

APURBA SAKTI

CURRICULUM VITAE (last updated 11 Jan 2016)

Research Scientist

MIT Energy Initiative, Massachusetts Institute of Technology
Building E19 Room 308 • 77 Massachusetts Avenue • Cambridge, MA 02139
+1(617) 715-4512, sakti@mit.edu

EDUCATION

Doctor of Philosophy, Engineering and Public Policy, **Carnegie Mellon University**, December 2013

Thesis: Quantification of performance and cost trajectory of Li-ion battery designs for personal vehicle electrification in the near future.

(Primary Advisors: Jay F. Whitacre, and Jeremy J. Michalek)

Master of Science in Environmental Sciences, Policy, and Management, jointly awarded (*with Distinction*) by **Central European University**, Hungary; **University of Manchester**, UK; **Lund University**, Sweden; **The University of the Aegean**, Greece, August 2009

Thesis: UK Energy and Environmental Policy for Biomass Heating Options

Master of Science in Energy and Geo-Environmental Engineering, **Pennsylvania State University**, August 2007

Thesis: Study of structural transformations and hydrogen evolution from ball-milled coals

Bachelor of Engineering in Metallurgy, National Institute of Technology, Nagpur, 2005

Independent coursework audited, **Massachusetts Institute of Technology**

- Electric Power Systems Modeling for a Low Carbon Economy, January 2015
- Engineering, Economics and Regulation of the Electric Power Sector, Spring 2015
- Energy Economics and Policy, Spring 2015

EMPLOYMENT HISTORY

Massachusetts Institute of Technology, Cambridge, MA

Jan 2016-Present: **Research Scientist** at the MIT Energy Initiative.

- Reporting and working closely with the Director of Research at MITEI on the development of the Energy Storage Center, one of the four low-carbon energy centers announced by MIT as part of its plan for action on climate change.

April 2014-Dec 2015: **Postdoctoral Associate** at the MIT Energy Initiative, and the Department of Chemical Engineering

- Contributing Author, MIT Future of Solar Energy Study.
- Working and **partly managing** a project to investigate the value proposition of energy storage for an evolving electric grid, specifically for a **multinational client** that operates both in the **developing** as well as the developed world.
- Co-advising a master's student, Alex Yee, on investigating opportunities in the space conditioning (heating, cooling) sector by comparing natural gas vs. electricity in terms of global efficiency and infrastructure requirements.
- Collaborating with Argonne National Laboratory to improve energy storage modeling tools.

- **Guest lecturer**, Integrated Chemical Engineering I, on techno-economic aspects of energy storage.
- Helping faculty and other colleagues understand techno-economic aspects of energy storage. A recent piece on Tesla's Powerwall was published on MITEL website's front page.

Carnegie Mellon University, Pittsburgh, PA: August 2009-December 2013, Graduate Research Assistant

- Conducted research with the **Design Decisions Laboratory**, Vehicle Electrification Group and the Materials for Electrochemical Storage.
- Research picked up by the **New York Times** and a **startup company** is currently using my research.
- Collaborated closely with Argonne National Laboratory
- Volunteer organizer at The Battery Show, Novi, MI-world's largest battery conference.
- Member of Scientists and Engineers for America (SEA), CMU chapter

American Council for an Energy Efficient Economy, Washington, DC: June 2010-Aug 2010, and June 2011-Aug 2011, Independent Contractor.

- Provided consultation on battery technology and helped with the section on batteries in their Green Book. Published an ACEEE Fact Sheet on li-ion batteries.

Tyndall Center for Climate Change Research, Manchester, UK: Nov 2008-Jul 2009, Graduate Research Assistant, Supergen Bioenergy Consortium

- Investigated the potential of biomass as an alternative to fossil fuels for heating applications in the UK
- Performed background calculations to facilitate the determination of suitable locations for bio-refinery plants in Germany, Spain, Netherlands and Denmark.

United Nations Development Programme, Zagreb, Croatia: Jun 2008-Sept 2008, Intern, Removing Barriers to Energy Efficiency Project, Environmental Governance Programme (GREEN)

- Contributed by providing recommendations for the implementation of energy efficiency technologies and measures in Croatian residential and service sectors.

Center for Climate Change and Sustainable Energy Policy, Budapest, Hungary: Nov 2007-May 2008, Intern, Residential Monitoring to Decrease Energy Use and Carbon **Emissions in Europe (REMODECE) Project.**

- Temporarily in charge of the national level analysis. Collected data from households on electricity consumption of various appliances and contributed in the national electricity saving potential analysis.

Pennsylvania State University, University Park, PA: Aug 2005-Aug 2007, Graduate Research Assistant

- Conducted research at the Energy Institute (EI) on hydrogen production and storage

Indian Institute of Technology, Madras, India: May-Aug 2003, May-Aug 2004, Nov-Dec 2004, Intern

- Worked at the Dept. of Metallurgical and Materials Engineering, and Dept. of Chemistry
- Initiated equipment setup for flow field study in Proton Exchange Membrane Fuel Cells and synthesized carbon nanotubes catalytically for application as supports for anode materials in Direct Methanol Fuel Cells.

AWARDS AND HONORS

- Project manager for a capstone- course on Assessing Federal Drug Administration's Risk Evaluation and Mitigation Strategies that won the Stephen Omer Lee Award for the outstanding project course for 2011, 2012.
- Honorable Mention Technical Poster, 23rd Annual International Pittsburgh Coal Conference, Pittsburgh, 2006
- Center for Environmental Chemistry and Geo-Chemistry (CECG) PSU Fellowship, 2006
- Personality Award, Annual Gathering 'Metvista', NIT Nagpur, 2005
- Best Technical Paper No.2 in Mechanical Engineering, Annual Tech-Fest at IIT, Delhi, 2004
- Best Technical Paper No.3 in the Metallurgy/Materials Engineering, Annual Tech-Fest at IIT, Roorkee, 2004

SOFTWARE: (in order of competency): Apple OS, Microsoft OS, Microsoft Office, Battery Design Studio, MATLAB, GAMS, Stata, Visual Basic

SKILLS: Engineering design; Project management; Battery systems modeling; Energy storage markets and regulations; Optimization; Decision-making under uncertainty; Process-based cost modeling; Life Cycle Assessment, Hydrogen production and storage; Policy analysis; Coal; Hindi (fluent); Bengali (fluent); Assamese (fluent); Spanish (beginner).

EXTRACURRICULAR /LEADERSHIP/COMMUNITY SERVICE

- Panelist at the launch of **MITEI's Center for Energy Storage** during the Annual Research Conference, announced as part of MIT's plan for action on climate change. Only non-faculty member of the panel, October 2015.
- Panelist, "**Energy Storage: The Silver Bullet?**" 10th Annual Tufts Energy Conference, Boston, February 2015
- Session Chair for Energy, Environmental, and Economic Analysis, ASME (American Society of Mechanical Engineers) 12th Fuel Cell Science, Engineering, & Technology Conference, Boston, September 2014.
- Volunteer at Animal Rescue League, Pittsburgh, PA with over 75 hours of service, 2011-present.
- Director of Community Services, Rotary Club, VNIT Chapter, India, 2003-05

TEACHING EXPERIENCE

- **Guest lecturer**, Integrated Chemical Engineering I, on techno-economic aspects of energy storage.
- Carnegie Mellon University: Project manager for a capstone- course on Assessing Federal Drug Administration's Risk Evaluation and Mitigation Strategies that won the Stephen Omer Lee Award for the outstanding project course for 2011, 2012.
- Pennsylvania State University: Teaching Assistant for EGEE-101: Introduction to Energy and the Environment.

PUBLICATIONS/PRESENTATIONS/OTHER OUTREACH

Peer reviewed publications

- [19] **Sakti, A.**, Azevedo, I, Fuchs, E.R.H, Gallagher, K.G, Michalek, J.J., Whitacre, J.F. 2015. "A new framework for technology forecasting: A case of Li-ion battery designs, cell costs, and pack costs

for light-duty passenger vehicle electrification” submitted to the Proceedings of the National Academies of Sciences.

- [18] **Sakti, A.** *Contributing author* in the **The Future of Solar Energy**, An Interdisciplinary MIT study led by the MIT Energy Initiative and released in May 2015.
- [17] **Sakti, A.**, Michalek, J.J. Fuchs, E.R.H, and Whitacre, J.F. 2015, “A techno-economic analysis and optimization of Li-ion batteries for light-duty passenger vehicle electrification” *Journal of Power Sources*, 273, Pp. 966-980.
- [16] **Sakti, A.**, Michalek, J.J., Chun, Sang-Eun, and Whitacre, J. F. 2013. “A validation study of Lithium-ion Cell Constant C-Rate Discharge Simulation with Battery Design Studio®”, *Int. J. of Energy Res.*, 37 (12), pp. 1562–68.
- [15] Burgess-Clifford, C.E, Narayanan, D.L., Van Essendelft, D.T., Jain, P., **Sakti, A.**, and Lueking, A.D. 2009. “The effect of calcination on reactive milling of anthracite as potential precursor for graphite production”, *Fuel Processing Technology*, 90(12), pp. 1515-23.
- [14] Lueking, A.D., **Sakti, A.**, Alvarez-Fonseca, D., and Wonderling, N, 2009, “Enhanced Oxidative Reactivity for Anthracite Coal via a Reactive Ball Milling Pretreatment Step”, *Energy Fuels*, 23 (9), pp. 4318-24.
- [13] **Sakti, A.**, Wonderling, N.M., Burgess-Clifford, C.E., Badding, J.V., and Lueking, A.D., 2008, “Role of Carbon Order in Structural Transformations and Hydrogen Evolution Induced by Reactive Ball Milling in Cyclohexene”, *J. of Phy Chem. C*. 112 (44), pp 17427-35.

Peer reviewed work in progress:

- [12] **Sakti A.** et al., 2016, A techno-economic analysis of existing and emerging energy storage technologies for grid storage: A case study of Italy, work in progress
- [11] **Sakti A.**, et al., 2016, An enhanced representation of electrochemical batteries in electrical power systems models, work in progress (in collaboration with Argonne National Laboratory)

Other outreach:

- [10] **Sakti, A.**, Miller, R.A., Brushett, F.R., 2015, What’s cost got to do with it? An assessment of Tesla’s Powerwall, **opinion piece published on the front page of the MIT Energy Initiative’s website.**
- [9] **Sakti, A.** 2011. Factors that can contribute to Cost Reduction of Lithium-Ion Batteries for Personal Vehicles, ACEEE Fact Sheet.

Conference and invited presentations/talks:

- [8] **Sakti A.** “Techno-economics of energy storage systems”, October 2015, MIT Energy Initiative’s Annual Research Conference.
- [7] **Sakti A.** (speaker) “Quantification of performance and cost trajectory of Li-ion battery designs for personal vehicle electrification in the near future”, July 2014, National Renewable Energy Laboratory, Boulder, CO
- [6] **Sakti A.** (speaker) “Quantification of performance and cost trajectory of Li-ion battery designs for personal vehicle electrification in the near future”, June 2014, ASME 12th Fuel Cell Science, Engineering, & Technology Conference, Boston, MA.
- [5] **Sakti A.** (speaker) “Quantification of performance and cost trajectory of Li-ion battery designs for personal vehicle electrification in the near future”, Jan 2014, MIT Energy Initiative and Chemical Engineering, Cambridge, MA
- [4] **Sakti, A.** (speaker), Michalek, J.J. Fuchs, E., Whitacre, J.F., 2011, “Techno-Economic Analysis of Lithium-Ion Batteries for Personal Vehicle Electrification”. *Technology Management and Policy Conference*, May 2011, State College, PA.
- [3] **Sakti, A.**, Michalek, J.J. Fuchs, E., Whitacre, J.F., 2011, “Techno-Economic Analysis of Lithium-Ion Batteries for Personal Vehicle Electrification”. *Climate and Energy Decision Making under Uncertainty*, May 2011, Pittsburgh, PA. (poster)

- [2] **Sakti, A.**, Khan, S., Langer, T., Michalek, J.J., and Whitacre, J.F., 2011, “Techno-Economic Analysis of Lithium-Ion Batteries for Personal Vehicle Electrification”. National Academies Transportation Research Board Annual Meeting, January 2011, Washington, D.C. (poster)
- [1] **Sakti, A.**, Burgess-Clifford, C.E., Lueking, A.D., 2006 “Hydrogen Production from and Subsequent Trapping in Ball Milled Anthracite Coal” Pittsburgh Coal Conference, September 2006, Pittsburgh, PA --**Selected for Award: Honorable Mention, Technical Poster**

SELECT MEDIA COVERAGE

- [1] **Carnegie Mellon University**, Oct 21, 2014, “Big factories won’t solve high cost of electric vehicles, Carnegie Mellon researchers say”.
- [2] **Green Car Congress**, Oct 22, 2014, “CMU/MIT study finds large-scale battery manufacturing will do little to reduce unit costs past a 200-300MWh annual production level”
- [3] **New York Times**, Oct 25, 2014 “Wheelies: The Real Deal Jeep Edition”.

REFEREES

Prof. Robert C. Armstrong

Director, MIT Energy Initiative & Chevron professor of Chemical Engineering
Massachusetts Institute of Technology, Cambridge, MA 02139
rca@mit.edu

Prof. Jay F. Whitacre

Professor, Engineering and Public Policy & Materials Science and Engineering
CTO, Aquion Energy
Carnegie Mellon University, Pittsburgh, 15213
jwhitacre@aquion-energy.com

Prof. Jeremy J. Michalek

Professor, Engineering and Public Policy & Mechanical Engineering
Carnegie Mellon University, Pittsburgh, 15213
jmichalek@cmu.edu

Prof. Fikile R. Brushett

Raymond A. and Helen E. St. Laurent Career Development Chair in Chemical Engineering
Massachusetts Institute of Technology, Cambridge, MA 02139
brushett@mit.edu

Dr. Raanan A. Miller

Associate Director, MIT Energy Initiative
Massachusetts Institute of Technology, Cambridge, MA 02139
ramiller@mit.edu

Dr. Kevin G. Gallagher

Chemical Engineer
Argonne National Laboratory, Lemont, IL 60439
kevin.gallacher@anl.gov