Energy, Environmental & Chemical Engineering

The Department of Energy, Environmental & Chemical Engineering (EECE) provides integrated and multidisciplinary programs of scientific education in cutting-edge areas, including the PhD in Energy, Environmental & Chemical Engineering. The research and educational activities of the department are organized into four clusters: aerosol science and engineering; engineered aquatic processes; multiscale and electrochemical engineering; and synthetic biology and bioproduct engineering. These overlapping clusters address education and research in four thematic areas: energy; environmental engineering science; advanced materials; and sustainable technology for public health and international development. In addition to the core faculty in the department, faculty in the schools of Medicine, Arts & Sciences, Business, Law, and Social Work collaborate to provide students with a holistic education and to address topical problems of interest.

The department is a key participant in the university's Energy, Environment & Sustainability (http://sustainability.wustl.edu/) initiative, and it supports both the International Center for Energy, Environment and Sustainability (InCEES) (http://incees.wustl.edu/) and the McDonnell Academy Global Energy and Environment Partnership (MAGEEP) (http://mageep.wustl.edu/). Major externally funded research centers in the department include the Consortium for Clean Coal Utilization (http://cleancoal.wustl.edu/), the Nano Research Facility (NRF) and Jens Environmental Molecular and Nanoscale Analysis Laboratory (Jens Lab) (https://nano.wustl.edu/), and the Center for Aerosol Science and Engineering (CASE) (https://aerosols.wustl.edu/).

Contact: Monique Spears
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Faculty
Chair and Endowed Professor
Pratim Biswas (https://engineering.wustl.edu/faculty/Pratim-Biswas.html)
Lucy and Stanley Lopata Professor
PhD, California Institute of Technology
Aerosol science and engineering, air quality and pollution control, nanotechnology, environmentally benign energy production

Endowed Professors
Stifel and Quinette Jens Professor
PhD, University of California, Davis
Combustion, advanced energy systems, clean coal, aerosols, nanoparticle synthesis, rechargeable battery materials, thermal science

Walter E. Browne Professor of Environmental Engineering
PhD, California Institute of Technology
Aquatic chemistry, environmental engineering, water quality, water treatment

Vijay Ramani (https://engineering.wustl.edu/faculty/Vijay-Ramani.html)
Director of Graduate Studies
Roma B. and Raymond H. Wittcoff Distinguished University Professor
PhD, University of Connecticut
Electrochemical engineering, energy conversion

Professors
Zhen (Jason) He (https://engineering.wustl.edu/faculty/Zhen-Jason-He.html)
PhD, Washington University
Environmental biotechnology, bioenergy production, biological wastewater treatment, resource recovery, bioelectrochemical systems, sustainable desalination technology, anaerobic digestion, forward osmosis, membrane bioreactors

PhD, Harvard University
Aquatic processes, molecular issues in chemical kinetics, environmental chemistry, surface/physical chemistry, environmental engineering, biogeochemistry, nanotechnology
Randall Martin (https://engineering.wustl.edu/faculty/Randall-Martin.html)
PhD, Harvard University
Characterizing atmospheric composition to inform effective policies surrounding major environmental and public health challenges ranging from air quality to climate change

Palghat A. Ramachandran (https://engineering.wustl.edu/faculty/Palghat-Ramachandran.html)
PhD, University of Bombay
Chemical reaction engineering, applied mathematics, process modeling, waste minimization, environmentally benign processing

PhD, University of Washington, Seattle
Metabolic engineering, bioremediation

Vice Dean for Education
DSc, Washington University
Air quality planning and management; aerosol science and engineering, green engineering

PhD, California Institute of Technology
Aerosol properties and processes, nucleation and new particle formation, aerosols in the marine environment, effects of aerosols on cloud microphysical properties and macrophysical struct

**Associate Professors**

Rajan Chakrabarty (https://engineering.wustl.edu/faculty/Rajan-Chakrabarty.html)
PhD, University of Nevada, Reno
Characterizing the radiative properties of carbonaceous aerosols in the atmosphere; and researching gas phase aggregation of aerosols in cluster-dense conditions

Marcus Foston (https://engineering.wustl.edu/faculty/Marcus-Foston.html)
PhD, Georgia Institute of Technology
Utilization of biomass resources for fuel and chemical production, renewable synthetic polymersure, and development of advanced aerosol instruments

Tae Seok Moon (https://engineering.wustl.edu/faculty/Tae-Seok-Moon.html)
PhD, Massachusetts Institute of Technology
Metabolic engineering and synthetic biology

Brent Williams (https://engineering.wustl.edu/faculty/Brent-Williams.html)
Raymond R. Tucker Distinguished InCEES Career Development Associate Professor
PhD, University of California, Berkeley
Aerosols, global climate issues, atmospheric sciences

Fuzhong Zhang (https://engineering.wustl.edu/faculty/Fuzhong-Zhang.html)
PhD, University of Toronto
Metabolic engineering, protein engineering, synthetic and chemical biology

**Assistant Professors**

Peng Bai (https://engineering.wustl.edu/faculty/Peng-Bai.html)
PhD, Tsinghua University, China
Develop next-generation batteries, probe the in situ electrochemical dynamics of miniature electrodes down to nanoscales, capture the heterogeneous and stochastic nature of advanced electrodes, and identify the theoretical pathways and boundaries for the rational design of materials, electrodes and batteries through physics-based mathematical modeling and simulation

Fangqiong Ling (https://engineering.wustl.edu/faculty/Fangqiong-Ling.html)
PhD, University of Illinois at Urbana-Champaign
Microbial ecosystem analysis and modelling, process modelling, machine learning, NextGen sequencing bioinformatics, environmental microbiology, and bioreactor design

Kimberly M. Parker (https://engineering.wustl.edu/faculty/Kimberly-Parker.html)
PhD, Stanford University
Investigation of environmental organic chemistry in natural and engineered systems

Elijah Thimsen (https://engineering.wustl.edu/faculty/Elijah-Thimsen.html)
PhD, Washington University
Gas-phase synthesis of inorganic nanomaterials for energy applications, and novel plasma synthesis approaches

**Research Assistant Professor**

Benjamin Kumfer (https://engineering.wustl.edu/faculty/Benjamin-Kumfer.html)
DSc, Washington University
Advanced coal technologies, biomass combustion, aerosol processes and health effects of combustion-generated particles

**Professor of Practice**

John Reardon (https://engineering.wustl.edu/faculty/John-Reardon.html)
MS, University of New Mexico
Entrepreneurial engineering
Senior Lecturers

Janie Brennan [https://engineering.wustl.edu/faculty/Janie-Brennan.html]
Director of Undergraduate Studies
PhD, Purdue University
Biomaterials, chemical engineering, engineering education

Raymond Ehrhard [https://engineering.wustl.edu/faculty/Ray-Ehrhard.html]
BS, Missouri University of Science and Technology
Water and wastewater treatment technologies, process energy management

Lecturers

Trent Silbaugh [https://engineering.wustl.edu/faculty/Trent-Silbaugh.html]
PhD, University of Washington
Chemical engineering

Avni Solanki [https://engineering.wustl.edu/faculty/Avni-Solanki.html]
PhD, University of Florida
Wastewater, sustainable development, environmental engineering, and engineering education

Joint Faculty

Doug Allen
PhD, Purdue University
USDA Research Scientist, Danforth Plant Sciences Center
Metabolic networks of oilseed plants

Nathan Ravi
PhD, Virginia Polytechnic Institute
Cataract, ocular biomaterials

Adjunct Faculty

Gary Moore
MS, Missouri University of Science and Technology
Environmental management

Keith Tomazi
PhD, University of Missouri-Rolla
Process development engineering

Grigoriy Yablonsky
PhD, Boreskov Institute of Catalysis
Chemical reaction engineering and heterogeneous catalysis

Senior Professor

Milorad P. Dudukovic
Laura and William Jens Professor
PhD, Illinois Institute of Technology
Chemical reaction engineering, multiphase reactors, visualization of multiphase flows, tracer methods, environmentally benign processing

Rudolf B. Husar
PhD, University of Minnesota
Environmental informatics, aerosol science and engineering

Degree Requirements

Doctor of Philosophy (PhD) in Energy, Environmental & Chemical Engineering (EECE)

The doctoral degree requires a total of 72 credits beyond the bachelor's degree. Of these, a minimum of 36 credits must be graduate course work, and a minimum of 30 credits must be doctoral thesis research units. To be admitted to candidacy, students must have completed at least 18 credits at Washington University, have an overall grade-point average of at least 3.25, and pass the qualifying examination. Note that, to be eligible to take the qualifying exam, students must maintain a 3.25 GPA as described in the EECE PhD handbook. All students are required to enroll in the department seminar every semester to receive passing grades. The first-year students must complete the core curriculum, perform two research rotations, and find a permanent research adviser. Then, within 18 months after the qualifying exam (generally in their third year), students should defend their thesis proposal.

After successful proposal defense, students should provide their research updates through annual meetings or reports with their thesis committee until their graduation. While conducting doctoral research, students should perform in a professional manner in their research lab and/or office setting and be in compliance with all safety and regulatory requirements for their research projects. During the doctoral program, students must satisfy their fundamental and advanced teaching requirements by participating in mentored teaching experiences in the department for two or three semesters, by attending professional development workshops from the Teaching Center, and by presenting at least two formal presentations at the local level or at national or international conferences. Upon completion of their dissertation, students must present their dissertation research in a public forum and successfully defend the dissertation before their thesis committee.

For more detailed guidelines, please refer to the EECE doctoral studies handbook available on the EECE Graduate Degree Programs webpage [https://eece.wustl.edu/graduate/programs/Pages/PhD-Energy-Environmental-Chemical-Eng.aspx].