John C. Stevens, Ph.D.

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

Dr. Stevens' focus area is integrated system planning. Dr. Stevens focuses on determining the value of and business case for deploying synthetic fuels such as hydrogen and determining the value of emerging technologies for decarbonizing energy systems. Dr. Stevens received a Ph.D. in Mechanical Engineering and a M.S. in Mechanical Engineering from the University of California at Berkeley, and a B.S. in Mechanical Engineering from Tufts University.

Select E3 projects include:

- Project lead for an ARPA-E project whose deliverable was an open-source Python-based machine learning model, RESERVE, which predicts dynamic ancillary services (AS) needs in deeply renewable grids. Team constructed a bespoke PLEXOS production simulation of CAISO to quantify RESERVE's ability to reduce production costs, greenhouse gas (GHG) emissions and renewable curtailment versus incumbent CAISO practices. Authored peer-reviewed article on project findings.
- Project manager for CPUC-funded effort to develop a white paper about and financial model of emerging zero-carbon technologies that can provide firm generation power. Technologies considered include hydrogen electrolyzers, hydrogen storage, hydrogen pipelines and hydrogen-powered combustion and fuel cell power plants. Additional competitors to hydrogen also considered. Cost data underwent public review by CPUC stakeholders and is to be incorporated in sensitivity cases in the next round of CPUC IRP modeling.
- Technical lead on project for Mitsubishi Power Americas, to evaluate the total market size of electrolyzers paired with hydrogen-powered combustion turbines (CTs) and combined cycle (CCGTs) power plants. Evaluated plant economics in the California Independent System Operator (CAISO) electricity market. Coauthored white paper on findings.
- Advisor for project for confidential developer looking to build hydrogen power plants in California. Assessed impact of Inflation Reduction Act, pipeline costs, and storage costs on the levelized cost of hydrogen. Used E3's RESOLVE model to evaluate economic competitiveness of hydrogen combustion power plants versus carbon capture and sequestration power plants.
- Project lead for study for confidential utility evaluating rate impacts of a proposed green ammonia plant using E3's RESOLVE model. Project deliverables include marginal resource build and rate impacts of building flexible ammonia plant.
- Technical lead on project for major international utility's development arm to assess best business model for deploying green hydrogen projects. Assessed economics of using green hydrogen relative to fossil fuel incumbents for electricity, chemicals and transportation sectors.
- Lead developer of E3's in-house tool for calculating the synthesis, storage and delivery cost trajectories of electrofuels, including electrolytic hydrogen, synthetic natural gas (SNG), and synthetic diesel. Tool has been widely used in E3 analyses since 2018, in particular for electric and gas utility integrated resource plans (IRPs).

- Project manager and proposal lead for a study performed for a major OEM evaluating the total market size and per-vehicle benefits of vehicle-grid integration (VGI) for battery electric vehicles (BEVs) in CAISO and NYISO. Project assessed VGI revenues from AS, capacity and energy market participation. Project also identified critical advancements in policy required to deploy VGI.
- Evaluated the value of various solar PPAs to hypothetical offtakers based on plant's energy and capacity market revenue in CAISO market.
- Served as modeling lead using PLEXOS to analyze potential value of pumped storage hydro for major balancing area (BA) in Western Interconnection.
- Primary developer of E3's Python-based RESERVE tool, which has been used to predict AS needs for 15 different BAs across the U.S.
- Improved E3's modeling of the expected load carrying capacity of shaped demand response measures through code updates to E3's Python-based RECAP tool.
- Project manager and proposal lead for project using RESERVE and PLEXOS to calculate the integration charges for IPP wind, solar and solar + storage power plants operating in a vertically integrated utility in the Western Interconnection.
- Team member on project evaluating the benefits of flexible solar power plant operation in Tampa Electric service territory.

U.S. DEPARTMENT OF ENERGY Washington, DC
Physical Scientist, *Office of Energy Efficiency and Renewable Energy (EERE)* June 2016 – June 2017
Hydrogen and Fuel Cell Technologies Office (HFTO)

- Project manager for HFTO's "H2@Scale" initiative. This initiative sought to launch an R&D program to enable low-cost hydrogen-production via various technologies, such as AEM, PEM and SOEC electrolyzers.
- Evaluated the market segmentation between hydrogen and battery electric vehicles for light-medium- and heavy-duty vehicles.
- Evaluated various project proposals by national laboratories and private companies.

LAWRENCE BERKELEY NATIONAL LABORATORY Berkeley, CA
Graduate Student Researcher January 2011 – December 2015

- Developed large-scale multiphysics simulation programs to design optically concentrating, photoelectrochemical systems with greater than 11% annual solar to hydrogen production efficiency.
- Modeled annual profiles of hourly transient component temperature in field-deployed photoelectrochemical devices. Identified different temperature regulation methods to prevent device failure.

EMCOR ENERGY SERVICES San Francisco, CA
Energy Engineer August 2007 – July 2009

- Identified energy and peak demand savings through retrofits to and new construction of thermal energy storage systems, chillers, package units, boilers, heat pumps, variable speed drives, fume hoods, and building envelope improvements in municipal, commercial, industrial and institutional facilities in Northern California.

Education

University of California — Berkeley, CA
Ph.D., Mechanical Engineering — 2015

University of California — Berkeley, CA
M.S., Mechanical Engineering — 2012

Tufts University — Medford, MA
B.S., Mechanical Engineering — 2007

Selected Presentations and Non-Peer Reviewed Publications

1. Stevens, J. C., "Hydrogen 101 – Understanding Hydrogen Currently." S&P Global Platts 3rd Annual Hydrogen Markets Americas Conference. 3/30/2022.
2. Stevens, J. C. et al, "Green Hydrogen as a Low-Carbon Step Toward Net-Zero." Cornell Energy Connection. 11/19/2021. https://www.youtube.com/watch?v=BFMbJlF1LXk
3. Lintmeijer et al, "Opportunities for Low-Carbon Hydrogen in Colorado: A Roadmap" 10/25/2021. https://www.ethree.com/new-e3-report-examines-colorados-opportunities-for-hydrogen-deployment/
4. Mahone, A. et al, "Hydrogen Opportunities in a Low-Carbon Future: An Assessment of Long-Term Market Potential in the Western United States" 6/21/2020. https://www.ethree.com/wp-content/uploads/2020/07/E3_MHPS_Hydrogen-in-the-West-Report_Final_June2020.pdf
5. Nelson, J. et al, "Investigating the Economic Value of Flexible Solar Power Plant Operation" 10/1/2018. https://www.ethree.com/wp-content/uploads/2018/10/Investigating-the-Economic-Value-of-Flexible-Solar-Power-Plant-Operation.pdf

Peer-Reviewed Publications

1. Sun, Y.; Nelson, J.; **Stevens, J. C.**; Au, A.; Venugopal, V.; Gulian, C.; Kasina, S.; O'Neill, P.; Yuan, M.; and Olson, A. "Machine Learning Derived Dynamic Operating Reserve Requirements in High-Renewable Power Systems," *Journal of Renewable and Sustainable Energy.* 2022, 14, 036303. https://aip.scitation.org/doi/pdf/10.1063/5.0087144
2. Morrison, G.; **Stevens, J. C.**; Joseck, F. "Relative Economic Competitiveness of Light-Duty Battery Electric and Fuel Cell Electric Vehicles", Transportation Research Part C. 2018, 87, 183-196. https://doi.org/10.1016/j.trc.2018.01.005
3. **Stevens, J. C.**; Weber, A. Z. "A computational study of optically concentrating, solar-fuels generators from annual thermal- and fuel-production efficiency perspectives" *Journal of the Electrochemical Society* 2016, 163, H475-H484. https://doi.org/10.1149/2.0121607jes
4. Sathre, R; Greenblatt, J. B.; Walczak, K. A.; Sharp, I. D.; **Stevens, J. C.**; Ager, J. W. III; Houle, F. A. "Opportunities to Improve the Net Energy Performance of Photoelectrochemical Water-Splitting Technology" *Energy and Environmental Science* 2016, 9, 803-819. https://doi.org/10.1039/C5EE03040D
5. Xiang, C. X.; Weber, A. Z.; Ardo, S.; Berger, A.; Cordian, R.; Fountain, K.; Haussener, S.; Hu, S.; Liu, R.; Lewis, N. S.; Modestino, M.; Shaner, M.; Singh, M. R.; **Stevens, J. C.**; Sun, K.; Walczak, K.

"Modeling, Simulation and Implementation of Solar-Driven Water-Splitting Devices" *Angewandte Chemie* 2016, 55, 12974-12988. https://doi.org/10.1002/anie.201510463

6. Sathre, R.; Scown, C. D.; Morrow, W. R.; **Stevens, J. C.**; Sharp, I. D.; Ager, J. W. III; Walczak, K. A.; Houle, F. A.; Greenblatt, J. B. "Life-cycle Net Energy Assessment of Large-Scale Hydrogen Production Via Photo-Electrochemical Water Splitting" *Energy and Environmental Science* 2014, 7, 3264-3278. https://doi.org/10.1039/C4EE01019A
7. Singh, M. R.; **Stevens, J. C.**; Weber, A. Z. "Design of Membrane-Encapsulated Wireless Photoelectrochemical Cells for Hydrogen Production" *Journal of the Electrochemical Society* 2014, 161, E3283-E3296. http://dx.doi.org/10.1149/2.033408jes