

Varun Rai: Curriculum Vitae

Current Position

Assistant Professor, LBJ School of Public Affairs, University of Texas at Austin
7/2010-current

Past Positions

Research Fellow, Program on Energy and Sustainable Development (PESD), Stanford University
4/2008-6/2010

Education

Ph.D. Mechanical Engineering, Stanford University, Stanford, CA
GPA – 4.00/4.0
4/2008

M.S. Mechanical Engineering, Stanford University, Stanford, CA
GPA – 3.95/4.0
9/2002-3/2004

B. Tech. Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India
GPA – 8.48/10.0
7/1998-5/2002

Areas of Interest

Engineering-Economic analysis of energy systems; Energy policies of China and India; Climate change economics and policy; Technological innovation and diffusion

Honors and Achievements

- Spokesperson, Group of Global Economic Fellows 2009 2009
- Global Economic Fellow at the Global Economic Symposium, Pleon Castle, Germany 2009
- Fellow, Salzburg Global Seminar, Session #459 (“The global energy fulcrum: Rise of Asia and European response”) 2008
- Named among the top three students in the area of electrochemical science in Northern California (Runners up for the Daniel Cubicciotti Award) 2007
- Finalist at the \$50,000 Stanford BASES Social-Entrepreneurs Challenge 2007
- Member, Student Committee for Faculty Search in Flow Physics and Computation Division, Mechanical Engineering, Stanford 2006

Total five student members. The committee interviewed five candidates on their teaching and research vision. Committee’s vote is equivalent to that of one Stanford faculty

- Franklin P. and Caroline M. Johnson Graduate Student Fellowship 2003
- GSPB Service Award for excellence in graduate teaching, Stanford University 2003
- Scores (2360 on 2400) in the top 1% in the GRE General Test 2001
- Nurture Program Scholarship, National Board of Higher Mathematics, India 1999

Awarded each year to 15 mathematically talented freshmen students from India

- Selected for the International Mathematical Olympiad Training Camp held at the Indian Institute of Science, Bangalore, India (1995) and Bhabha Atomic Research Center, India (1997)

Every year 45 high school students from India are selected after a series of exams on mathematics

In the News Media

- On *Climate One*, *Commonwealth Club Radio* on Energy in India (October 2009)
- On *Newx National News TV Channel* on Climate Change Mitigation Efforts in India (September 2009)
- In *Science*, *The Wall Street Journal*, *Bloomberg News*, *Point Carbon Research*, and *McClatchy's News* on CCS in China (September 2009)
- In *Washington Post* on technological learning curves for CCS (August 2009)
- In *FactCheck.Org* on costs of building CCS-equipped power plants (January 2009)
- In *Newsweek* on CO₂-emissions from coal-based power generation (January 2009)
- In *Businessworld* on the status of technologies for carbon capture and storage (December 2008)
- In *CleanTech News* on India's renewable-energy policies (October 2008)
- In *The Hindustan Times* on the CO₂-emissions reductions benefits of the US-India nuclear deal (July 2008)

Professional & Research Experience

Research Fellow 4/2008-Current
Stanford University, Program on Energy and Sustainable Development, Stanford, CA

Areas: Engineering-Economic analysis of energy systems; Energy policy of India; Climate change policy; Role of national oil companies; Technological innovation and diffusion

- Modeling of bottom-up energy-technology scenarios that could help in reductions of CO₂ emissions. Includes, energy efficiency, carbon capture and storage, and technology diffusion
- Strategies for engaging developing countries in global climate change policy
- Political economy of reforms in India's energy sector; Interlinks with climate-change-mitigation efforts
- Factors that influence the performance and behavior of national oil companies

Graduate Research Assistant 9/2003-3/2008
Stanford University, Computational Energy Sciences Group, Stanford, CA
Advisor: Heinz Pitsch, Associate Professor

Topic: Multiscale modeling of hydrogen fuel cells

- Developed a statistical modeling framework, 3DMC, for simulating the performance of hydrogen fuel cells; For PhD thesis, applied 3DMC to explain fundamental performance aspects of hydrogen fuel cells
- Contributed significantly to proposals submitted to NASA, NSF, and Honda resulting in prestigious NSF CAREER grant for Prof. Heinz Pitsch (Ph.D. advisor) as well as continued funding from Honda R&D Co., Japan

Visiting Research Student 10/2006-12/2006
Ceder Group, MIT, Cambridge, MA
Advisor: Gerbrand Ceder, Professor

Topic: First-principles statistical simulations of fuel cells

- Results provided insights to factors causing performance loss in hydrogen fuel cells

Teaching Experience

Invited Lecturer

Stanford Undergraduate honors program. Topic: Political economy of taxing oil Fall 2008-09

Head Teaching Assistant & Stand-in Lecturer

Engineering Thermodynamics (Introductory undergraduate course) Winter 2006-07
Stanford University, Mechanical Engineering Department, Stanford, CA

- Taught entropy and the second law of thermodynamics
- Gave midterm and final review sessions
- Designed all homework sets, problem sessions, and exams

Teaching Assistant

Linear Algebra Fall 2002-03
Partial Differential Equations Winter 2002-03
Numerical Methods Spring 2002-03
Stanford University, Mechanical Engineering Department, Stanford, CA

- Graduate level series for chemical, mechanical, and petroleum engineers
- Led problem sessions, designed exams, and homework sets
- Received Stanford GSPB Award for excellence in teaching

Lecturer

Mathematics for IIT Entrance Exam 06/2002-08/2002
XL IIT Institute, Allahabad, U.P., India

- Delivered sixteen lectures to approximately 400 aspiring IIT students
- Topics included quadratic equations, complex numbers, permutations & combinations, and probability

Other Professional Activities

Technical Review

- Climatic Change
- Energy Policy
- Cambridge University Press
- Mitigation and Adaptation of Strategies for Global Change
- International Journal of Oil, Gas and Coal Technology
- Global Environmental Change
- Climate Policy
- Reviewed 8 other technical/policy papers at the request of authors or of directors of programs that publish working paper series

Other Services

- Member, Student Committee for Faculty Search in Flow Physics and Computation Division, Mechanical Engineering, Stanford 2006

- Member, Conference Coordination and Organizing Committee for *Reconciling Carbon and Energy Security*, Stanford University 2008

All Publications

Energy and Statistical Modeling

J. Bistline and V. Rai, "The Role of Carbon Capture and Storage in Greenhouse Gas Emissions Reduction Models: A Parametric Study for the U.S. Power Sector", *Energy Policy*, 38(2), 1177 (December 2009)

V. Vishwanathan, V. Rai, and H. Pitsch, "First-principles-based Reaction-Kinetics Model for Oxygen Reduction Reaction on Pt₃Ni(111)", Forthcoming in *Electrochemical Society (ECS) Transactions* (Accepted June 2009)

V. Rai, M. Aryanpour, and H. Pitsch, "First-Principles Analysis of Oxygen-Containing Adsorbates Formed from the Electrochemical Discharge of Water on Pt(111)", *Journal of Physical Chemistry C*, 112(26), 9760 (June 2008).

V. Rai, H. Pitsch, A. Novikov, "Efficient Dynamic Monte Carlo Algorithm for Time-Dependent Catalytic Chemistry", *Physical Review E*, 74, 046707 (October 2006).

M. Aryanpour, V. Rai, and H. Pitsch, "Convergent Iterative Constrained Variation Algorithm for Calculation of Electron-Transfer Transition States", *Journal of the Electrochemical Society*, 153 (3), E52 (January 2006).

V. Rai, M. Aryanpour, A. Dhanda, S. Walch, and H. Pitsch, "PEMFC Electrochemistry: Simulation of non-equilibrium surface chemistry on 3-dimensional geometries", *Proceedings of the Joint International Meeting of the Electrochemical Society*, 2005-11, 264 (May 2005)

R. Rai, V. Rai, M.K. Tiwari, V. Allada, "Disassembly sequence generation: a Petri net based heuristic approach", *International Journal of Production Research*, 40(13) (2002).

Carbon Capture and Storage Policy

V. Rai, D.G. Victor, and M.C. Thurber, "Carbon Capture and Storage at Scale: Lessons from the Growth of Analogous Energy Technologies", *Energy Policy*, 38(8), 4089 (August 2010).

R.K. Morse, V. Rai, and G. He, "The Real Drivers of Carbon Capture and Storage in China and Implications for Climate Policy". PESD Working Paper #88 (August 2009).

V. Rai, N. Chung, M.C. Thurber, and D.G. Victor, "PESD Carbon Storage Database", PESD Working Paper #76 (July 2008).

Political Economy of Energy in India

V. Rai, "Changing Face of Indian Energy System: A March towards Normalcy", *India in Transition*, Center for the Advanced Study of India (CASI), University of Pennsylvania (October 2008).

J. Carl, V. Rai, D.G. Victor, "Energy and India's Foreign Policy", PESD Working Paper #75, Stanford University (April 2008).

Climate Change Policy

V. Rai, "Climate-Change Mitigation in India", *Seminar Journal*, No. 606 (February 2010).

V. Rai, "Future of the Clean Development Mechanism Post-2012". *Harvard International Review*, 31(3) (Fall 2009).

V. Rai and D.G. Victor, "Climate Change and the Energy Challenge: A Pragmatic Approach for India", *Economic and Political Weekly*, 44(31), p78-85 (August 2009).

D. G. Victor and V. Rai, 2009, "Dirty Coal is Winning," *Newsweek International*, 12 January 2009

Performance and Behavior of National Oil Companies

V. Rai, "Adapting to Shifting Government Priorities: An Assessment of ONGC-India's Performance and Strategy". In preparation as a book chapter (Forthcoming in 2010-11)

D.G. Victor and V. Rai, "Awakening Giant: Strategy and Performance of the Abu Dhabi National Oil Company (ADNOC)". In preparation as a book chapter (Forthcoming in 2010-11)

Invited Talks

- "Aligning Domestic Progress on Energy and Climate Issues in India", UCLA Law School (April 2010)
- "Managing Volatility and Growth: Issues with the Governance and Performance of National Oil Companies", 8th PetroIndia, India Energy Forum, New Delhi, India (November 2009)
- "Carbon Capture and Storage: Policies, Deployment, and the North-South Divide", Indo-US Workshop on "Climate and Energy Futures", Chennai, India (October 2009)
- "Allocating Risks Effectively for Technological Growth", Calera Carbon Symposium, Santa Clara, California (July 2009)
- "Policies and Incentives for Carbon Capture and Storage Investments", Calera Corporation, Santa Clara, California (June 2009)
- "Political Economy of India's Energy Challenge", Kennedy School of Government, Harvard University (April 2009)
- "Climate Change and the Energy Challenge: A Pragmatic Approach for India", Center for Policy Research, New Delhi, India (March 2009)
- "Technological Innovation and the Future of the Oil and Gas Industry" (with David. G. Victor), Energy 2030 Conference, Abu Dhabi, UAE (November 2008)
- "Carbon Capture and Storage (CCS): Technologies, Opportunities, and Risks", Energy 2030 Conference, Abu Dhabi, UAE (November 2008)
- "The Indian Energy Landscape", US Los Alamos National Laboratory (September 2008)
- "Renewable Energy Cheaper Than Coal?" (with David G. Victor, Richard Morse, and Jeremy Carl), Google Inc, Mountain View, California (August 2008)
- "Energy and India's Foreign Policy" (with David G. Victor and Jeremy Carl), Center for the Advanced Study of India, University of Pennsylvania (April 2008)

Invited Panel Discussions

- "Solving the Climate Change Problem: Technology, California, and the Emerging Markets", UC San Diego (October 2009)
 - Other Panelists
 - *Dan Bilello*, US National Renewable Energy Lab
 - *David Zilberman*, UC Berkeley

- *Alan Heyduk*, UC Irvine
- “The Energy-Emissions Scenarios and Climate Change Mitigation in India”, ORF-RLS Summit on Climate Change, Observer Research Foundation, New Delhi, India (September 2009)
 - Other Panelists
 - *Rajan Gupta*, Senior Scientist and Laboratory Fellow, Los Alamos National Laboratory
 - *V Raghuraman*, Former Principal Advisor, Confederation of Indian Industries & Principal Advisor Jaguar Overseas Limited
- “Intergenerational Dialogue: Resolutions for the Major Global Challenges”, Closing Plenary Session at the Global Economic Symposium 2009, Pleon, Germany (September 2009)
 - Other Panelists
 - *Hans-Paul Buerkner*, President and CEO, Boston Consulting Group, Germany
 - *Mehmet Simsek*, Minister of Finance, Turkey
 - *Siwei Cheng*, President, Association for Soft Science Studies of China
 - *Haruhiko Kuroda*, President and Chairperson, Board of Directors, Asian Development Bank
- “CCS Projects and Investments: Update on the International Landscape”, The Senate Energy and Natural Resources Committee, US Senate, Washington DC (April 2009)
 - Other Panelists
 - *Tom Kerr*, Senior Energy Analyst, International Energy Agency
 - *Drew Clarke*, Deputy Secretary, Australian Department of Resources and Energy
- “Business Models for Carbon Capture and Storage”, PESD Annual Meeting on *Reconciling Carbon and Energy Security*, Stanford University (October 2008)
 - Other Panelists
 - *Chris Hobson*, Senior Vice President, Research & Environmental Affairs, Southern Company
 - *Jonathan Briggs*, CEO, Hydrogen Energy