Jonathan D. Ogland-Hand, PhD

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Research Interests

Energy decarbonization, integrated modelling, electric power systems, energy storage valuation, developing CO_2-based approaches to energy storage, CO_2-geothermal power plants, sedimentary basin geothermal resources, reservoir simulation, capacity expansion modelling, renewable energy integration, unit commitment and economic dispatch modelling, techno-economic modelling, optimization modelling, dynamic programming.

Experience Prior to Current Position

The Ohio State University — Columbus, Ohio
Doctoral Student — August 2014 – Present

- Developed and valued approaches for using geologically stored CO_2 and geothermal resources for energy storage by building and integrating process level models of a subsurface CO_2 based energy storage system, cost models, and systems-level optimization models of the electricity system. Found approaches to energy storage that use geologically stored CO_2 and geothermal resources can (1) store energy for long durations; (2) have high efficiencies (i.e., >100%) because of the energy input from the geothermal heat flux; (3) have value to reducing system-wide CO_2 emissions and water requirements from the electricity system; and (4) have value in transmission constrained electricity systems.
- Created a natural resource economic model for geothermal energy resources. Modeled the physical processes of geothermal heat extraction with the NUFT reservoir simulator and used those results to characterize a dynamic optimization model that I developed. Found that using CO_2 to extract geothermal energy can be more sustainable than using conventional geofluid.
- Mentored undergraduates: (a) taught optimization basics, IBM ILOG CPLEX Optimization Studio, and MATLAB, and created a research plan for a student during the 2017 Summer Research Opportunities Program and (b) taught three students how to use the NUFT reservoir simulator and created a research plan for them during the 2016 to 2017 Academic Year.

Lawrence Livermore National Laboratory — Livermore, CA
Academic Cooperation Participant — Summer 2015

- Worked under the guidance of Dr. Thomas Buscheck and became proficient with the Non-isothermal Unsaturated Flow and Transport (NUFT) reservoir simulator.

Valparaiso University — Valparaiso, IN
College of Engineering Undergraduate Research Intern — May 2013 – July 2014

- Worked with electrical engineers, mechanical engineers, and chemists on concentrating solar power projects: (1) funded by the US NSF to produce hydrogen using metal oxides; (2) funded by the US DOE to produce magnesium from magnesium-oxide.

Education

The Ohio State University — Columbus, OH
Doctor of Philosophy in Environmental Science — May 2019
Advisor: Jeffrey M. Bielicki
Committee Members: Ramteen Sioshansi, Brent L. Sohngen, and Gil Bohrer

The Ohio State University — Columbus, OH
Master of Science in Environmental Science — August 2017

Valparaiso University — Valparaiso, IN
Bachelor of Science in Mechanical Engineering — May 2014
Minor: Mathematics

Peer-Reviewed Journal Articles

J. Ogland-Hand, J. Bielicki, Y. Wang, B. Adams, T. Buscheck, M. Saar. (2019). "The Value of Bulk Energy Storage for Reducing CO_2 Emissions and Water Requirements from Regional Electricity Systems," *Energy Conversion and Management, 181, 674-685.*

J. Bielicki, B. Adams, H. Choi, B. Jamiyurason, S. Taff, T. Buscheck, **J. Ogland-Hand**, J. Randolph, M. Saar. "Engineering Cost-Competitive Geothermal Electricity from Geologic CO_2 Storage," *Energy Conversion and Management.* In Revision.

J. Ogland-Hand, J. Bielicki, B. Adams, E. Nelson, T. Buscheck, M. Saar, R. Sioshansi. "The Value of CO_2-Bulk Energy Storage with Wind in Transmission Constrained Electric Power Systems," *Energy.* In Prep.

J. Ogland-Hand, J. Bielicki, M. Miranda, I. Patel, B. Adams, T. Buscheck, K. Mansoor, M. Saar. "Optimal Heat Mining of Geothermal Reservoirs," *Renewable Energy.* In Prep.

Funded Research Grants

The Ohio State University Sustainable and Resilient Economy Program $21,450 | Summer 2018
Developing Capacity for Seasonal Energy Storage Capacity

The Ohio State University Center for Energy Research, Training, and Innovation $16,000 |Spring 2018
Engineering the Subsurface to Seasonally Store Energy While Sequestering CO_2

The Ohio State University Environmental Policy Initiative Student Grant Competition $4,500 | Spring 2016
The Value of Bulk Energy Storage for Reducing Water Stress While Meeting the Goal of a Policy that Limits CO_2 Emissions

Conference Papers and Proceedings

S. Maldonado, J. Bielicki, M. Miranda, **J. Ogland-Hand,** C. Howard, B. Adams, T. Buscheck, M. Saar, (2020). "Geospatial Estimation of the Electric Power Potential in Sedimentary Basin Geothermal Resources Using Geologically Stored Carbon Dioxide," *Proceedings World Geothermal Congress 2020,* Reykjavik, Iceland, April 26-May 2, 2020.

J. Ogland-Hand, M. Miranda, J. Bielicki, B. Adams, T. Buscheck, M. Saar, (2018). "Operational Characteristics of a Geologic CO_2 Storage Bulk Energy Storage Technology," *14th International Conference on Greenhouse Gas Technologies,* Melbourne, Australia, October 21-25, 2018.

J. Ogland-Hand, J. Bielicki, E. Nelson, B. Adams, T. Buscheck, M. Saar, R. Sioshansi, (2018). "Effects of Bulk Energy Storage in Sedimentary Basin Geothermal Resources on Transmission Constrained Electricity Systems," *Proceedings of the 43rd Workshop on Geothermal Reservoir Engineering,* Stanford CA, February 12-14, 2018.

M. Fleming, M. Saar, B. Adams, **J. Ogland-Hand,** T. Kuehn, T. Buscheck. J. Bielicki, J. Randoph (2018). "High Efficiency and Large-Scale Subsurface Energy Storage with CO_2," *Proceedings of the 43rd Workshop on Geothermal Reservoir Engineering,* Stanford CA, February 12-14, 2018.

J. Ogland-Hand, J. Bielicki, T. Buscheck, (2017). "The Value of CO_2-Bulk Energy Storage to Reducing CO_2 Emissions," *Energy Procedia, 114, 6886-6892.*

J. Ogland-Hand, J. Bielicki, T. Buscheck, (2016). "The Value of Bulk Energy Storage in Sedimentary Basin Geothermal Resources for Reducing CO_2 Emissions," *Proceedings of the 41st Workshop on Geothermal Reservoir Engineering,* Stanford University, Stanford CA, February 22-24, 2016. SGP-TR-209.

J. Bielicki, B. Adams, H. Choi, B. Jamiyansuren, M. Saar, S. Taff, T. Buscheck, **J. Ogland-Hand**, (2016). "Sedimentary Basin Geothermal Resource for Cost-Effective Generation of Renewable Electricity from Sequestered Carbon Dioxide," *Proceedings of the 41st Workshop on Geothermal Reservoir Engineering,* Stanford CA, February 22-24, 2016.

Teaching Experience

The Ohio State University Columbus, OH
Instructor of Record: ENR 3900 (Sustainability Metrics) Spring 2017
- Facilitated discussion and taught methods pertaining to life cycle thinking, risk assessment, and sustainability indicators to a class of 43 students enrolled in the Environment, Economy, Development and Sustainability program. Average rating: 4.3/5.
- Introduced a memo template into the laboratory curriculum and revised the laboratory assignment grading rubrics.

The Ohio State University Columbus, OH
Graduate Teaching Assistant: ENR 3900 | CIVILEN 5130 | PUBAFRS 5600 Fall 2016 | Fall 2017 | Spring 2018
- Taught 40 undergraduate students the basics of Microsoft Excel for ENR 3900 (Sustainability Metrics).
- Created exam and homework rubrics and graded exams and homework for CIVILEN 5130 (Applied Hydrology).
- Graded homework and created a midterm exam for PUBAFRS 5600 (Science, Engineering, and Public Policy).

Oral Presentations and Guest Lectures

Optimizing the Use of CO_2-Bulk Energy Storage for Transmission Deferral November 2018
2018 INFORMS Annual Meeting Phoenix, AZ

Using Integrated Models to Value the Use of Bulk Energy Storage for Reducing CO_2 Emissions from Regional Electricity Systems November 2018
2018 INFORMS Annual Meeting Phoenix, AZ

Using CO_2-BES to Address Environmental Challenges Facing the Electricity System February 2018
Otterbein University Physics Coffee Hour Westerville, OH

Effects of Bulk Energy Storage in Sedimentary Basin Geothermal Resources on Transmission Constrained Electricity Systems February 2018
Stanford Geothermal Workshop Palo Alto, CA

The Value of CO_2-Geothermal Bulk Energy Storage to CO_2 April 2016
CO_2 Summit II: Technologies and Opportunities Santa Ana Pueblo, NM

Prepared Lecture on Energy Storage April 2015
Valparaiso University College of Engineering Valparaiso, IN

Poster Presentations

Using Geothermal Resources to Increase Utilization of Wind Energy Technologies and Transmission Infrastructure October 2018
2018 Geothermal Resource Council Annual Meeting Reno, NV

The Value of CO_2-Geothermal Bulk Energy Storage to Reducing CO_2 Emissions December 2016
2016 American Geophysical Union Fall Meeting San Francisco, CA

Optimal Geothermal Heat Extraction Using CO_2 April 2016
CO_2 Summit II: Technologies and Opportunities Santa Ana Pueblo, NM

Using CO_2 for Renewable Energy Production from Geothermal, Wind, and Solar Resources August 2014
1st Annual Ohio Conference on the Sustainable Use of Greenhouse Gases Columbus, OH

Storing Sunlight in Rust June 2014
121st ASEE Annual Conference and Exposition Indianapolis, IN

Solar Thermal Decoupled Electrolysis: A Study of the Conversion of Fe_3O_4 to Fe_2O_3 September 2013
246th American Chemical Society National Meeting & Exposition Indianapolis, IN

Leadership Experience

The Ohio State University Columbus, OH
Environmental Science Graduate Program (ESGP) Student Association | President 2017 to 2018 Academic Year
ESGP Graduate Studies Committee | Student Representative 2017 to 2018 Academic Year

Valparaiso University Valparaiso, IN
Tau Beta Pi Engineering Honors Society Student Chapter | President 2013 to 2014 Academic Year
Valparaiso University Men's Club Soccer | President 2013 to 2014 Academic Year
American Society of Mechanical Engineers Student Chapter | Treasurer 2011 to 2012 Academic Year
Sigma Phi Epsilon National Fraternity IN Zeta Chapter | VP of Membership Development 2011 to 2012 Academic Year

Global Humanitarian Volunteer Experience

Sustainable and Resilient Tanzanian Community, The Ohio State University August 2015
Service Trip Group Leader
- Mentored a group of eight Ohio State University undergraduates during a two-week service trip in Tanzania, Africa

Engineers Without Borders, Valparaiso University Student Chapter September 2010 – December 2013
Finance Team Leader and Grant Writing Chair
- Traveled to La Palma, Nicaragua for Initial Assessment Trip in November 2013 and raised $9,500 through grant writing

Honors and Awards

2018 Geothermal Resource Council Graduate Scholarship Award (1 of 5 students in USA) August 2018
2018 Research Experience in Carbon Sequestration (RECS) Workshop Attendee July 2018
2018 Catalyzing Advocacy for Science and Engineering AAAS Workshop Attendee (1 of 4 OSU students) March 2018
2017 to 2018 OSU Preparing Future Faculty Fellow May 2017
2016 National Science Foundation Graduate Research Fellowship Honorable Mention March 2016
2016 ARPAe Innovation Summit Student Program Participant (1 of 100 students in USA) February 2016
2015 National Science Foundation Graduate Research Fellowship Honorable Mention March 2015
2014 Ohio State University Graduate School Fellowship March 2014
Valparaiso University College of Engineering Outstanding Senior Award February 2014
Scholarship Award Presented by the St. Joseph Valley Section of American Society of Mechanical Engineers April 2012

Professional Affiliations

Institute for Operations Research and the Management Sciences (INFORMS)
American Geophysical Union (AGU)
Sigma Xi Scientific Research Society
Tau Beta Pi Engineering Honors Society