ROGER RAUFER, Ph.D., P.E.

RESIDENT PROFESSOR
Energy, Resources and Environment
Hopkins Nanjing Center
Nanjing, China

Education:

Ph.D.	Energy Management & Policy, University of Pennsylvania, 1984
M.A.	Political Science, University of Illinois at Chicago, 1980
M.S.	Environmental Engineering, University of Cincinnati, 1974
B.S.	Chemical Engineering, Ohio University, 1971

Experience Summary:

- Hopkins-Nanjing Center, Nanjing, China; Resident Professor, Energy, Resources and Environment (ERE), 2014—Present
- U.N. & World Bank Environmental Project Consultant in China, 1990—2014
- U.S.-based independent consulting engineer, 1990—2014
- Visiting Lecturer, Institut Français du Pétrole Energies Nouvelles (IFPEN), Rueil-Malmaison, France, 1989—Present
- GE's 'Oil & Gas University,' Florence, Italy, Lecturer, 2005—2015
- Adjunct Professor, University of Pennsylvania, 1983—2001; Lecturer, 2007—2009
- Technical Advisor (full-time), Div. for Sustainable Development, United Nations, New York, 2001—2005
- Vice President, Environmental Services, PMC, Inc., Philadelphia, PA, 1985—1990
- Manager, Environmental Services, ETA Engineering, Inc., Westmont, IL, 1974—1981

Biographical Statement:

Roger Raufer is an environmental engineer with more than forty years of experience in energy and environmental management, with particular expertise in emissions trading. He completed one of the very first doctoral dissertations on this topic (1984), and has authored two books about its role in environmental management. Much of his work in recent years has focused on emissions trading and energy/environmental concerns in Asia.

Prior to these efforts, his work was primarily associated with the environmental impacts of U.S.-based energy projects, including extensive efforts for both electric utilities and independent power producers. He has obtained a variety of U.S. environmental permits for combustion turbines, standard industrial and utility boilers, and various types of waste combustion systems.

Within the U.S., he has also served as a consultant to the Department of Energy, the Environmental Protection Agency, and the National Commission on Air Quality. Internationally, he has performed work for the World Bank, the U.S. Agency for International Development, and the United Nations, and has taught and lectured at universities in Asia, Europe, the Middle East, South America, and the Caribbean. He also served for four years as a full-time Technical Advisor to the Division for Sustainable Development at UN Headquarters in New York.

Selected Project Experience:

- ***China:*** Assisted the U.N./Chinese government in developing a program to reduce air pollution in three target cities (Qingdao, Huhhot, and Guiyang) in an economically efficient manner; follow-up air pollution projects in five cities (Beijing, Guangzhou, Xi'an, Benxi and Guiyang); landfill gas GEF project in Anshan; programmatic GEF project on energy efficiency in industrial and building sectors; environmental planning in small and medium-sized cities (Liuzhou, Taiyuan, Guiyang, Meishan, and Sanmenxia); concession approach for wind resource development; development of 'green poverty alleviation' scheme through carbon trading; GEF/World Bank SO2 emissions trading project in Shanxi and Shandong Provinces; mid-term review of GEF/UNDP PEERAC project addressing energy efficiency of room air conditioners;

- ***Hong Kong:*** Advised Hong Kong Stock Exchange concerning potential markets in 'emissions-related products,' including Kyoto Protocol flexibility mechanisms, EU Emissions Trading Scheme, U.S. SO_2 and NOx credits/allowances, renewable energy certificates, and white tags/certificates (for energy efficiency markets). Co-authored report on emissions markets for CLSA, and advised their clients in more than a dozen cities in North America, Asia and Europe; private-sector textile industry carbon-reduction projects for HK financial services firm;

- ***Other International:*** Economic benefits analysis for lead and particulate control programs, and lead smelter action plan, under Cairo Air Improvement Project (CAIP); Transboundary air pollution modeling and combustion technology in Ulaan Baatar, Mongolia; Poland, Romania and Ukraine site visits for development of EcoLinks information initiative for CEE/NIS countries; Complex terrain dispersion modeling of combustion turbines in Ecuador, and power sector pollution control projects; Sustainable development indicators for energy (IAEA) and power sector (UN ESCAP); Development of successful rural energy project in five Asian countries (UN ESCAP); Urban energy integration in Asian cities (UN ESCAP); UN DESA adaptation project evaluation in Grenada, Guatemala and Bolivia;

- ***Air Pollution Policy:*** Directed one of five regional studies for the U.S. National Commission on Air Quality; the four volume, 1100 page report was prepared in 8-1/2 months, and was subsequently used by the U.S. Congress for proposed control technology and policy amendments to the Clean Air Act;

- ***Acid Rain:*** Conducted five analyses for U.S. EPA, addressing various implementation aspects of utilizing economic mechanisms for controlling acid rain. This research helped identify problems

that led to the shift from emission reduction credits to emission allowances in the Clean Air Act Amendments of 1990;

- ***Power Plants/Cogeneration:*** Successful Prevention of Significant Deterioration (PSD) air pollution permit for 300 MW natural gas fired, combined cycle cogeneration plant in New Jersey for private power firm, including Best Available Control Technology (BACT) and dispersion modeling (this facility was part of what was then the largest single independent power financing [$600 million] in U.S. history); Successful multi-unit "netting transaction" permit for $167 million combustion turbine/auxiliary boiler cogeneration facility for urban steam loop in Pennsylvania (and significant permit revisions when turbine vendor was changed and selective catalytic reduction system added). Other air quality permits for recycling wood gasification facility, digester gas projects, etc.;

- ***Dispersion Modeling/EIAs:*** Directed more than three dozen atmospheric dispersion modeling analyses for utilities, chemical process plants, refineries, industrial firms and mobile/area sources. Also conducted analyses of environmental impacts for numerous cogeneration facilities and utility fuel conversions, including coal, natural gas, oil, and waste fuels. Numerous BACT determinations and expert testimony;

- ***Solid Waste:*** Member of design team for proposed 5700 ton/day refuse derived fuel (RDF) project, focusing on pollution control systems. Also consultant concerning environmental issues for a 2250 ton/day mass-burn resource recovery facility, including permit requirements, risk assessment and environmental impact statement.

Selected Teaching Experience:

- Hopkins Nanjing Center, Nanjing, China; Resident Professor, Energy, Resources and Environment, 2014-Present.

- Institut Français du Pétrole Energies Nouvelles (IFPEN), Rueil-Malmaison, France, Lecturer in academic and executive training programs, 1989-Present.

- General Electric 'Oil & Gas University'; Abu Dhabi, Italy, Indonesia, 2005-2015.

- University of Pennsylvania, Philadelphia, PA, Adjunct faculty, 1984-2001; Lecturer, 2007-2009.

- University of the West Indies, Kingston, Jamaica; Visiting Lecturer in Energy Management, 1984.

- World Bank and UN training programs, Director and/or Lecturer; China, Ecuador, Hungary, Iran, Nicaragua, 1993-2004.

Professional Engineering (P.E.) Registration:

- U.S. State of Ohio #42452, 1977-present;
- U.S. State of Illinois #62-36558, 1978-present.

Selected Publications:

Books

R.K. Raufer, *Pollution Markets in a Green Country Town: Urban Environmental Management in Transition*, Westport, CT: Praeger Publishers, (1998).

R.K. Raufer and S.L. Feldman, *Acid Rain and Emissions Trading: Implementing a Market Approach to Pollution Control*, Totowa, NJ: Rowman & Littlefield, (1987).

Dissertation/Thesis

Ph.D. dissertation: *Emissions Trading by Electric Utilities for Acid Deposition Control*, University of Pennsylvania, Philadelphia, PA, (August, 1984).

M.S. thesis: *Six Proposed Standard Methods of Ambient Particulate Sampling*, University of Cincinnati, (June, 1974). [Three of the standard methods were subsequently published in *Methods of Air Sampling and Analysis*, 2nd Edition, M. Katz, Ed., APHA Intersociety Comm., (1977)].

Recent Journals, Book Chapters, etc.

R. Raufer, N. Manthey, and A. Gegenheimer, "Blockchain and Climate: A New Energy Frontier," *China-U.S. Focus*, (October, 2018) (Available at: https://www.chinausfocus.com/finance-economy/blockchain-and-climate-a-new-energy-frontier)

R. Raufer, "Emissions Trading in China: An Update," *IFP School Alumni Mag*, 266:32-35, (July, 2017) (Available at: http://roger-raufer.com/documents/IFP_School_Alumni_Mag_No._266_Article_de_Roger_RAUFER.pdf)

R. Raufer, P. Coussy, C. Freeman, and S. Iyer, "Emissions Trading," *Handbook of Climate Change Mitigation and Adaptation*, Chen, W.Y. et al., Eds., Springer, (2016). (See: http://link.springer.com/referenceworkentry/10.1007/978-1-4614-6431-0_8-2)

R. Raufer, "Carbon Taxes vs. Emissions Trading in China," *Energy Intelligence: New Energy* (14 June 2012). (Available at: http://www.roger-raufer.com/documents/Raufer_New_Energy_China_PvsQ.pdf)

R. Raufer and S. Iyer, "Emissions Trading," *Handbook of Climate Change Mitigation*, Chen, W.Y. et al., Eds., Springer, (2012). (See: http://www.springer.com/engineering/energy+technology/book/978-1-4419-7990-2?otherVersion=978-1-4419-7992-6)

R. Raufer, "Emissions Trading in China," *L'Hydrocarbure*, 249:15-17, (Janvier, 2011) (Available at: http://roger-raufer.com/documents/Raufer_L%27Hydrocarbure.pdf)

R. Raufer and S. Li, "Emissions Trading in China: A Conceptual 'Leapfrog' Approach?," *Energy*, 34: 904-912, (July, 2009). (See: http://www.sciencedirect.com/science/article/pii/S0360544209000978)

A detailed, 20-page, academic-style c.v., listing more than 150 technical papers, book chapters, conference papers, invited presentations, technical reports, etc., is available upon request.