

## JACQUELINE A. DOWLING

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### EDUCATION

#### Postdoctoral Fellow

*Carnegie Science* | Stanford, CA  
Climate Energy Lab

Sept 2023 - Present

#### Ph.D., Chemistry

*California Institute of Technology* | Pasadena, CA  
Division of Chemistry and Chemical Engineering  
Minor: Environmental Science and Engineering  
Thesis Title: Long-Duration Energy Storage in  
Reliable Wind and Solar Electricity Systems

June 2023

#### Bachelor of Arts

*Carleton College* | Northfield, MN  
Department of Chemistry

June 2017

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### MANUSCRIPTS IN SUBMISSION OR PREPARATION

Available upon request.

1. Planning resource adequacy of solar- and wind-based electricity systems. Ruggles, T. H.\*; Virgüez, E. A.\*; Reich, N. D.; **Dowling, J. A.**; Bloomfield, H.; Antonini, E.; Davis, S. J.; Lewis, N. S.; Caldeira, K. **Accepted 2024**, *Advances in Applied Energy*.
2. Maintaining resource adequacy in renewable electricity systems during decades of weather variability. Reich, N. D.; Ruggles, T. H.; Virgüez, E. A.; **Dowling, J. A.**; Covelli, D.; Caldeira, K.; Lewis, N. S. *In preparation*.

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### PROFESSIONAL PUBLICATIONS

Over 700 citations in Google Scholar.

1. Opportunities and constraints of hydrogen energy storage systems. **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.; Calderia, K.; Lewis, N. S. **2024**, *Environ. Res.: Energy*. <https://doi.org/10.1088/2753-3751/ad58e5>.
2. The influence of regional geophysical resource variability on the value of single- and multi-storage technology portfolios. Li, A. X.\*; Virgüez, E. A.\*; **Dowling, J. A.\***; Ruggles, T. H.; Wongel, A.; Reich, N. D.; Lewis, N. S.; Caldeira, K. **2024**, *Environ. Sci. Tech*. <https://doi.org/10.1021/acs.est.3c10188>.
3. Catalysis of the oxygen-evolution reaction in 1.0 M sulfuric acid by manganese antimonate films synthesized via chemical vapor deposition. **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., **2024**, *ACS Applied Energy Materials*. <https://doi.org/10.1021/acsaem.4c00135>. **Front cover**.
4. Powdered  $Mn_ySb_{1-y}O_x$  catalysts for cerium-mediated oxygen evolution in acidic environments. Ifkovits, Z. P.; Evans, J. M.; Kempler, P. A.; Pham, K. H.; Morla, M. B.; **Dowling, J. A.**; Carim, A. I.; Lewis, N.S., **2022**, *ACS Energy Letters*. <https://doi.org/10.1021/acsenerylett.2c01754>.
5. The role of concentrated solar power with thermal energy storage in least-cost highly reliable electricity systems fully powered by variable renewable energy. Kennedy, K. M.; Ruggles, T. R.; Rinaldi, K. Z.; **Dowling, J. A.**; Duan, L.; Caldeira, K.; Lewis, N. S., **2022**, *Advances in Applied Energy*. <https://doi.org/10.1016/j.adapen.2022.100091>.
6. Long-duration energy storage for reliable renewable electricity: The realistic possibilities. **Dowling, J. A.**; Lewis, N. S., **2021**, *Bulletin of the Atomic Scientists*. <https://doi.org/10.1080/00963402.2021.1989191>.
7. Portfolios all the way down ... Caldeira, K.; **Dowling, J. A.**, **2021**, *Joule*. <https://doi.org/10.1016/j.joule.2021.10.008>.

8. Opportunities for flexible electricity loads such as hydrogen production from curtailed generation. Ruggles, T. R.; **Dowling, J. A.**; Lewis, N. S.; Caldeira, K., **2021**, *Advances in Applied Energy*. <https://doi.org/10.1016/j.adapen.2021.100051>.
9. Wind and solar resource droughts in California highlight the benefits of long-term storage and integration with the Western Interconnect. Rinaldi, K. Z.; **Dowling, J. A.**; Ruggles, T. R.; Caldeira, K.; Lewis, N. S., **2021**, *Environmental Science & Technology*. <https://doi.org/10.1021/acs.est.0c07848>.
10. America's Zero Carbon Action Plan. Chapter 5.1 Accelerating Deep Decarbonization in the U.S. Power Sector. Bazilian, M. D.; Victor, D. G.; Castro, C.; **Dowling, J. A.**; Dehghanian, P.; Gençer, E.; Kammen, D.; Logan, J.; Maunder, M.; Tarroja, B.; Wagner, G., **2020**, *Sustainable Development Solutions Network*. <https://www.unsdsn.org/Zero-Carbon-Action-Plan>.
11. Would firm generators facilitate or deter variable renewable energy in a carbon-free electricity system? Yuan, M.; Tong, F.; Duan, L.; **Dowling, J. A.**; Davis, S. J.; Lewis, N. S.; Caldeira, K., **2020**, *Applied Energy*. <https://doi.org/10.1016/j.apenergy.2020.115789>.
12. Role of long-duration energy storage in variable renewable electricity systems. **Dowling, J. A.**; Rinaldi, K. Z.; Ruggles, T. R.; Davis, S. J.; Yuan, M.; Tong, F.; Lewis, N. S.; Caldeira, K., **2020**, *Joule*. <https://doi.org/10.1016/j.joule.2020.07.007>. **Cited > 350 times, Joule cover.**
13. Molecular characterization of individual particles from freshly emitted sea spray aerosol: Influence of ocean biology on particle composition and its interactions with water vapor. 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., **2017**, *Chem*. <https://doi.org/10.1016/j.chempr.2017.03.007>.
14. Heterogeneous chemistry of biological-derived components of sea spray aerosol: The role of acid-base chemistry. Trueblood, J.; Estillore, A. D.; Lee, C.; **Dowling, J. A.**; Prather, K. A.; Grassian, V. H., **2016**, *J Phys Chem A*. <https://doi.org/10.1021/acs.jpca.6b07023>.

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## RESEARCH EXPERIENCE

**Postdoctoral Research Fellow, Carnegie Science.** Advisors: Senior Scientist Emeritus Ken Caldeira and Professor Steve Davis | Stanford, CA | Sept 2023-current.

**Graduate Research Collaborator, Carnegie Science.** Advisors: Senior Scientist Emeritus 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.*

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## 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, Professor Julie Kornfield, and Professor Katherine Faber | 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.

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## AWARDS AND HONORS

**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. Election to the Carleton Chapter of Sigma Xi, a national honor society, indicates that a student has demonstrated evidence of research potential in a field of pure or applied science.

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## CONFERENCES AND INVITED TALKS (selected)

***Impact of Variability and Extremes of Weather in Energy Systems<sup>+</sup>; Multi-Objective Decision Making Under Uncertainty<sup>+</sup>; The Hydrogen Economy: Challenges and Opportunities<sup>+</sup>; Representation of Hydrogen in Capacity Expansion Modeling\****

<sup>+</sup>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, Sb<sub>1-y</sub>O<sub>x</sub> 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