



Professional Affiliations

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
 Adjunct Faculty, Cal Poly State University, San Luis Obispo CA
 American Solar Energy Society (ASES)
 International Ground-Source Heat Pump Association (IGSHPA)
 Certified Energy Manager (CEM), Association of Energy Engineers (AEE)
 Founding member of the Board of Directors, Office for Resource Efficiency

Registrations / Certifications

Registered Professional Engineer: Colorado, California, Oregon
 Member National Council of Examiners for Engineering and Surveying (NCEES)
 Registered as both Mechanical and Civil P.E.

Education

Bachelor of Science in Civil Engineering with Honors, University of California, Berkeley
 Direct Digital Controls, University of Wisconsin
 HVAC/Refrigeration Technology, Front Range Community College
 TechComm 101, Society for Technical Communication

Selected Awards & Accomplishments

Several LEED-registered projects
 Awards of excellence and distinction from the Society for Technical Communication

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David Houghton, P.E., Principal

Principal Dave Houghton brings a unique combination of efficiency research and real-world design experience to Ecos Research. Drawing on 25 years of experience in the energy efficiency field, Dave's background includes building science, utility consulting and executive leadership, writing and presenting on energy-related topics, and hands-on experience in building systems engineering. Dave's work at Ecos Research includes emerging technology development and validation, lab and field testing of energy-related innovations, and efforts to make existing buildings run better (such as auditing, commissioning, and data analytics).

Selected Experience and Projects

Founder, Resource Engineering Group, Inc.

In 1997, Dave founded REG to bring efficiency, sustainability, and simplicity to building engineering. The company grew to ten engineers, registration in over a dozen states, and projects spread across North America, with a focus on engineering excellence, innovative thinking, and clear communication. REG was consulting engineer or engineer-of-record for hundreds of building projects including multi-family and multi-home developments, large and small commercial spaces, schools, auditoriums, and resorts. Dave remains a consultant to REG, which is now owned and operated by the next generation of engineers.

Adjunct Faculty, Cal Poly San Luis Obispo

Lecturer for CE 475, *Civil Infrastructure and Building Systems* (4.0 WTU). Course covers mechanical and electrical systems for buildings, with a focus on energy use, utility interactions, zero-net-energy buildings, and real-world lessons from three decades of consulting and engineer-of-record experience. Topics include heating and cooling load reduction, HVAC system types, central plants, basic electrical design and calculations, lighting, and controls.

Strategic Basis for Achieving Zero Net Energy Facilities, report to San Diego Gas & Electric (as consultant to Ecova)

Principal investigator and lead author of report that analyzes the potential impacts of ZNE mandates on the utility. Organized and led research team, conducted client workshop, and was responsible for final report that summarized and detailed ZNE considerations, including categories of building types and their challenges, effects on grid operations, and action items for moving forward to address this trend.

Chairman, Gunnison County Planning Commission, Gunnison CO (2003-2006)

As a member of the 5-person Commission, developed and implemented policies for land use, resource extraction, affordable housing and economic development for the fifth largest county in Colorado. As Chairman, conducted large public meetings and coordinated with legal counsel, county executives, and County Commissioners.

Member, Board of Directors, Gunnison County Electric Assn, Gunnison CO (1999-2003)

Member of the 7-person board with executive responsibilities for operation and planning of electric distribution utility with approximately 14,000 meters and \$15M annual revenue. Coordinated with regional and national utility organizations including Tri-State G&T, NRECA, and CREA. Helped set policies for power purchasing, reliability, rate design, renewable energy, and energy efficiency.

Technology Editor, Architectural Lighting Magazine, New York NY (1999-2002)

Monthly contributor covering new lighting technology and applications, wrote seventeen articles over three-year period. Attended national (LightFair) and international (Messe Frankfurt) expos.

Research Associate, E Source, Boulder CO (1992-1997)

As one of four founding employees, co-authored *Technology Atlas* Book Series: Space Cooling, Space Heating, and Lighting. Authored over twenty reports on energy efficiency technologies, including LED traffic signals, rooftop HVAC units, and liquid flow meters. Presented to national conferences and conducted energy training programs for utilities and large property owners.

Research Associate, Rocky Mountain Institute, Snowmass CO (1989-1992)

Conducted research for the COMPETITEK utility intelligence service, co-authored *State-of-the-Art* book series, general energy policy and technology research, energy consulting for Fortune 500 clients.

Project Engineer, ICF Kaiser Engineers, Oakland CA (1986-1989)

Conducted planning studies for extension of rail transit systems in Seattle WA, Cleveland OH, and other locations. Provided engineering support for construction of new rail yard for Bay Area Rapid Transit (BART). Worked on joint ventures with other international engineering firms.

David Houghton P.E.

Publications and Reports

- *Home Battery Storage Systems – A Look into the Market, Their Energy Efficiency and Performance*, for Natural Resources Defense Council (Nov 2017)
- *ENERGY STAR Scoping Report: Electric Grid Efficiency*, Report for U.S. Environmental Protection Agency (Apr 2016)
- *ENERGY STAR Scoping Report: Home Battery Systems*, Report for U.S. Environmental Protection Agency (Apr 2016)
- *Clothing Wear and Tear of Heat Pump Versus Electric Resistance Clothes Dryers*, for Northwest Energy Efficiency Alliance (Mar 2016)
- *Comprehensive Energy Audit Report for San Luis Coastal Unified School District* (Aug 2015)
- *From the Gas Station to the Garage: What Co-ops Need to Know about Residential Plug-in Electric Vehicle Charging*, report for the National Rural Electric Cooperative Association (Oct 2014)
- *Technical Evaluation of Thermal Energy Storage Systems*, internal report for Ice Energy (Sep 2014)
- *Regulatory Evaluation of Thermal Energy Storage Systems*, internal report for Ice Energy (Nov 2014)
- *Commercial Demand Response—Basics and Beyond*, report for the National Rural Electric Cooperative Association (May 2014)
- *Energy Savings Opportunity of Highly Insulating Windows in New California Homes*, report for Natural Resources Defense Council (Feb 2014)
- *Advanced Meter Interval Data: Now You Have it, So What Should You Do With It?*, report for the National Rural Electric Cooperative Association (Feb 2013)
- *Strategic Basis for Achieving Zero Net Energy Facilities that are Cost-Effective and Interoperable with Smart Distribution System Operations*, Ecova report for San Diego Gas & Electric Company (Dec 2011)
- *Radiant Night-Sky Heat Rejection and Radiant Cooling Distribution for a Small Commercial Building*, *Proceedings of the Summer Study on Energy Efficiency in Buildings*, American Council for an Energy-Efficient Economy, (2006)
- *Frankfurt Lighting Expo Report*, *Architectural Lighting* (April 2002)
- *Induction Lighting*, *Architectural Lighting* (Jan 2002)
- *Digital Lighting Controls*, *Architectural Lighting* (Oct 2001)
- *Fiber Optic Lighting Status Report*, *Architectural Lighting* (Nov 2000)
- *Building Comfort with Less HVAC*, *Architectural Record* (December 1998)
- *Building Commissioning*, *Architectural Record* (May 1998)
- *A New Page in Lighting Control*, *Architectural Lighting* (Apr-May 1998)
- *Learning from Lighting Failures*, E source (November 1997)
- *The Ultrawatt Lighting Controller*, E source (May 1997)
- *Operating and Maintaining Rooftop Air Conditioners*, *ASHRAE Journal* (December 1997)
- *Learning from Lighting Failures*, E source (November 1997)
- *Operating and Maintaining Rooftop Air Conditioners*, E source (December 1996)
- *Space Heating Technology Atlas*, E source, with Gerald Cler, et. al. (August 1996)
- *Refrigerated Vending Machines: Overlooked Devices Hold Opportunities for Efficiency, New Services*, E source (May 1996)
- *Know Your Flow: A Market Survey of Liquid Flow Meters*, E source (March 1996)
- *The Columbine Building: Efficient Office Provides a Reality Check*, E source (November 1995)
- *Demand-Controlled Ventilation: Teaching Buildings to Breathe*, E source (September 1995)



- *Turning Air Conditioning on its Head: Underfloor Air Distribution Offers Flexibility, Comfort, and Efficiency*, E source (August 1995)
- *Space Cooling and Air Handling Technology Atlas*, E source (June 1995) w/ M. Shepard et. al.
- *The Ice Bear: Thermal Storage for Rooftop Air Conditioners*, E source (February 1995)
- *Sulfur Lighting: New Technology Challenges HID Sources*, E source (1994)
- *Lighting Technology Atlas*, E source, with Lindsay Audin et. al. (1994)
- *Projected and Measured Results from an Energy-Efficient Small Commercial Office Building*, Proceedings of the Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, (1994)
- *LED Traffic Lights: New Technology Signals Major Energy Savings*, E source, with Chris Calwell (1994)
- *Off-Peak Water Heating: Innovative Approaches*, E source, with Karen George (1993)
- *Rooftop Air Conditioners: A Buyer's Guide*, E source (1992)
- *Eliminating CFCS Without Regrets*, Home Energy (Jan/Feb 1993)
- *Electronic Ballasts: Developments in the US Market*, E source (1992)
- *The State of the Art: Space Cooling and Air Handling*, E source, with Robert Bishop et. al. (1992)
- *Saving Commercial HVAC Energy by the Ton*, Proceedings of the Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy (1992)

Professional Affiliations (past and present)

- Adjunct Faculty, California Polytechnic State University, San Luis Obispo
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
- American Solar Energy Society (ASES)
- International Ground-Source Heat Pump Association (IGSHPA)
- US Green Building Council (USGBC)
- Certified Energy Manager (CEM), Association of Energy Engineers (AEE)
- Former Chair, Gunnison County Planning Commission
- Former member of the Board of Directors, Paradigm Services LLC
- Founding member of the Board of Directors, Office for Resource Efficiency
- Registered Professional Engineer: Colorado, California, Oregon, Washington, New Mexico, Idaho, Utah
- National Council of Examiners for Engineering and Surveying (NCEES)
- Registered as both Mechanical and Civil P.E.