

# **Bradley L. Edgar, Ph.D.**

## **PROFESSIONAL EXPERIENCE**

### **44 Energy Technologies, Inc., Oakland, California**

**Chief Executive Officer, 2013 - Present**

Co-founder and CEO of 44 Energy Technologies. Responsible for general management of the company, business development, and leadership of consulting group.

44 Energy Technologies provides consulting services to commercialize energy, transportation, and environmental technologies. The 44 team has extensive experience with fuels, engines, emissions, and advanced powertrain technologies. In addition, 44 understands the role of government policy, regulation, and legislation as a driving force to bring technologies to market and generate significant opportunities. To that end, 44 can effectively advise clients on program development and implementation to capitalize on these opportunities.

The company provides consulting and contracting services including opportunity identification, grant and proposal writing, program management, building teams of contractors and experts, testing, and engineering analysis.

### **Cleaire Advanced Emission Controls, LLC, San Leandro, California**

**President and Chief Technology Officer, 2008-2013**

Technical leader for company that designed and manufactured state-of-the-art diesel emission retrofit systems for in-use diesel engines. Responsible for company's product strategy, development, and verification activities. Held lead role in marketing and business development.

Worked closely with regulators at the California Air Resources Board and the United States Environmental Protection Agency as in-use diesel regulations and incentive programs were developed.

Led the effort to create a number of public/private partnership programs to match funding sources with a recognized air quality reduction need. Acted as principal spokesperson to the media, governmental regulators, and end-user community.

Integral part of management team that moved the company from a start-up condition to more than 50 employees.

Recipient of 2010 CARB Haagen-Smit Award in the area of Science and Technology. The award is presented annually to recognize individuals for significant contributions toward improving air quality in the State of California.

### **Cleaire Advanced Emission Controls, LLC, San Leandro, California**

**Executive Vice-President and Chief Technology Officer, 2001-2008**

Founding member of Company, which started in 2001. Led team of highly skilled engineers and design experts in developing state of the art diesel engine aftertreatment systems. Conceptualized and implemented a plan to build a portfolio of products focused on truck, bus, and off-road equipment retrofit applications. Responsible for development, manufacturing, and marketing of products. Assembled an intellectual property portfolio of patents, trademarks, proprietary software, design concepts, and manufacturing processes. Guided successful efforts to achieve multiple product verifications through the California Air Resources Board's diesel emission control strategy programs.



**Ceryx Inc., Santa Paula, California**  
**Chief Technology Officer, 1999-2001**

Responsible for research, product development, and engineering focused on clean diesel technologies. Managed a staff of scientists, engineers, and technicians. Developed the QuadCAT 4-Way Catalytic Converter for emissions reduction from diesel engines. Directed intellectual property and proposal activity. Worked closely with a number of strategic partners and original equipment manufacturer (OEM) customers.

**Thermatrix Diesel Systems, Thermatrix Inc., San Jose, California**  
**Technical Director, Thermatrix Diesel Systems, 1997-1998**

Manager of technology for a subsidiary of Thermatrix Inc., an air pollution control equipment developer and manufacturer. Team leader of group responsible for the successful design of a patented product for treatment of volatile organic compounds (VOCs). Designed and built a unique, highly effective heat exchanger/oxidizer for treating small VOC and particulate streams. Managed joint project between Thermatrix and a major automotive supplier to develop a system for removal of soot and particulate from mobile and stationary diesel engines.

**Canary Air Company, Berkeley, California**  
**Founder, 1992-1997**

Founded the company in 1992. Managed a number of combustion, energy, and environmental projects. Developed several software products for the estimation of energy efficiency and emissions reduction improvements. Work included improving natural gas utilization for industrial applications, estimating air toxics emissions from industrial processes, including power and steam generation, and evaluating the benefits of power plant capital improvements.

**University of Stuttgart, Germany**  
**Post-Doctoral Researcher**

Research in the field of spray flame dynamics at the University of Stuttgart. Developed a partially evaporated, two-phase Bunsen burner to study the combustion characteristics of dilute sprays. Measured droplet size and velocity using phase doppler particle anemometry (PDPA) to support numerical modeling efforts.

**Southwest Research Institute**  
**Researcher, Intern**

Investigated the use of oxygenated compounds, such as dimethyl and diethyl ether, for use as ultra-clean diesel engine fuels. Measured autoignition delay in a constant volume combustion apparatus and developed fundamental chemical kinetic mechanisms to model the chemical processes of autoignition. The research led to a Society of Automotive Engineers (SAE) paper that earned the 1999 Arch T. Colwell Merit Award for outstanding technical contribution.

**University of California, Berkeley, and University of Stuttgart, Germany**  
**Graduate Student Researcher and Instructor**

Investigated the use of oxygenated compounds, such as dimethyl and diethyl ether, for use as ultra-clean diesel engine and gas turbine fuels. Conducted experiments to measure emissions from a diesel engine fueled by dimethyl ether. Conducted experiments to measure emissions and flammability limits of premixed and non-premixed flames operating at elevated pressures to simulate gas turbine combustion.

Investigated a process for the removal of pollutants from a diesel engine. This process involved a technology called Selective Non-Catalytic Reduction, whereby oxides of nitrogen were reduced by adding diesel fuel and ammonia to the exhaust of an engine. The work led to a United States Patent.

Instructor for upper division Mechanical Engineering laboratory class. Developed and enhanced a curriculum to measure and analyze emissions and performance of a spark ignited engine. Added a specific teaching module for small two-stroke engines.

## **EDUCATION**

Ph.D., Mechanical Engineering, University of California, Berkeley, 1997

Emphasis in combustion, energy conversion, and air pollution

Thesis title: Dimethyl Ether and Other Oxygenated Fuels for Low Emission Diesel Engine Combustion

M.S., Mechanical Engineering, University of California, Berkeley, 1993

Thesis title: Selective Non-Catalytic Reduction Applied to Stationary Engines

B.S., Mechanical Engineering, University of California at Berkeley, 1990

## **AWARDS**

2010 Haagen-Smit Clean Air Award

2008 Clean Air Award for Technology/Research, Breathe California

2005 Environmental Award for Outstanding Achievement, U.S. EPA Region IX

1999 Arch T. Colwell Merit Award, Society of Automotive Engineers

1995 National Air and Waste Management Association Scholarship

1994 Jonathan Laitone Fluid Dynamics Award Winner, U.C. Berkeley

1992 National Air and Waste Management Association Scholarship

1992 Link Energy Foundation Fellowship Honorable Mention Award

1991 Oscar Gabelle Award for Achievement as a Student Athlete, U.C. Berkeley

## **PROFESSIONAL AFFILIATIONS AND MEMBERSHIPS**

American Society of Mechanical Engineering

Society of Automotive Engineers

UC Berkeley Department of Mechanical Engineering Advisory Committee

The International Combustion Institute

## **PATENTS**

U.S. Patent 7,117,079, "Apparatus and Method for Simultaneous Monitoring, Logging and Controlling of an Industrial Process"

U.S. Patent 7,025,811, "Apparatus for Cleaning a Diesel Particulate Filter with Multiple Filtration Stages"

U.S. Patent 6,996,976, "Apparatus for Mounting a Device to a Pipe"

U.S. Patent 6,935,105, "Integrated apparatus for removing pollutants from a fluid stream in a lean-burn environment with heat recovery"

U.S. Patent 6,814,303, "Fluid-cooled mount for an injector"



U.S. Patent 6,532,339, "Device for thermally processing a gas stream, and method for same"  
U.S. Patent 6,282,371, "Devices for reducing emissions, and methods for same"  
U.S. Patent 6,015,540, "Method and apparatus for thermally reacting chemicals in a matrix bed"  
U.S. Patent 6,003,305, "Method of reducing internal combustion engine emission, and system for the same"  
U.S. Patent 5,989,010, "Matrix bed for generating non-planer reaction wave fronts, and method thereof"  
U.S. Patent 5,547,650, "Process for Removal of Oxides of Nitrogen,"

## **PUBLICATIONS**

Edgar, B. Rumminger, M., Streichsbier, M., "A Framework for Evaluating Aftertreatment PM Control Strategies," SAE Paper 03FTT-88

Rumminger, M.D., X. Zhou, Balakrishnan, K., Edgar, B.L., Ezekoye, O.A., "Regeneration Behavior and Transient Thermal Response of Diesel Particulate Filters" SAE Paper 2001-01-1342

Edgar, B. L., Christ, A. R., and Beck, N. J., "LeanCAT-An Integrated Three Way Catalyst System for Lean Burn Engines", Presented at the 2000 SAE Congress, Detroit, MI, SAE Paper 2000-01-0859

Page, D. L., MacDonald, R. J., Edgar, B. L., "The QuadCAT Four-Way Catalytic Converter: An Integrated Aftertreatment System of Diesel Engines," SAE Paper 992924

Edgar, B. L. and Martin, R. J., "Application of Flameless Thermal Oxidation to Diesel Emissions," Poster Presentation at the 26<sup>th</sup> Symposium (International) of the Combustion Institute, Boulder, CO, (1998).

Edgar, B.L., Baer, C. B., Barkdoll, M.P., Martin, R. J., and McAdams, S.R., "Electric Preheat Extends Applicability of Large-Size Flameless Thermal Oxidizers," Air and Waste Management Association, AWMA Paper 98-RP93B.03, July, (1998).

Page, D. L., and Edgar, B. L., "A Systems Level Optimization Strategy for Diesel Engines," SAE Paper 981984

Edgar, B. L. Dibble, R. W. and Naegeli, D. W., "Autoignition of Dimethyl Ether and Dimethoxy Methane Sprays at High Pressure," SAE Paper 971677, May, (1997).

Edgar, B. L., Wong, G. and Dibble, R. W., "Kinetics of the Autoignition of Dimethyl Ether and Dimethoxy Methane at High Pressure," Presentation at the 25th Symposium (International) of the Combustion Institute, Naples, Italy, (1996).

Edgar, B. L., Wong, G., and Dibble, R. W., "Emissions from a Diesel Engine Fueled by Dimethyl Ether and Diethyl Ether," Presentation at the Western States Meeting of the Combustion Institute, October 30-31, Stanford, CA, (1996).

Edgar, B. L., Naegeli, D. W. and Dibble, R. W., "The Autoignition of Dimethyl Ether - Experimental Measurements and Kinetic Modeling," Presentation at the Western States Meeting of the Combustion Institute, October 30-31, Stanford, CA, (1996).

Chang, W., Man, M., Edgar, B. L., and Dibble, R. W., "Measurements and Modeling of Formaldehyde from Methanol and Dimethyl Ether Bunsen Flames," Presentation at the Western States Meeting of the Combustion Institute, October 30-31, Stanford, CA, (1996).

Nguyen, Q.V., Edgar, B.L., Gulati, A., and Dibble, R. W., "An Experimental and Numerical Comparison of Extractive and In-Situ Laser Measurements of Non-Equilibrium Carbon Monoxide in Lean-Premixed Natural Gas Combustion," *Combustion and Flame*, Vol. 100, p. 395, (1995).

Edgar, B.L., Rumminger, M., Bond, T., Dibble, R.W., and Chen, J.-Y., "Support of Ultra-Lean Gas Turbine Combustion Using Radiative Feedback," Poster Presentation at the 25th Symposium (International) of Combustion, Irvine, CA, (1994).

Edgar, B.L., and Dibble, R.W., "TurboNOx: A Process for Efficient and Economical Removal of NOx from Low Temperature Exhaust," Poster Presentation at the 24th Symposium (International) on Combustion, Sydney, Australia, (1992).

Edgar, B.L., and Dibble, R.W., "Numerical Modeling and Experimental Results of SNCR Technology Applied to Stationary Engines and Gas Turbines," Presented at the Workshop on NOx Control, March 25-26, Ventura, California, (1992).