINE A. DOWLING

Assistant Professor

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Civil and Environmental Engineering

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ACADEMIC APPOINTMENT

Assistant Professor, *University of Iowa*

Department of Civil and Environmental Engineering | Iowa City, IA, Jan 2026

Postdoctoral Energy Fellow, *Stanford University*

Department of Energy Science and Engineering; Department of Earth System Science
Stanford, CA, April 2024 - Jan 2026

Postdoctoral Researcher, *Carnegie Institution for Science*

Department of Global Ecology | Stanford, CA, Sept 2023 - April 2024

EDUCATION

Ph.D., Chemistry, *California Institute of Technology* | Pasadena, CA, June 2023

Minor: Environmental Science and Engineering

Division of Chemistry and Chemical Engineering

Title: Long-Duration Energy Storage in Reliable Wind and Solar Electricity Systems

Bachelor of Arts, *Carleton College* | Chemistry | Northfield, MN, June 2017

PEER-REVIEWED JOURNAL ARTICLES (850+ citations in Google Scholar, *co-first author)

1. Wongel, A., **Dowling, J.A.**, Duan, L., Vernon, A., McKay, I., Caldeira, K., Thermal energy storage in dirt for repowering decommissioned coal plants, 2025, *Findings*, doi.org/10.32866/001c.141340.
2. Ruggles, T.H.*, Virgüez, E.A.*, Reich, N.D., **Dowling, J.A.**, Bloomfield, H., Antonini, E., Davis, S.J., Lewis, N.S., Caldeira, K., Planning reliable solar- and wind-based electricity systems, 2024, *Adv. Appl. Energy*. doi.org/10.1016/j.adapen.2024.100185.
3. **Dowling, J.A.**, Ruggles, T.H., Virgüez, E.A., Reich, N.D., Ifkovits, Z.P., Davis, S.J., Li, A.X., Kennedy, K.M., Rinaldi, K.Z., Duan, L., Caldeira, K., Lewis, N.S. Opportunities and constraints of hydrogen energy storage systems, 2024, *Environmental Research: Energy*. doi.org/10.1088/2753-3751/ad58e5.
4. Li, A.X.*, Virgüez, E.A.*, **Dowling, J.A.***, Ruggles, T.H., Wongel, A., Reich, N.D., Lewis, N.S., Caldeira, K., The influence of regional geophysical resource variability on the value of single- and multi-storage technology portfolios, 2024, *Environmental Science & Technology*. doi.org/10.1021/acs.est.3c10188.
5. **Dowling, J.A.***, Ifkovits, Z.P.*, Carim, A.I., Evans, J.M., Swint, M.C., Ye, A.Z., Richter, M.H., Li, A.X., Lewis, N.S., Catalysis of the oxygen-evolution reaction in 1.0 M sulfuric acid by manganese antimonate films synthesized via chemical vapor deposition, 2024, *ACS Applied Energy Materials*. doi.org/10.1021/acsaem.4c00135. **ACS Front cover.**
6. Ifkovits, Z.P., Evans, J.M., Kempler, P.A., Pham, K.H., Morla, M.B., **Dowling, J.A.**, Carim, A.I., Lewis, N.S., Powdered $\text{Mn}_y\text{Sb}_{1-y}\text{O}_x$ catalysts for cerium-mediated oxygen evolution in acidic environments, 2022, *ACS Energy Letters*. doi.org/10.1021/acsenenergylett.2c01754.
7. Kennedy, K.M., Ruggles, T.R., Rinaldi, K.Z., **Dowling, J.A.**, Duan, L., Caldeira, K., Lewis, N.S., The role of concentrated solar power with thermal energy storage in least-cost highly reliable electricity systems fully powered by variable renewable energy, 2022, *Advances in Applied Energy*. doi.org/10.1016/j.adapen.2022.100091.

8. Ruggles, T.R., **Dowling, J.A.**, Lewis, N.S., Caldeira, K., Opportunities for flexible electricity loads such as hydrogen production from curtailed generation, 2021, *Advances in Applied Energy*. doi.org/10.1016/j.adapen.2021.100051.
9. Rinaldi, K.Z., **Dowling, J.A.**, Ruggles, T.R., Caldeira, K., Lewis, N.S., Wind and solar resource droughts in California highlight the benefits of long-term storage and integration with the Western Interconnect, 2021, *Environmental Science & Technology*. doi.org/10.1021/acs.est.0c07848.
10. Yuan, M., Tong, F., Duan, L., **Dowling, J.A.**, Davis, S.J., Lewis, N.S., Caldeira, K., Would firm generators facilitate or deter variable renewable energy in a carbon-free electricity system?, 2020, *Applied Energy*. doi.org/10.1016/j.apenergy.2020.115789.
11. **Dowling, J.A.**, Rinaldi, K.Z., Ruggles, T.R., Davis, S.J., Yuan, M., Tong, F., Lewis, N.S., Caldeira, K., Role of long-duration energy storage in variable renewable electricity systems, 2020, *Joule*. doi.org/10.1016/j.joule.2020.07.007. **Cited 500+ times, Joule Front cover.**
12. Laskina, O., Cochran, R.E., Trueblood, J., Estillore, A.D., Morris, H.S., Jayarathne, T., Sultana, C.M., Lee, C., Lin, P., Laskin, J., Laskin, A., **Dowling, J.A.**, Qin, Z., Cappa, C.D., Bertram, T.H., Tivanski, A., Stone, E.A., Prather, K.A., Grassian, V.H., Molecular characterization of individual particles from freshly emitted sea spray aerosol: Influence of ocean biology on particle composition and its interactions with water vapor, 2017, *Chem*. doi.org/10.1016/j.chempr.2017.03.007.
13. Trueblood, J., Estillore, A.D., Lee, C., **Dowling, J.A.**, Prather, K.A., Grassian, V.H., Heterogeneous chemistry of biological-derived components of sea spray aerosol: The role of acid-base chemistry, 2016, *Journal of Physical Chemistry A*. doi.org/10.1021/acs.jpca.6b07023.

TECHNICAL REPORTS & NON-PEER REVIEWED JOURNAL ARTICLES

1. **Dowling, J.A.**, Lewis, N.S., Long-duration energy storage for reliable renewable electricity: The realistic possibilities, 2021, *Bulletin of the Atomic Scientists*. doi.org/10.1080/00963402.2021.1989191.
2. Caldeira, K., **Dowling, J.A.**, Portfolios all the way down ..., 2021, *Joule*. doi.org/10.1016/j.joule.2021.10.008.
3. Bazilian, M.D., Victor, D.G., Castro, C., **Dowling, J.A.**, Dehghanian, P., Gençer, E., Kammen, D., Logan, J., Mauter, M., Tarroja, B., Wagner, G., America's Zero Carbon Action Plan. Chapter 5.1 Accelerating Deep Decarbonization in the U.S. Power Sector, 2020, *Sustainable Development Solutions Network*. www.unsdsn.org/Zero-Carbon-Action-Plan.

MANUSCRIPTS IN SUBMISSION OR PREPARATION

1. Reich, N.D., Ruggles, T.H., Virgüez, E.A., **Dowling, J.A.**, Caldeira, K., Lewis, N.S., Cost-effective approaches to maintaining resource adequacy in renewable electricity systems over decades of weather variability, 2025, *Submitted*.
2. Freese, L., Spandagos C., Andrews, A., Jones, E.C., **Dowling, J.A.**, Rising, J., Crozier, C., Mirkouei, A., Luo, Q., Gong, W., Schenuit, F., Bednar, D., Bridging research and policy to achieve a clean energy future, 2025, *Submitted*.
3. **Dowling, J.A.**, Saad, D., Wongel, A., Azevedo, I., Caldeira, K., Brandt, A., Davis, S.J., Net-zero emissions heat, *In Prep*.
4. Wongel, A., **Dowling, J.A.**, Davis, S.J., Caldeira, K., Supplying process heat with concentrated solar thermal energy, *In Prep*.
5. Saad, D., **Dowling, J.A.**, Sodwatanta, M., Jo C., O'Donnel, J., Davis S.J., Azevedo, I., Brandt, A., Heat electrification vs carbon capture & storage: Decarbonizing industrial process heat in California's energy transition, *In Prep*.

RESEARCH EXPERIENCE

Graduate Research Collaborator (Gates Ventures funded), Carnegie Science. Advisors: Senior Scientist Ken Caldeira and Professor Nathan Lewis | Stanford, CA | 2018 - 2023.

Graduate Research Assistant, California Institute of Technology. Advisor: Professor Nathan Lewis Pasadena, CA | 2017 - 2023.

Undergraduate Senior Thesis, Carleton College. Advisors: Professor Steven Drew and Professor Bruce Parkinson | Northfield, MN | 2017.

Dyes and Dots: The Chemistry of Harvesting Sustainable Energy. (Photoelectrochemistry)

Assistant Developer, National Center for Atmospheric Research (NCAR). Advisors: Dr. Charles Bardeen, Dr. Andrew Gettelman | Boulder, CO | Summer 2016.

Developing Diagnostics for the Whole Atmosphere Community Climate Model (WACCM).

Undergraduate Researcher (NSF funded), University of California San Diego. Advisor: Professor Kim Prather | San Diego, CA | Summer 2015.

Reactions of a Marine-Derived Organic Compound with an Urban Air Pollutant.

Research Assistant, University of Iowa. Advisor: Professor Vicki Grassian | Iowa City, IA | 2014-2015. *Characterization of Molecular and Biological Species in Sea Spray Aerosols.*

TEACHING EXPERIENCE

Research Mentor | Caltech Summer Undergraduate Research Fellowship | 2021-2023.

Anna X. Li | Caltech Undergraduate | Co-author of energy system modeling publication.

Madeleine C. Swint | Caltech Undergraduate | Co-author of electrocatalysis publication.

Course Developer & Teaching Assistant | Caltech | 2019-2022.

Sustainable Engineering | Professor Julie Kornfield | Winter 2021, Winter 2022. Teaching assistant. Cross-listed as ChE/ESE/ME/MS 111 in various departments: chemical engineering, environmental science & engineering, mechanical engineering, and material science.

Sustainable Chemical Engineering | Professor Julie Kornfield | Fall 2020. Developed curriculum for a new course (ChE 111) including materials for the syllabus, lectures, problem sets, readings, essays, projects, and exams.

Fundamentals of Sustainability Science and Engineering | Instructor Mamadou Diallo | Winter 2020. Teaching assistant and guest lecturer. Cross-listed as ChE190, MS150, and ESE100 in chemical engineering, material science, and environmental science & engineering.

Sustainability at Caltech | Student-led initiative | Winter 2019. Seminar leader and organizer of student-led sustainability initiatives on campus. Developed the class, listed as ESE 104.

AWARDS & HONORS

Stanford Energy Postdoctoral Fellowship | Stanford University | April 2025 - Jan 2026.

The energy-centered postdoctoral research program is nurturing a global community of future leaders to realize sustainable, affordable, and secure energy for the world.

Energy Policy Boot Camp Fellow | Washington D.C. | June 2024.

Mason-Maryland Energy and Climate-Tech Innovation Policy Boot Camp for Early Career Researchers funded by the Sloan Foundation.

SoCalGas Fellowship | California Institute of Technology | 2020-22.

Fellowship from SoCalGas in support of low-carbon energy science and policy.

Patricia "Pat" Beckman Graduate Fellowship | California Institute of Technology | 2018-19.

Zeller-Resnick Fellow | California Institute of Technology | 2017-18.

Provides an annual fellowship to an incoming first-year graduate student showing excellent potential in the field of sustainability science or sustainable energy science.

Charles Carlin Prize in Chemistry | Carleton College | 2017.

The prize honors senior chemistry majors whose enjoyment of chemistry and gracious good humor has inspired and assisted others in the field.

Sigma Xi, the Scientific Research Society | 2016-17.

National honor society for students who have demonstrated evidence of research potential in a field of pure or applied science.

LEADERSHIP & SERVICE

Professional Affiliations

Institute for Operations Research and the Management Sciences (INFORMS) | 2022-present

American Geophysical Union (AGU) | 2019-present

Open Energy Modelling Initiative (Openmod) | 2019-present

United States Association for Energy Economics (USAEE/IAEE) | 2019

Journal Referee: *Joule*, *Applied Energy*, *Environmental Science & Technology*, *Environmental Research: Energy*, *Nature Communications*, *Nature Reviews Clean Technology*

Alpine Club, Co-President | Caltech | 2019-2021

Managed a team of 15 club officers, budget, safety courses, film festivals, and gear rentals for the 250-person club. Supported by the Moore-Hufstедler Fund and Banff Film Festival.

Actor for Giving Voice Vignette | Caltech | 2019

Worked with Professor Melany Hunt on gender equity in STEM, NSF-funded Caltech project.

Sustainability Assistant | Carleton College | Winter 2017

Implemented campus-wide sustainability initiatives & resources for students, faculty, and staff.

Energy Club, President | Carleton College | 2016-17

Organized two campus-wide symposiums, energy-tech lab demos, and community events.

Sustainable Energy Principles and Practice in India | Carleton College | Fall 2016-17

Off-campus study program with the Physics Department, installed a solar array in India.

CONFERENCES & INVITED TALKS (selected)

Energy Storage Portfolios

Oral Presenter | American Geophysical Union | Washington D.C., Fall 2024

Net-Zero Emissions Energy Systems⁺ (four sessions), Heat Decarbonization⁺, Opportunities and Constraints of Hydrogen Energy Storage Systems^{*}

⁺*Session Co-Chair*, ^{*}*Oral Presenter* | INFORMS | Seattle, WA, Fall 2024

Impact of Variability and Extremes of Weather in Energy Systems⁺, Multi-Objective Decision Making Under Uncertainty⁺, The Hydrogen Economy: Challenges and Opportunities⁺, Representation of Hydrogen in Capacity Expansion Modeling^{*}

⁺*Session Co-Chair*, ^{*}*Oral Presenter* | INFORMS | Phoenix, AZ, Fall 2023

Energy System Flexibility: Considering Daily, Seasonal, and Interannual Weather Variability

Plenary Speaker | Next Generation Energy Climate Modelling | United Kingdom, Fall 2022

Earth-Abundant Mn_ySb_{1-y}O_x Electrocatalysts for Water Oxidation in Acidic Media

Poster Presenter | Electrochemistry Gordon Research Conference | Ventura, CA, Fall 2022

Harnessing Renewable Hydrogen for Long Term Energy Storage

Oral Presenter | Institute for Operations Research and the Management Sciences | Fall 2022

Oral Presenter | United States Climate Alliance | Summer 2022

Oral Presenter | California Council on Science and Technology | Summer 2022

Oral Presenter | Renewable Gas 360 | Sacramento, CA | Spring 2021 | **Audience of > 400**

Oral Presenter | California Hydrogen Business Council | Fall 2020 | **Audience of > 300**

Role of Long-Duration Energy Storage in Variable Renewable Electricity Systems

Oral Presenter | American Geophysical Union | San Francisco, CA, Fall 2020

Oral Presenter | United States Association for Energy Economics | Denver, CO, Fall 2019

Oral Presenter | Open Energy Modelling Workshop | NREL | Denver, CO, Fall 2019

Net-Zero Emissions Energy Systems: Geophysical Constraints, Consequences, and Opportunities

Session Convener | American Geophysical Union | San Francisco, CA, Fall 2019, Fall 2021