

Fangwei Cheng Ph.D.
Postdoctoral Research Associate, Princeton University

Summary of Qualifications

- Researcher with strong background in chemical engineering, environmental engineering and energy system modeling.
- Highly proficient at using life cycle assessment (LCA), techno-economic analysis (TEA), mass flow analysis (MFA), data mining, and energy system modeling and optimization.
- Experienced in evaluating, designing, and optimizing energy processes/systems.

Education

University of Virginia – Charlottesville, VA

Ph.D. in Civil Engineering, GPA: 3.94/4.0 Aug 2016 – August 2020

University of Missouri – Columbia, MO

M.S. in Chemical Engineering, GPA: 3.8/4.0 Aug 2014 – May 2016

Wuhan Institute of Technology – Wuhan, China

B.S. in Chemical Engineering, GPA: 85/100 Sep 2011 – June 2015

Certificate

GTx –MicroMaster in Analytics: Essential Tools and Methods Dec 2018

NECCS-FE Environmental (ID: 17-738-27) Oct 2019

Professional Experience

Andlinger Center of Energy and Environment, Princeton University

Postdoctoral Research Associate mentored by Prof. Jesse Jenkins Sep 2020 – present

- Supported ARPA-E funded project and applied plant-level process modeling to help design modular representations of novel flexible carbon capture and storage technologies in the energy system optimization model (i.e., GenX).
- Optimized the cost and performance of emerging low-carbon technologies.
- Investigated the value of biomass in transition to net-zero carbon economies.

Dept. of Engineering Systems and Environment, University of Virginia

Doctoral Research Assistant mentored by Prof. Lisa Colosi Peterson Aug 2016 – Aug 2020

- Dissertation topic: “Evaluating the feasibility of selected thermochemical conversion pathway as energy-producing negative emissions technologies.”
- Applied LCA and TEA to study the production cost and greenhouse gas emissions of metal organic framework (i.e., UiO-66-NH₂) production from multiple synthesis routes and assessed its feasibility for carbon capture and storage.
- Economic and environmental evaluation of 24 cases for negative emissions technologies.
- Applied LCA and TEA to investigate the environmental and economic impacts of gasification as a technological route to facilitate energy transition in China under various carbon tax scenarios.
- Applied LCA and TEA to evaluate the feasibility of hydrothermal treatment (HTT) and pyrolysis of biomass as negative emissions technologies to mitigate climate change.
- Developed machine learning models to quantitatively predict the mass, carbon, and energy yields arising from HTT and pyrolysis of biomass.
- Explored the sustainability of biomass-derived biofuel from HTT and pyrolysis.
- Designed and performed experimental and computational studies to investigate the energy, environmental, and economic impacts of aqueous co-product management via nutrient removal and recovery.

Dept. of Chemical Engineering, University of Missouri

Research Assistant mentored by Prof. Baolin Deng

Aug 2015 – May 2016

- Thesis topic “TiO₂/Diatomite composites for effective arsenic removal.”
- Prepared TiO₂-diatomite composites, characterized the material by XRD and SEM.
- Studied the feasibility of TiO₂-diatomite composites for arsenic removal. Evaluated adsorption isotherms, kinetics, and mass transfer.

Publications

Cheng, F*, Jenkins, J., and Larson, E., Value of clean fuels from biomass in the transition to net-zero emission economies (*in preparation*)

Cheng, F*, Patankar, N., Chakrabarti, S., and Jenkin, J. *, Modeling the operational flexibility of natural gas combined cycle power plants coupled with flexible carbon capture and storage via solvent storage and flexible regeneration, *International Journal of Greenhouse Gas Control*, 2022, 118, 103686.

Cheng, F*, and Luo, H., Evaluating the minimum fuel selling price of algae-derived biofuel from hydrothermal liquefaction, *Bioresource Technology Reports*, 2022, 17, 100901.

Luo, H., **Cheng, F***, Yu, B., Hu, L., Zhang, J., Qu, X., Yang, H., Luo, Z., Full-Scale Municipal Sludge Pyrolysis in China: Design Fundamentals, Environmental and Economic Assessments, and Future Perspectives. *Science of the Total Environment*, 2021, 795, 148832.

Cheng, F., Small, A.A., and Colosi, L.M.*, The levelized cost of negative CO₂ emissions from thermochemical conversion of biomass coupled with carbon capture and storage. *Energy Conversion and Management*, 2021, 237, 114115.

Luo, H*, **Cheng, F***, Huelsenbeck, L., & Smith, N. Comparison between conventional solvothermal and aqueous solution-based production of UiO-66-NH₂: Life cycle assessment, techno-economic assessment, and implications for CO₂ capture and storage. *Journal of Environmental Chemical Engineering*, 2021, 9(2), 105159.

Cheng, F., Luo, H., and Colosi, L.M.*, Slow pyrolysis as a platform for negative emissions technology: An integration of machine learning models, life cycle assessment, and economic analysis. *Energy Conversion and Management*, 2020, 223, 113258.

Cheng, F., Porter, M. D., and Colosi, L. M.*, Is hydrothermal treatment coupled with carbon capture and storage an energy-producing negative emissions technology? *Energy Conversion and Management*, 2020, 203, 112252.

Bauer, S.K¹; **Cheng, F¹**; and Colosi, L.M.*, Evaluating the Impacts of ACP Management on the Energy Performance of Hydrothermal Liquefaction via Nutrient Recovery. *Energies*, 2019, 12, 729.

Luo, H., **Cheng, F.**, Hu, W., Wang, J., Xiang, S., Fidalgo de Cortalezzi M*, 2D-Fe₃O₄ Nanosheets for Effective Arsenic Removal, *Journal of Contemporary Water Research & Education*, 2017. 160(1): p. 132-143.

Cheng, F., Luo, H., Hu, L., Yu, B., Luo, Z., and Fidalgo de Cortalezzi, M.*, Sludge carbonization and activation: From hazardous waste to functional materials for water treatment. *Journal of Environmental Chemical Engineering*, 2016. 4(4, Part A): p. 4574-4586.

**corresponding author*

¹ *equal authorship*

Teaching Experience

Dept. of Engineering System and Environment, University of Virginia

Graduate Teaching Assistant

Fall 2017-Spring

2019

- Worked as a teaching assistant for CE 5240 “Groundwater Hydrology”, CE 6220 “Water Chemistry”, CE 2500 “Sustainability Science”, and CE 3210 “Fluid Mechanics”.
- Held office hours each week, graded homework and tests, designed quiz and projects, gave lectures on review sessions, and prepared course materials and solution manuals.

Research Mentor

Fall 2017-Spring 2019

- Mentored 5 undergraduate students for CE 4990 “Civil Engineering Capstone Project”. Prepared assignments and designed experimental research for students.

Technical Skills

- **Software:** Using Microsoft Office, Aspen Plus, Origin, OpenLCA, Arc GIS, Python, Julia, and R.
- **Instruments:** Performing XRD, FTIR, AAS, and TGA, and analyzing the results.

Relevant Coursework

- **Chemical & Environmental Engineering:** Groundwater Hydrology & Contaminant Transport, Geochemistry, Green Engineering, Water Chemistry, Microbiology & Bio-Treatment, Hazardous Waste Management, Advance Mass Transfer, Chemical Reaction Engineering Science, Advance Heat & Momentum Transfer, Advance Chemical Engineering Thermodynamic, Advanced Topics in Combustion I: Optimization Methods for Energy Systems Engineering
- **System Engineering and Data science:** Risk Analysis, Computational as a Research Tool, Data Mining, Decision analysis, Computing for Data Analysis, Introduction to Analytics Modeling, Data Analytics for Business, Applied Analysis, Statistics Method for Research,

Presentations

- **Cheng, F.** (presenting) and Larson, E., Value of clean fuels from biomass in the transition to net-zero emission economies, GTI TCBIomass Conference, 2022 (upcoming)
- **Cheng, F.** (presenting), Patankar, N., Chakrabarti, S., and Jenkin, J., Evaluating the operation flexibility of natural gas combined cycle power plant coupled with flexible carbon capture and storage, INFORMS Annual Meeting, 2021
- **Cheng, F** (presenting); U. Singh; A.B. Rao; and L.M. Colosi. Techno-economic scoping of gasification as a technological route to facilitate decarbonized energy transitions in developing countries, AGU Fall Meeting Abstracts. 2019.
- Singh, U; **Cheng, F**; and Colosi, L.M.; Capture, don't curtail: the costs and potential for direct air capture deployment powered by excess renewable energy in the United States, AGU Meeting Abstracts. 2019.
- **Cheng, F** (presenting); Colosi, L. M.; Clarens, A. F. Bio-organoclay composite materials designed to seal leaking and abandoned natural gas wellbores, AGU Fall Meeting 2018.
- Clarens, A.F.; **Cheng, F**; and Colosi, L.M.; Novel bio-organoclay composites designed to seal leaking wellbores, InterPore 2018

Public Service

Reviewer

April 2021 – present

- Reviewer for Environmental Science & Technology, Energy Conversion and Management, Resources Conservation & Recycling, Biomass & Bioenergy, Energy and Built Environment, Energies, Water, and Clean Energy. Member of Energies Reviewer Board.

Consultant, Wuhan Water Authority

Jan 2020 – Feb 2020

- Worked on a consulting panel (under the supervision of Dr. Zhen Luo) to make suggestions on medical/municipal wastewater management in Wuhan during the COVID-19 outbreak.

Honors and Awards

- Graduate Student Travel Fellowship, University of Virginia, 2019
- Grant-in-Aid Scholarship for academic excellence, University of Missouri-Columbia, 2015
- Scholarship for Academic Achievement, Wuhan Institute and Technology, 2012