

Braeton J. Smith

Colorado School of Mines, Division of Economics and Business
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As of March 2018

Education

Ph.D. Candidate, Mineral & Energy Economics, Colorado School of Mines, expected Aug 2018

- Research: Material and fuel substitution in energy applications
- Committee: Roderick Eggert (advisor), Ian Lange, Peter Maniloff, Corby Anderson

M.S., Mineral & Energy Economics, Colorado School of Mines, 2014

M.S., Applied Economics, Oregon State University, 2012

- Concentration: Natural Resource and Environmental Economics

B.A., Economics and Spanish (double major), University of New Mexico (*magna cum laude*), 2009

- Minor: Statistics
- Study Abroad: Universidad de Palermo, Buenos Aires, Argentina, Summer 2007

Research Interests

Resource & Environmental Economics, Material and Fuel Substitution, Clean Energy Technology, Material Criticality, Econometrics, Economic Consequence Analysis, Expert Elicitation, Electricity

Relevant Professional Experience

Colorado School of Mines (Golden, CO); Division of Economics and Business

- Research Assistant, Critical Materials Institute (with Dr. Rod Eggert); January 2014 – **Present**
- Recitation Leader/Teaching Assistant: Principles of Economics; August 2012 – December 2013

Geo-Relational Information Technologies, Inc. (Albuquerque, NM)

- Economist II (contractor to Sandia National Laboratories); April 2013 – **Present**

Sandia National Laboratories (Albuquerque, NM); Resilience and Regulatory Effects Department

- Graduate/Professional Technical Intern (Economist); September 2010 – March 2013
- Undergraduate Technical Intern; June 2009 – September 2010

University of New Mexico (Albuquerque, NM); Center for Academic Program Support (CAPS)

- Tutor: Mathematics, Statistics, and Economics; January – May 2009

Fellowships

National Physical Science Consortium Graduate Fellowship, 2010 – 2012

- Sponsored by Sandia National Laboratories
- Award: \$16,000 per year and full tuition at Oregon State University

Papers & Research

Peer-Reviewed Journal Articles

1. **Smith, Braeton J.**, and Roderick G. Eggert (2018), “Costs, substitution, and material use: The case of rare earth magnets.” *Environmental Science & Technology*, 52(6), 3803-3811. <https://dx.doi.org/10.1021/acs.est.7b05495>.

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2. Imholte, Devin D., Ruby T. Nguyen, Aditya Vedantam, Maxwell L. Brown, Ananth Iyer, **Braeton J. Smith**, John Collins, Corby G. Anderson, and Brock O’Kelley (2018), “An assessment of U.S. rare earth availability for supporting U.S. wind energy growth targets.” *Energy Policy*, 113, 294-305. <https://dx.doi.org/10.1016/j.enpol.2017.11.001>.
 3. **Smith, Braeton J.** and Roderick G. Eggert (2016), “Multifaceted material substitution: The case of NdFeB magnets, 2010-2015.” *JOM*, 68(7), 1964-1971. <https://dx.doi.org/10.1007/s11837-016-1913-2>.

Selected Technical Reports and Deliverables with Sandia National Laboratories

1. Tidwell, Vincent C., Vanessa N. Vargas, Shannon M. Jones, Bern C. Dealy, Calvin Shaneyfelt, **Braeton J. Smith**, and Barbara D. Moreland (2016), “Analysis of High Plains Resource Risk and Economic Impacts.” *Sandia National Laboratories*, SAND2016-3405.
2. Vargas, Vanessa N., Bern C. Dealy, and **Braeton J. Smith** (2015), “The Regional Economic Accounting Tool: Updates and Extensions.” *Sandia National Laboratories*, SAND2015-4130C.
3. National Infrastructure Simulation and Analysis Center (2011), “Analytical Baseline Study for the Cascadia Earthquake and Tsunami.” Department of Homeland Security, Office of Infrastructure Protection, Risk Development and Modeling Branch.
4. Ehlen, Mark A., Drake E. Warren, Verne W. Loose, Vanessa N. Vargas, Paula S. Downes, Eric D. Eidson, Greg E. Mackey, and **Braeton J. Smith** (2010), “Economics Definitions, Methods, Models, and Analysis Procedures for Homeland Security Applications.” *Sandia National Laboratories*, SAND2010-4315.
5. **Smith, Braeton J.** and Calvin R. Shaneyfelt (2010), “Economic Impacts of a Hypothetical H1N1 Pandemic: A Cross-Sectional Analysis.” *Sandia National Laboratories*, SAND2010-4314.
6. Loose, Verne W., Vanessa N. Vargas, Drake E. Warren, Shirley J. Starks, Theresa J. Brown, and **Braeton J. Smith** (2010), “Economic and Policy Implications of Pandemic Influenza.” *Sandia National Laboratories*, SAND2010-1910.

Papers in Conference Proceedings

1. **Smith, Braeton J.** (2014), “Substituting Wind for Coal: The Effects of an Increasing Share of Wind in the United States.” *37th IAEE International Conference Proceedings*.
2. **Smith, Braeton J.** (2011), “The Role of Fuel Type on the Residential Price of Electricity: A Panel Approach to the Energy Policy Act of 2005.” *30th USAEE/IAEE North American Conference Proceedings*.

Work in Progress

1. “Responding to future price shocks: An expert elicitation of the effect of future costs on material use” (with Roderick Eggert)
2. “Material criticality for clean energy technology” (with Roderick Eggert, Maxwell Brown, Brett Jordan, Haeyeon Kim, Sul-Ki Lee, and Toru Muta)

Other Papers

1. **Smith, Braeton J.** (2012), “The environmental Kuznets curve and fuel-switching in electricity generation,” M.S. Project Report, Applied Economics Graduate Program, Oregon State University.
2. Warren, Drake E., Vanessa N. Vargas, Verne W. Loose, **Braeton J. Smith**, and Eric D. Vugrin (2010), “An Input-Output Procedure for Calculating Economy-Wide Economic Impacts in Supply Chains Using Homeland Security Consequence Analysis Tools.” Prepared for the North American Regional Science Council 57th Annual North American Meetings of the Regional Science Association International, Denver, Colorado, November 10-13, 2010.

Presentations

Conference Presentations

Smith, Braeton J. and Roderick G. Eggert, “Quantifying Future Material Substitution in NdFeB Magnets for Clean Energy Technology.” Presented at the 2nd Annual Critical Materials Institute (CMI) Forum for Postdoctoral and Student Researchers at the Colorado School of Mines in Golden, CO on February 10, 2017.

Smith, Braeton J. and Roderick G. Eggert, “Rare Earth Substitutability in Rare Earth Magnets: Evidence from

2010-2015.” Presented at the 6th Energy Policy Research Conference (EPRC6) in Santa Fe, NM on September 8, 2016.

Smith, Braeton J. and Roderick G. Eggert, “Multifaceted Material Substitutability: The Case of NdFeB Magnets, 2010-2015.” Presented at the 1st Annual CMI Forum for Postdoctoral and Student Researchers at the Colorado School of Mines in Golden, CO on February 3, 2016.

Smith, Braeton J. and Roderick G. Eggert, “Rare Earth Substitutability in Clean Energy Technology: Using Expert Elicitation to Estimate Elasticities.” Presented at the 33rd USAEE/IAEE North American Conference in Pittsburgh, PA on October 27, 2015.

Vargas, Vanessa N., Bern C. Dealy, and **Braeton J. Smith**, “The Regional Economic Accounting Tool: Updates and Extensions.” Presented at the Western Social Science Association (WSSA) 57th Annual Conference in Portland, OR on April 10, 2015.

Smith, Braeton J., “Substituting Wind for Coal: The Effects of an Increasing Share of Wind in the United States.” Presented at the 37th IAEE International Conference in New York, New York on June 18, 2014.

Smith, Braeton J., “Defining the environmental Kuznets curve for CO₂: The role of fuel-switching in the power generation sector.” Presented at the 31st USAEE/IAEE North American Conference in Austin, TX on November 6, 2012.

Smith, Braeton J., “The Role of Fuel Type on the Residential Price of Electricity: A Panel Approach to the Energy Policy Act of 2005.” Presented at the 30th USAEE/IAEE North American Conference in Washington, D.C. on October 11, 2011.

Warren, Drake E., Vanessa N. Vargas, and **Braeton J. Smith**, “An Input-Output Procedure for Calculating Economy-Wide Economic Impacts in Supply Chains Using Homeland Security Consequence Analysis Tools.” Presented at the North American Regional Science Council 57th Annual North American Meetings of the Regional Science Association International in Denver, CO on November 13, 2010.

Poster Presentations

Smith, Braeton J. and Roderick G. Eggert, “Future Material Substitution in NdFeB Magnets for Clean Energy Technology.” Presented at the 3rd Annual Critical Materials Institute (CMI) Forum for Postdoctoral and Student Researchers at the Colorado School of Mines in Golden, CO on January 22-23, 2018.

Smith, Braeton J. and Roderick G. Eggert, “Material Substitution in NdFeB Magnets for Clean Energy Technology: Evidence from 2010-2015.” Presented at:

- 2nd Annual Critical Materials Institute Forum for Postdoctoral and Student Researchers in Golden, CO on February 9-10, 2017
- Magnetics 2017 Conference in Orlando, FL on January 18-19, 2017.

Eggert, Roderick, Sadie Fulton, Jose Hofer, Brett Jordan, Haeyon Kim, Sul-Ki Lee, and **Braeton Smith**, “Material Criticality: Comparing China, EU, Japan, and USA.” Presented at the 6th EU-US-Japan Trilateral Conference on Critical Raw Materials in Brussels, Belgium on November 29, 2016.

Jeffers, Robert, Kara Cafferty, **Braeton Smith**, and Maxwell Brown, “Simulating the Neodymium Supply Chain Using Explicit Supply and Demand.” Presented at the 33rd International Conference of the System Dynamics Society in Cambridge, MA on July 22, 2015.

Other Presentations

Smith, Braeton J. and Roderick G. Eggert, “The Many Dimensions of Substitution in Rare Earth Magnets: A Survey.” Presented at the Critical Materials Institute Magnet Thrust Meeting at Brown University in Providence, RI on May 6, 2015.

Smith, Braeton J., “The environmental Kuznets curve and fuel-switching in electricity generation.” M.S. defense presented at Oregon State University in Corvallis, OR on September 14, 2012.

Professional & Academic Service

Professional & Academic Memberships

- International/United States Association for Energy Economics (IAEE/USAEE), 2010 – Present

- Colorado School of Mines (CSM) Chapter of the USAEE (CSM-USAEE), 2014 – Present
- The University of New Mexico (UNM) Economics Society, 2009

Officer and Leadership Roles

- President (and Founder), CSM-USAEE, 2014 – Present
- Regent (and Co-founder), The UNM Economics Society, 2009

Peer-Review Activity

- Journal of Renewable and Sustainable Energy

As President of the CSM-USAEE (2014 – Present)

- Professional Events Organized
 - Rocky Mountain Energy Economics (RMEE) Banquet
 - 3rd Annual RMEE Banquet, Denver Athletic Club, Denver, CO, October 27, 2016.
 - 2nd Annual RMEE Banquet, Denver Athletic Club, Denver, CO, November 19, 2015
 - Inaugural RMEE Banquet, Colorado School of Mines, Golden, CO, October 30, 2014.
 - Numerous other activities including field trips and networking events in the Colorado Front Range
- Created, maintain, and contribute to CSM-USAEE’s website and blog, <http://csm-usaee.blogspot.com/>
- Contributions to the USAEE’s quarterly newsletter, *The Dialogue* (discontinued)
 1. “Local Chapter Activities: Colorado School of Mines Chapter.” Vol. 24(3), September 2016.
 2. “Update from the Colorado School of Mines Chapter.” Vol. 23(2), May 2015.
 3. “Welcoming our newest affiliate: The Colorado School of Mines Chapter.” Vol. 22(3), October 2014.
 4. “Highlights from the 30th USAEE/IAEE North American Conference.” Vol. 20(1), January 2012. (with Peter H. Kobos)

Miscellaneous

Computer Software

- Stata (advanced), SAS (intermediate), REMI PI+ (intermediate), GAMS (novice), Mathematica (novice), AMPL (novice), Matlab (novice)

Certifications

- College Reading and Learning Association (CRLA) Level 1 Tutor

Languages

- English (native), Spanish (conversational), Portuguese (basic)

Foreign Travel

- Argentina (study abroad), Canada, Chile, Colombia, Peru, Mexico

References

Available upon request