

ENERGY AND ENVIRONMENTAL ECONOMICS, INC.

San Francisco, CA

Partner

Amber Mahone leads E3's Clean Energy practice area, which specializes in analyzing and modeling long-term greenhouse gas reduction strategies in the energy economy, including a focus on building electrification and future of natural gas questions. She has led California's analysis of greenhouse gas reduction strategies and worked on similar projects focusing on the Northwest, New York, New England, and the entire U.S. E3's Clean Energy practice brings an inter-disciplinary approach to energy analysis, weaving together E3's strengths in electricity planning and markets with a broader, economy-wide perspective on how the transportation, buildings, and industrial sectors may evolve over time.

Ms. Mahone's expertise ranges from renewable integration, to transportation and building efficiency and electrification, to biofuels and emerging low-carbon technologies. Over the course of the past 15 years at E3, Ms. Mahone has also worked in electricity resource planning, energy efficiency cost-effectiveness, and non-wires alternatives analysis. Her clients include many of the California state energy agencies and utilities, as well as utilities and commissions across the U.S.

Ms. Mahone holds an M.P.A. from Princeton University and a B.A. in International Relations from Wellesley College. Recent projects include:

- **Colorado Energy Office, Opportunities for Hydrogen Deployment, 2021.** Led the E3 team that examined the potential role that hydrogen could play in the decarbonization of Colorado's economy. The public report for the Colorado Energy Office, *Opportunities for Low-Carbon Hydrogen in Colorado: A Roadmap*, outlines the state of the hydrogen market and potentially promising applications in Colorado, highlighting unique characteristics that could support hydrogen development in the state. The Roadmap distinguishes both opportunities and barriers to the deployment of hydrogen, as well as key steps that Colorado can take to realize its hydrogen potential.
- **Colorado Greenhouse Gas Pollution Reduction Roadmap, 2021.** The Colorado GHG Roadmap, which E3 supported with scenarios analysis using our PATHWAYS and RESOLVE models, presents actionable and achievable steps that Colorado can take to significantly reduce greenhouse gas (GHG) emissions over the next five, ten, and thirty years. While the state has already taken important steps toward decarbonization, E3's analysis found Colorado will need to take additional policy action to meet the climate goals established in 2019 in the state's Climate Action Plan to Reduce Pollution (HB 1261) targets.
- **California Air Resources Board 2022 Scoping Plan Analysis, 2021 – ongoing.** Supporting the CARB in evaluating greenhouse gas reduction scenarios for California that achieve carbon neutrality by 2035 and 2045. Using the California PATHWAYS model to evaluate the energy systems transformations necessary across all sectors of the economy to achieve these ambitious goals.
- **Massachusetts Future of Gas Analysis for the Local Distribution Companies, 2021 – ongoing.** Supporting the five investor-owned gas utilities in Massachusetts with their future of gas filings,

as required by the Department of Public Utilities docket 20-80. Our independent consultant analysis evaluates strategies for Massachusetts to meet their climate reduction goals through 2050, drawing out the potential implications and trade-offs for the gas distribution companies and their customers, with a focus on energy affordability.

- **City of Philadelphia, Philadelphia Gas Works Business Diversification Strategy, 2021.** The City of Philadelphia and the Philadelphia Gas Works (PGW) commissioned E3 to develop a Business Diversification Study for PGW, together with the City, PGW, and other stakeholders. With this report, E3 defined and evaluated technology pathways to reduce greenhouse gas emissions from PGW's natural gas business, evaluated the impact of those pathways on PGW's current business model and its customers, and recommended a series of pilots and next. Ms. Mahone briefed the Mayor's office as well as the Gas Commission on the results of the Business Diversification Study.
- **California Energy Commission "Challenge of Retail Gas," 2018-2020.** Managed E3's analysis of the implications of economy-wide decarbonization for the state's natural gas utilities and customers. E3 evaluated two strategies for reducing carbon emissions from California buildings: building electrification and renewable natural gas. E3 found that building electrification is likely to be a lower-cost and lower-risk strategy for reducing carbon emissions from buildings in California. E3 also found that, particularly under a high building electrification future, customers remaining on the natural gas system could face disproportionately high costs in the absence of a gas transition strategy.
- **Pacific Northwest Pathways to 2050, 2018.** Managed E3's analysis of regional 2050 decarbonization scenarios for the Pacific Northwest on behalf of gas distribution utility NW Natural. E3 analyzed four scenarios – two maintaining direct use of gas in buildings, and two assuming large-scale building electrification – and, unlike prior studies, paid special attention to the costs and performance of space heating technologies. Gas scenarios require reducing the carbon intensity of natural gas, high building energy efficiency, and deeper GHG reductions in non-building sector emissions; electrification scenarios require rapid adoption of electric heating technologies and significant electricity sector investments to address winter peak demand.
- **California Air Resources Board 2030 Target Scoping Plan Update, 2016 – 2017.** Managing E3's greenhouse gas modeling work with the California Air Resources Board as part of a public stakeholder process to update the state's AB 32 Scoping Plan. This project requires interpreting and representing federal, state and local laws and regulations in the PATHWAYS model and presenting the modeling results to state agency staff and the public.
- **California Independent System Operator SB 350 Regional Integration Study, 2016.** Managing E3's role in a complex modeling project with the California Independent System Operator to evaluate the costs and benefits to California ratepayers of regional integration of the Western Grid. This study also assesses the greenhouse gas, land use, environmental justice and jobs impacts of regional integration of the grid. The study was legislatively mandated under California SB 350 (2015) and is part of a broad stakeholder process.
- **California Energy Commission Long-term Energy Futures, 2016 – 2017.** Managing a large research grant with the California Energy Commission through the Electric Program Investment Charge (EPIC). The research grant was awarded to E3 to develop and evaluate long-term greenhouse gas reduction scenarios for California in the context of understanding climate change impacts to the state's energy infrastructure and economy. The research project is being performed in conjunction with Lawrence Berkeley National Laboratory, UC Berkeley and UC Irvine.
- **California Energy Agencies Analysis of Meeting California's 2030 Climate Goals, 2014 – 2015.** Worked with the energy principals of California's major energy agencies: the Air Resources Board, the California Public Utilities Commission, the Energy Commission and the Independent System

Operator, with input from Governor Brown's office. Managed the analysis of what would be required to reduce greenhouse gas emissions to meet the state's 2050 greenhouse gas goals. The results of this analysis were used to inform the Governor's 2030 greenhouse gas reduction target of 40% below 1990 levels, which was later enacted into law under SB 350.

- **Northwest Utility Cost of Carbon Abatement, 2016.** Managed a project with a Northwest utility to evaluate the cost per ton of CO₂ of different greenhouse gas abatement strategies in the region.
- **Southern California Gas Company Decarbonizing Pipeline Gas, 2014 – 2015.** Worked with Southern California Gas Company to evaluate the role of the natural gas distribution company in a low-carbon future. This project used E3's PATHWAYS model to evaluate options and trade-offs for the use of decarbonized gas in buildings and the transportation sectors.
- **Investigating a Higher Renewables Portfolio Standard in California, PG&E, SCE, SDG&E, 2013.** Managed a multi-client, high profile engagement with California's five largest electric utilities to model the renewable integration implications of increasing the state's renewable electricity generation to 50% by 2030. This project used a new production simulation dispatch algorithm developed by E3, called REFLEX.
- **Colorado Public Utilities Commission and Western Electricity Coordinating Council Scenario Planning, 2012.** Scenario Planning for the Electric Sector, Assisted the Colorado Public Utilities Commission and the Western Electricity Coordinating Council (WECC) in separate efforts to develop long-term electricity-sector scenarios for use in resource and transmission planning.
- **Bonneville Power Administration Non-wires Alternatives, 2012.** Analyzed cost-effectiveness of, and resource potential for, energy efficiency, distributed generation, generator re-dispatch and demand response alternatives to a proposed transmission line in Bonneville Power Administration's service territory.
- **Northwestern utility energy efficiency and demand response cost effectiveness.** Worked with a coalition of Northwestern electric utility cooperatives to evaluate the business case for energy efficiency and demand response programs in their service territory.
- **California Energy Commission Time Dependent Valuation for the Energy Efficiency Building Code, 2012.** Project manager for the economic analysis underlying the 2013 update to the California Title 24 energy efficiency building standards.
- **U.S. Environmental Protection Agency (EPA), Residential Energy Feedback and Behavior-based Energy Efficiency, 2011.** Lead author on this report, commissioned by the U.S. EPA for the State Energy Efficiency Action (SEE Action) Network's Customer Information and Behavior working group, a joint initiative between the EPA and the Department of Energy. The report addresses how customer information and behavior (CIB) energy efficiency programs work, who are the major players in this space, how energy efficiency savings are measured from these programs, and what are the key regulatory and policy challenges for CIB energy efficiency programs.
- **BCHydro Integrated Resource Planning, 2010.** Developed scenario forecasts of carbon dioxide emissions in the West by state and province and scenarios of energy efficiency and electric vehicle adoption.
- **California Public Utilities Commission Long-term Procurement Planning, 2010.** Supported the California Public Utilities Commission in their Long-term Procurement Plan proceeding, including development of recommendations regarding the breadth and scope of the California Investor-Owned Utility long-term plans.
- **Hydrogen Energy International, Greenhouse Gas Reduction Scenarios in California, 2009.** Part of team that developed an independent and publicly available report on "Meeting California's Long-Term Greenhouse Gas Reduction Goals." The report evaluated emission reduction options in all sectors of the California economy through the year 2050.

- **California Public Utilities Commission Electricity Sector Greenhouse Gas Abatement Analysis, 2007 – 2010.** Performed analysis of California’s electricity sector compliance with the state’s Global Warming Solutions Act (AB 32) for the California Public Utilities Commission, assessing the economic and emissions impacts of different greenhouse gas reduction strategies in the electricity sector under consideration by state policymakers.
- **U.S. Environmental Protection Agency (EPA), Guide to Resource Planning with Energy Efficiency, 2007.** Supporting author of the report commissioned by the U.S. EPA to support the National Action Plan for Energy Efficiency. The Guide describes the key issues, best practices, and main processes for resource planners to learn how to implement energy efficiency as a utility resource.

INTERNATIONAL MONETARY FUND (IMF)

Research Assistant, Policy Development and Review Department

Washington, DC

2003 – 2005

- Researched and wrote case study on macroeconomic impacts of aid inflows to Ethiopia as one of five case studies for IMF Board Paper. Created briefing material and wrote speeches for the IMF Spring and Annual Meetings, the G-8 Summit in Gleneagles, as well as other high profile international summits.

Education

Princeton University

M.A., Public Affairs - Certificate in Science, Technology, and Environmental Policy

Princeton, NJ

June 2007

Wellesley College

*B. A., International Relations, minor in Economics
Summa Cum Laude*

Wellesley, MA

2003

Bard College, International Honors Program

Global Ecology Study Abroad Program in the United States, England, Tanzania, India, the Philippines and Mexico

Annandale-on-Hudson, NY

2001 – 2002

Publications

1. Mahone, A. Z. Subin, R. Orans, M. Miller, L. Regan, M. Calviou, M. Saenz, N. Bacalao, (2018) “On the Path to Decarbonization,” *IEEE Power and Energy Magazine*, 1540-7977, July/August issue.
2. Mahone, A. Z. Subin, J. Kahn-Lang, D. Allen, V. Li, G. De Moor, N. Ryan, S. Price, (2018) “Deep Decarbonization in a High Renewables Future: Updated Results from the California PATHWAYS Model” *California Energy Commission, CEC-500-2018-012.*
3. Mahone, A., D. Mahone, E. Hart, (2016) “What if Efficiency Goals were Carbon Goals?” *ACEEE Summer Study 2016 Conference Proceedings.*
4. Yeh, S., C. Yang, M. Gibbs, D. Roland-Holst, J. Greenblatt, A. Mahone, D. Wei, G. Brinkman, J. Cunningham, A. Eggert, B. Haley, E. Hart, J. Williams, (2016), “A modeling comparison of deep

greenhouse gas emissions reduction scenarios by 2030 in California”, Energy Strategy Reviews, 13-14 (2016) 169-180.

5. *Olson, A., A. Mahone, E. Hart, J. Hargreaves, R. Jones, N. Schlag, G. Kwok, N. Ryan, R. Orans, R. Frowd, (2015), “Halfway There: Can California Achieve a 50% Renewable Grid?”, IEEE Power and Energy Magazine (July/August 2015) 41 – 52.*
6. *McKenzie, L., R. Orans, J. Williams, A. Mahone, (2014) “Strengthening the Clean Power Plan: Three Key Opportunities for the EPA,” The Electricity Journal, Vol. 27(10), 80-92.*
7. *Williams, J., A. DeBenedictis, R. Ghanadan, A. Mahone, J. Moore, W. Morrow III, S. Price, M. Torn, (2012) “The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity,” Science, Vol. 335, 53 – 59.*
8. *Mahone, A., B. Haley, R. Orans, J. Williams, (2011) “Electric Vehicles and Gas-Fired Power: A Strategic Approach to Mitigating Rate Increases and Greenhouse Price Risk,” Public Utilities Fortnightly (Dec 2011) 42 - 50, available at: http://www.fortnightly.com/exclusive.cfm?o_id=918*
9. *Orans, R., F. Pearl, A. Mahone, (2010) “A Modest Proposal: After Cap and Trade,” The Brookings Institute papers, available at: http://www.brookings.edu/papers/2010/0628_cap_trade_pearl.aspx*
10. *Mahone, A., C.K. Woo, J. Williams, I. Horowitz (2009) "Renewable Portfolio Standards and Cost-Effective Energy Efficiency Investment," Energy Policy, 37(3), 774 - 777.*

Selected Presentations

1. *(2018) “From Ambition to Action in Transportation,” Invited panelist, UC Davis at the Global Climate Action Summit (GCAS), September 12, 2018, San Francisco, CA.*
2. *(2018) “Deep Decarbonization in a High Renewables Future,” UC Davis California Climate Policy Modeling (CCPM-3) Workshop, May 2018, Davis, CA*
3. *(2016) “PATHWAYS to Decarbonization: Implications for Electricity Generation, Renewables and Natural Gas,” IPIECA Low Emissions Pathways Workshop, March 15 – 16, 2016, Houston Texas.*
4. *(2016) “Cap and Trade and Other Carbon Reduction Policies: Complementary or Counterproductive?” EUCI Conference on Optimizing Carbon Market Mechanisms in the Western Interconnect, January 20 – 21, 2016, Los Angeles, CA.*
5. *(2015) “West Coast Climate Change Policies,” Western States Petroleum Association Issues Conference, October 30, 2015, Half Moon Bay, CA.*
6. *(2015), “California Climate Goals for 2030 and 2050,” California Council for Environmental and Economic Balance Summer Issues Seminar, July 15, 2015, Lake Tahoe, CA.*

7. (2015) *“Cap and Trade and Complementary Climate Policies in California: AB32 and Beyond,”* North American Carbon Program, January 28, 2015, Washington, DC.
8. (2014) *“The Long Game: Energy Efficiency in a Low Carbon World”* March 30 – April 1, 2014, ACEEE National Symposium on Market Transformation, Baltimore, MD.
9. (2014) *“The Effect of High Renewable Penetration on California Markets and Carbon Balance,”* with Arne Olson, EUCI Conference on California Carbon Policy Impacts on Western Power Markets, January 27, 2014, San Francisco, CA.
10. (2011) *“Emerging Programs & Policies in Customer Information and Behavior,”* Behavior, Energy and Climate Change Conference, Nov. 30 – Dec. 2, 2011, Washington DC.
11. (2011) *“Carbon Reductions and Impacts on Electric Utilities,”* Southeast Electricity Exchange IRP Task Force Meeting, September 20, 2011, Charlotte, NC.
12. (2011) *“Energy Efficiency and CO2 Savings,”* International Energy Program Evaluation Workshop on Evaluating Carbon Emissions from Energy Efficiency Projects, August 15, 2011, Washington DC.
13. (2011) *“Ratepayer risk, Greenhouse Gas Emissions and Electric Vehicles,”* Advanced Workshop in Regulation and Competition, 24th Annual Western Conference, June 16, 2011, Monterey, CA.
14. (2010) *“Getting to 2050: Pathways to deep reductions in GHG emissions,”* WestCARB Annual Business Meeting, October 19, 2010, Sacramento, CA.
15. (2009) *“Energy Efficiency in 2050: Long-Term Greenhouse Gas Reduction Targets,”* ACEEE'S Fifth National Conference on Energy Efficiency as a Resource, September 27 – 29, 2009, Chicago, Illinois.
16. (2009) *“Long-term Greenhouse Gas Reductions in California: Vehicle Electrification and Electricity Generation in 2050,”* 32nd IAEE International Conference: Energy, Economy, Environment: The Global View, June 21 – 24, 2009, San Francisco, California.
17. (2008) *“Energy Efficiency’s Impact on California’s Renewable Energy Development,”* ACEEE Summer Study on Energy Efficiency in Buildings, August 17 – 22nd, 2008, Pacific Grove, CA.