

# Joseph F. DeCarolis

Associate Professor  
Department of Civil, Construction, and Environmental Engineering  
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## Professional Preparation

Carnegie Mellon University	Engineering and Public Policy	Ph.D. 2004
Clark University	Physics, Environmental Science & Policy	B.A. 2000

## Professional Appointments

2015-present	Associate Professor	North Carolina State University
2008-2015	Assistant Professor	North Carolina State University
2004-2008	Environmental Scientist	U.S. Environmental Protection Agency
2005-2008	Part-Time Instructor	Nicholas School, Duke University
2000-2004	Research Assistant	EPP, Carnegie Mellon

## Awards and Honors

- ALCOA Foundation Research Achievement Award, 2016
- Whole Systems Energy Modelling (wholeSEM) Fellow, University College London, 2015
- ACSA/AIA Housing Design Education Award, 2013
- ASEE Southeastern Section, Outstanding New Teacher Award, 2011
- NSF CAREER Award, 2010
- U.S. EPA National Risk Management Research Laboratory team award for collaboration, 2008.
- Most Innovative Research Paper: “Is the Answer to Climate Change Mitigation Blowing in the Wind?” Presented at the First International Doctoral Consortium on Technology, Policy, and Management at Delft University, 2002.
- Phi Beta Kappa, 2000.

## Courses Taught

- Sustainable Building Design, Spring 2012-2015
- Energy & Climate, Spring 2009-2010; Fall 2010-present
- Fundamentals of Environmental Engineering, Fall 2009-2011; 2013-present
- Energy Modeling, Spring 2011; Spring 2013
- Environmental Life Cycle Assessment, Spring 2012; Spring 2014; Spring 2016

## Peer-Reviewed Publications

1. \*Jaunich, M.K., J.W. Levis, J.F. DeCarolis, E.V. Gaston, M.A. Barlaz, S.L. Bartelt-Hunt, E.G. Jones, L. Hauser, R. Jaikumar (2016). Characterization of municipal solid waste collection operations. *Resources, Conservation and Recycling*, **114**: 92-102.
2. \*Hodge, K.L., J.W. Levis, J.F. DeCarolis, M.A. Barlaz (2016). A Systematic Evaluation of Industrial, Commercial, and Institutional Food Waste Management Strategies in the US. *Environmental Science & Technology*, **50**(16): 8444–8452.
3. \*Jaunich, M.K., J.W. Levis, M.A. Barlaz, J.F. DeCarolis (2016). A Life-cycle Process Model for Municipal Solid Waste Collection. *Journal of Environmental Engineering*, 04016037.
4. \*Al Gharably, M., J.F. DeCarolis, S.R. Ranjithan (2016). An enhanced linear regression-based building energy model (LRBEM+) for early design. *Journal of Building Performance Simulation*, **9**(2):115-133.
5. DeCarolis, J. F., \*\*S. Babae, \*B. Li, \*S. Kanungo (2016). Modelling to generate alternatives with an energy system optimization model. *Environmental Modelling & Software*, **79**: 300-310.
6. \*Li, B., J.F. DeCarolis. (2015). A Techno-Economic Assessment of Offshore Wind Coupled to Ocean Compressed Air Energy Storage. *Applied Energy*, **155**: 315–322.
7. \*Al Gharably, M., J.F. DeCarolis, S.R. Ranji Ranjithan (2015). An enhanced linear regression-based building energy model (LRBEM+) for early design. *Journal of Building Performance Simulation*, **9**(2): 115-133.
8. \*Wang, X., \*\*A.S. Nagpure, J.F. DeCarolis, M.A. Barlaz (2015). Characterization of Uncertainty in Estimation of Methane Collection from Select U.S. Landfills. *Environmental Science & Technology*, **49**(3): 1545–1551.
9. \*Pressley, P., J.W. Levis, A. Damgaard, M.A. Barlaz, J.F. DeCarolis (2015). Analysis of material recovery facilities for use in life-cycle assessment. *Waste Management*, **35**: 307-317.
10. Levis, J.W., M.A. Barlaz, J.F. DeCarolis, S.R. Ranjithan (2014). Systematic Exploration of Efficient Strategies to Manage Solid Waste in U.S. Municipalities: Perspectives from the Solid Waste Optimization Life-Cycle Framework (SWOLF). *Environmental Science & Technology*, **48**(7): 3625–3631.
11. \*Pressley, P., T.A. Aziz, J.F. DeCarolis, M.A. Barlaz, F. He, F. Li, A. Damgaard (2014). Municipal Solid Waste Conversion to Transportation Fuels: A life-cycle estimation of global warming potential and energy consumption. *Journal of Cleaner Production*, **70**: 145–153.
12. \*Babae, S., \*\*A.S. Nagpure, J.F. DeCarolis (2014). How Much Do Electric Drive Vehicles Matter to Future US Emissions? *Environmental Science & Technology*, **48**(3): 1382–1390.
13. Levis, J.W., M.A. Barlaz, J.F. DeCarolis, S.R. Ranjithan (2013). A generalized multistage optimization modeling framework for life cycle assessment-based integrated solid waste management. *Environmental Modelling & Software*, **50**: 51-65.
14. \*Hunter, K., \*S. Sreepathi, J.F. DeCarolis (2013). Modeling for insight using Tools for Energy Model Optimization and Analysis (Temoa). *Energy Economics*, **40**: 339-349.
15. \*Wang, X., \*\*A.S. Nagpure, J.F. DeCarolis, M.A. Barlaz (2013). Using Observed Data To Improve Estimated Methane Collection from Select U.S. Landfills. *Environmental Science & Technology*, **47**(7): 3251-3257.

16. Welsch, M., M. Howells, M. Bazilian, J.F. DeCarolis, S. Hermann, H.H. Rogner (2012). Modelling elements of Smart Grids – Enhancing the OSeMOSYS (Open Source Energy Modelling System) code. *Energy*, **46**(1): 337-350.
17. DeCarolis, J.F., \*K. Hunter, \*S. Sreepathi (2012). The case for repeatable analysis with energy economy optimization models. *Energy Economics*, **34**(6): 1845-1853.
18. \*Hygh, J.S., J.F. DeCarolis, D.B. Hill, R. Ranjithan (2012). Multivariate Regression as an Energy Assessment Tool in Early Building Design. *Building and Environment*, **57**: 165-175.
19. Howells, M., H. Rogner, N. Strachan, C. Heaps, H. Huntington, S. Kypreos, A. Hughes, S. Silveira, J. DeCarolis, M. Bazillian, A. Roehrl (2011). OSEMOSYS - The Open Source Energy Modelling System. *Energy Policy*, **39**: 5850-5870.
20. DeCarolis, J.F. (2011). Using modeling to generate alternatives (MGA) to expand our thinking on energy futures. *Energy Economics*, **33**: 145-152.
21. Vijay, S., J.F. DeCarolis, R.K. Srivastava (2010). A bottom-up method to develop pollution abatement cost curves for coal-fired utility boilers. *Energy Policy*, **38**: 2255-2261.
22. Kaplan, P.O., J.F. DeCarolis, S.A. Thorneloe (2009). Is It Better to Burn or Bury Waste for Clean Electricity Generation? *Environmental Science & Technology*, **43**(6): 1711-1717.
23. DeCarolis, J.F. and D.W. Keith (2006). The Economics of Large Scale Wind Power in a Carbon Constrained World. *Energy Policy*, **34**: 395-410.
24. Keith, D.W., J.F. DeCarolis, D.C. Denkenberger, D.H. Lenschow, S.L. Malyshev, S. Pacala, and P.J. Rasch (2005). The influence of large-scale wind-power on global climate. *Proceedings of the National Academy of Sciences*, **101**(46): 16115-16120.
25. DeCarolis, J.F., R.L. Goble, C. Hohenemser (2000). Searching for energy efficiency on campus - Clark University's 30-year quest. *Environment*, **42**(4): 8-20.
26. Coffey, T., Z. Bayindir, J.F. DeCarolis, M. Bennett, G. Esper, C.C. Agosta (2000). Measuring radio frequency properties of materials in pulsed magnetic fields with a tunnel diode oscillator. *Review of Scientific Instrumentation*, **71**(12): 4600-4606.

### Refereed Conference Proceedings

1. DeCarolis, J.F., \*K. Hunter (2013). How Much Should We Value Uncertainty in Energy System Planning. *International Energy Workshop (IEW)*, Paris, France, June 19-21, 2013.
2. DeCarolis, J.F., \*K. Hunter, \*S. Sreepathi (2012). Multi-stage stochastic optimization of a simple energy system. *International Energy Workshop*, Cape Town, South Africa, June 19-21, 2012.
3. DeCarolis, J.F., \*K. Hunter, \*S. Sreepathi (2011). Description and a first application of the TEMOA energy systems model. *International Energy Workshop*, Stanford, CA, July 6-8, 2011. †
4. DeCarolis, J.F., \*K. Hunter, \*S. Sreepathi (2010). Tools for Energy Model Optimization and Analysis (TEMOA). *International Energy Workshop*, Stockholm, Sweden, June 21-23, 2010. †
5. DeCarolis, J.F. (2009). Application of a Novel Optimization Technique to Produce Maximally Different Energy Futures. *International Energy Workshop*, Venice, Italy, June 17-19, 2009. †

- DeCarolis, J.F. and D.W. Keith, (2002). Is the Answer to Climate Change Mitigation Blowing in the Wind? *Proceedings of the first International Doctoral Consortium on Technology, Policy, and Management*. E. F. t. Heuvelhof (ed.). Delft, The Netherlands, Delft University, 199-215.

† *Extended abstract was peer-reviewed for acceptance*

\* *Student co-authors*

\*\* *Postdoctoral researchers under my supervision*

### **Non-Refereed Book Chapters**

- Kaplan P.O., J.F. DeCarolis, M.A. Barlaz (2011). Life Cycle Inventory of Waste-to-Energy and Comparison to Landfill-Gas-to-Energy Options, *in Encyclopedia of Sustainability Science and Technology*. R.A. Meyers, ed. (London: Springer)
- DeCarolis, J.F., C. Shay, and S. Vijay (2007). The Potential Mid-Term Role of Nuclear Power in the United States: A Scenario Analysis Using MARKAL, *in Energy Security, Climate Change and Sustainable Development*. J. Mathur, H.G. Wagner, and N.K. Bansal, eds. (New Delhi: Anamaya Publishers).

### **Non-Refereed Journal Publications**

- Bazilian, M., A. Rice, J. Rotich, M. Howells, J. DeCarolis, S. Macmillan, C. Brooks, F. Bauer, M. Liebreich (2012). Open source software and crowdsourcing for energy analysis. *Energy Policy (Viewpoint)*, **49**: 149-153.
- DeCarolis, J.F. and D.W. Keith (2005). The Costs of Wind's Variability: Is There a Threshold? *The Electricity Journal*, **18**(1): 69-77.
- Cooter, E., B. Eder, C. Rosenzweig, B. Lynn, R. Goldberg, C. Knutson, M. Hayes, D. Wilhite, J. DeCarolis, and T. Barnett (2005). Effects of Climate Change on Weather and Water. *EM (AWMA's Magazine for Environmental Managers)*, October 2005.
- DeCarolis, J.F. and D.W. Keith (2001). The real cost of wind energy. *Science*, **294** (5544): 1000-1003.

### **Peer-Reviewed Reports**

- DeCarolis, J.F. (2007), *The Impact of EPA's Green Power Purchases*. U.S. Environmental Protection Agency Report EPA/600/R-07/019.
- Johnson, T.L., J.F. DeCarolis, C.L. Shay, D.H. Loughlin, C.L. Gage, and S. Vijay (2006). *MARKAL Scenario Analyses of Technology Options for the Electric Sector: The Impact on Air Quality*. U.S. Environmental Protection Agency Report EPA-600/R-06/114.
- Shay, S., J.F. DeCarolis, D. Loughlin, C. Gage, S. Yeh and S. Vijay (2006). *EPA U.S. National MARKAL Database Documentation*. U.S. Environmental Protection Agency Report EPA-600/R-06/057.
- Morgan, G., J. Apt, L. Lave, J. Bergerson, S. Blumsack, J. DeCarolis, P. Hines, D. King, D. Patiño-Echeverri, and H. Zerriffi (2005). *The U.S. Electric Power Sector and Climate Change Mitigation*. Prepared for the Pew Center on Global Climate Change.

### **Invited Presentations**

- DeCarolis, J.F. (2015) "Energy Scenario Exploration with Modeling to Generate Alternatives (MGA)" WholeSEM Annual Conference, Cambridge, UK, July 6, 2015.

2. DeCarolis, J.F. (2014) “Using Stochastic Optimization and Modeling-to-Generate Alternatives to Produce Planning-Related Insight” RAND Decision Making Under Uncertainty (DMUU) Workshop, Santa Monica, CA, November 19, 2014.
3. DeCarolis, J.F. (2014) “Improving Model-based Scenario Analysis with Stochastic Optimization and Modeling to Generate Alternatives” IQ SCENE Workshop, University College London (UCL), London, UK, March 26, 2014.
4. DeCarolis, J.F. (2014) “A Call for Greater Transparency in Energy Modeling and Analysis” Le École de Physique, Les Houches, France, February 7, 2014.
5. DeCarolis, J.F. (2012) “Modeling for Insight with an Energy Economy Optimization Model” Presentation to the Center for Climate and Energy Decision Making, Carnegie Mellon University, Pittsburgh, PA, March 19, 2012.
6. DeCarolis, J.F. (2012) “Modeling for Insight with an Energy Economy Optimization Model” Presentation to the U.S. EPA, Office of Research and Development, Durham, NC, August 13, 2012.
7. DeCarolis, J.F. (2012) “Modeling for Insight with an Energy Economy Optimization Model” Presentation in the CEnREP Colloquim, Department of Agricultural and Resource Economics, NCSU, Raleigh, NC, October 12, 2012.
8. DeCarolis, J.F. (2011) “Using Energy Economy Models to Deliver Policy-Relevant Insight” Presentation to the Statistical and Applied Mathematical Sciences Institute (SAMSI), Raleigh, NC, September 20, 2011.
9. DeCarolis, J.F. (2010) “The Energy and Climate Challenge” Symposium on the *Global Thirst for Energy*, Office of International Affairs, NCSU, Sept 14, 2010.
10. DeCarolis, J.F., K.M. Hunter, S. Sreepathi (2010). “Building a Better Energy Economy Model” Sandia National Laboratory, Computer Science Research Institute, March 31, 2010.
11. DeCarolis, J.F., (2009) “Using energy models to chart a path towards sustainability” Tau Beta Pi, NC Alpha Chapter, February 17, 2009.
12. DeCarolis, J.F. (2008) “Large-Scale Wind Power and Beyond” FREEDM Systems Center, NCSU, October 31, 2008.
13. DeCarolis, J.F., (2007) “Prospects for Large-Scale Wind Power” University of Calgary, December 17, 2007.
14. DeCarolis, J.F., (2004) “Is the Answer to Anthropogenic Climate Change Blowing in the Wind?” Sigma Xi Lecture, Indiana University of Pennsylvania, November 10, 2004.
15. DeCarolis, J.F., D.W. Keith, and A.E. Farrell, (2002) “Estimating the True Cost of Large-Scale Wind in Electric Power Systems” ABB, August 29, 2002.

### **Graduate Degrees Directed**

- Samaneh Babae, PhD, 2015.  
Thesis: The Potential Role of Plug-in Electric Vehicles in the U.S. and their Effect on Emissions through Mid-Century
- Maged Al Gharably, MS, 2013 (co-chair with Jaselskis).  
Thesis: Multivariate Function-based Energy Assessment During Early Building Design
- Binghui Li, MS, 2013.  
Thesis: The Economic Performance of Ocean Compressed Air Energy Storage
- Phillip Pressley, MS, 2013 (co-chair with Aziz).  
Thesis: Fuel Production from Municipal Solid Waste: A Life-Cycle Assessment

- Kevin Hunter, MS, 2012.  
Thesis: An Open Source Framework and Model for Energy Economy Optimization and (Uncertainty) Analysis
- Anthony Combs, MS, 2012.  
Thesis: Life Cycle Analysis of Recycling Facilities in a Carbon Constrained World
- Janelle Griffin (Hygh), MS, 2011.  
Thesis: Implementing Energy Simulation as a Design Tool in Conceptual Building Design with Regression Analysis
- George (GW) Barrett, MS, 2011.  
Thesis: Optimization of New Home Energy Performance
- Priscilla Osei, MCE, 2013.
- Pranav Jampani, MCE, 2010.

### **Undergraduate Advising**

I am an academic adviser to approximately a dozen undergraduate students each year. I have mentored three undergraduate students, Dylan Cawthorne, Charles O’Connell, and Johnny Bo in research activities.

- Dylan Cawthorne worked with Prof. Arumugam and I to examine the effect of climate variability on electric power demand in the southern U.S. A draft manuscript based on his work will be submitted for publication in 2015.
- Charles O’Connell implemented the modeling-to-generate-alternative (MGA) algorithm within the open source energy system modeling framework I developed under my NSF CAREER award. I presented his work at University College London in Spring 2014 and was invited to give a similar talk at RAND in Fall 2014.
- Johnny Bo reviewed and updated transmission costs in a spreadsheet model that estimates the approximate levelized cost of electricity from Gulf Stream electricity. The spreadsheet model was developed as part of a project funded by the NC Ocean Energy Program.

### **Funded Research Projects**

- *Quantifying the Effects of Meanders on Gulf Stream Electricity Costs*  
J.F. DeCarolis (PI), A. Keeler (co-PI)  
UNC Coastal Studies Institute, \$65,000 (7/1/15 – 6/30/16)
- *Salinity Gradient Energy: An Inexhaustible Clean Energy Resource for North Carolina*  
D. Call (PI), O. Coronell (co-PI), J.F. DeCarolis (co-PI), Lindsay Dubbs (co-PI) UNC  
ROI, \$997,965 (7/1/2015-6/30/2018)
- *Cyber-Innovation for Sustainability Science and Engineering (CyberSEES Type 2): Cyber-Enabled Water and Energy Systems Sustainability Utilizing Climate Information*  
S. Arumugam (PI), J.F. DeCarolis (co-PI), K. Mathinthakumar (co-PI), N. Lu (co-PI)  
National Science Foundation, \$ 1,200,000 (8/15/2014 - 8/14/2018)
- *Science Across Virtual Institutes (SAVI): International Institute for Solid Waste Management Life-Cycle Modeling*  
M.A. Barlaz (PI), J.F. DeCarolis (co-PI), J.W. Levis (co-PI), S.R. Ranjithan (co-PI)  
National Science Foundation, \$ 498,326 (8/15/2014 - 8/14/2017)
- *Solid Waste Management Planning for Wake County in Consideration of Cost, Energy and Environmental Emission*

- M.A. Barlaz (PI), J.F. DeCarolis (co-PI), J.W. Levis (co-PI), S.R. Ranjithan (co-PI)  
Wake County, \$ 131,337 (7/1/2014 - 6/30/2015)
- *Quantifying the Effects of Uncertainty on the Economic Competitiveness of Gulf Stream Energy*  
J.F. DeCarolis (PI), A. Keeler (co-PI)  
UNC Coastal Studies Institute, \$52,387 (7/1/14 – 6/30/15)
  - *CAREER: Modeling for Insights with an Open Source Energy Economy Optimization Model*  
J.F. DeCarolis (PI)  
National Science Foundation, \$400,795 (1/1/11-12/31/16)
  - *The Environmental Sustainability of Integrated Solid Waste Management in a Carbon Constrained World*  
J.F. DeCarolis (PI), M.A. Barlaz (co-PI), S.R. Ranjithan (co-PI)  
National Science Foundation, \$ 299,575 (8/15/2010 - 7/31/2015)
  - *Integrated Solid Waste Management and Its Environmental Sustainability in a Carbon Constrained Environment*  
M.A. Barlaz (PI), S.R. Ranjithan (co-PI), J.F. DeCarolis (co-PI)  
Environmental Research & Education Foundation, \$268,873 (1/1/2010 - 12/31/2014)
  - *Multiple Tiered Methodology For Micro- to Macro-Scale Assessment of Plug-In Hybrid Electric Vehicles (M4-PHEVs)*  
H.C. Frey (PI) and J.F. DeCarolis (Co-PI)  
National Science Foundation, \$470,036 (10/01/09 - 9/30/14)
  - *Cost Modeling, Regulatory Structure, and Incentives for Gulf Stream Current Energy Production*  
J.F. DeCarolis (PI), A. Keeler (co-PI)  
UNC Coastal Studies Institute, \$40,348 (7/1/13 – 6/30/14)
  - *Levelized Cost Model for Gulf Stream Energy*  
J.F. DeCarolis (PI), A. Keeler (co-PI), G. Hagerman (co-PI)  
UNC Coastal Studies Institute, \$38,872 (7/1/12 – 6/30/13)
  - *Development of Ocean Compressed Air Energy Storage Including Transmission and Distribution Off the North Carolina Coast*  
M. Gabr (PI), J.F. DeCarolis (co-PI), M. Evans (co-PI), S. Rahman (co-PI), A. Mazzoleni (co-PI), P. Ro (co-PI), I. Husain (co-PI), E.B. Agamloh (co-PI), A.Q. Huang (co-PI)  
UNC Coastal Studies Institute, \$290,465 (7/1/12 – 6/30/13)
  - *Ocean Energy: Assessment of Energy Storage Aspects Including Control and Grid Connection Off the North Carolina Coast*  
M. Gabr (PI), J.F. DeCarolis (co-PI), M. Evans (co-PI), S. Rahman (co-PI), A. Mazzoleni (co-PI), P. Ro (co-PI), E.B. Agamloh (co-PI), A.Q. Huang (co-PI), S.M. Lukic (co-PI)  
UNC Coastal Studies Institute, \$257,000 (7/1/11 – 6/30/12)
  - *Utilizing Municipal Solid Waste as a Biofuel Feedstock*  
M.A. Barlaz (PI), T.A. Aziz (co-PI), J.F. DeCarolis (co-PI)  
EREF, \$39,776 (8/15/11 – 4/30/13)
  - *Modernizing Models and Data on Methane Production from Landfills*  
M.A. Barlaz (PI), J.F. DeCarolis (co-PI)  
Environmental Research & Education Foundation, \$110,000 (8/2/2010 - 7/31/2013)

- *Building Design Process Innovation for Enhancing Energy and Environmental Sustainability*  
J.F. DeCarolis (PI), S.R. Ranjithan (co-PI), D.B. Hill (co-PI), J. Hygh  
NCSU Strategic Research Initiative, \$23,272 (5/1/10 - 4/30/11)
- *GRIDc II: Green Research for Incorporating Data in the Classroom Phase 2*  
W. DeLuca (PI), L. Annetta (co-PI), P. Carpenter (co-PI), A. Clark (co-PI),  
J.F. DeCarolis (co-PI)  
National Science Foundation, \$400,024 (8/01/2009 - 7/31/2012)

### **University Service**

- Co-lead, Sustainable Energy Systems and Policy faculty cluster, 2015-present
- Campus Environmental Sustainability Team (CEST), 2009-2011
- Member, Energy Task Force (charged with response to the 2009 fed stimulus), 2009

### **Department Service**

- Coordinator, Environmental, Water Resources, and Coastal Engineering (EWC) Group, 2015-present
- Member, CCEE Graduate Programs Committee, 2013-present
- Member, CCEE Web Committee, 2013-present
- ABET Supporting Areas Committee, 2009-present
- Instructor, NCSU Summer Practicum, 2010-2013
- Instructor, NCSU CCEE High School Summer Camp, 2012-2014
- Coordinator, EWC Spring Symposium, 2010-2012
- Coordinator, EWC Seminar Series, Spring 2010-Spring 2012
- Member, Department Website Redesign Committee, 2010-2011, 2015