

# Narasimha D. Rao

Asst. Professor of Energy Systems  
School of Forestry and Environmental Studies  
Yale University  
195 Prospect St, New Haven CT 06511

www.decentlivingenergy.org  
www.iiasa.ac.at/rao-narasimha  
nr Rao@yale.edu  
+1 (203) 436 1692

## EXPERTISE

Energy and poverty, Empirical Economics, Climate Policy, Income inequality

## EDUCATION

- 2011 PhD, Stanford University, Environment and Resources
- 1996 M.Sc, Massachusetts Institute of Technology, Technology and Policy
- 1996 M.Sc, Massachusetts Institute of Technology, Electrical Engineering & Computer Science
- 1991 B.A, Dartmouth College, Engineering with Computer Science

## PROFESSIONAL APPOINTMENTS

- 2019 – present Senior Research Scholar, International Institute for Applied Systems Analysis (IIASA)
- 2014 – 2018 Project Leader, IIASA, Energy Program, Laxenburg, Austria
- 2016-present Adjunct Fellow, Ashoka Trust for Research in Ecology & Environment, Bangalore, India
- 2011 – 2014 Postdoc/Research Scholar, IIASA, Energy Program, Laxenburg, Austria
- 2002 – 2006 Visiting Faculty, Indian Institute of Management, Center for Public Policy, Bangalore, India
- 1998 – 2002 Senior Associate, Tabors Caramanis & Associates, Cambridge, USA
- 1996 – 1998 Consultant, Arthur D. Little, Power Systems Group, Cambridge, USA

## ONGOING RESEARCH LEADERSHIP

- 2015-19 Decent living energy: energy and emissions thresholds for providing decent living standards to all. European Research Council (ERC) Starting Grant award.

## PUBLICATIONS

### Refereed Journal Articles

- 2019 Mastrucci, A., E. Byers, S. Pachauri, **ND Rao**, Improving the SDG energy poverty targets: residential cooling needs in the Global South. *Energy and Buildings*. [doi](#)
- 2019 **Rao, ND**, M. Poblete-Cazanave, R. Bhalerao, KF Davis, S. Parkinson, Spatial analysis of energy needs and GHG emissions of food grains in India. *Science for Total Environment* 654(1):841-849. [doi](#)

- 2018 Parkinson, S; Krey, V; Huppmann, D; Kahil, T; McCollum, DaDavid; Fricko, O; Byers, E; Gidden, M; Mayor, B; Khan, Z; Raptis, C; **Rao, ND**; Johnson, N; Wada, Y; Djilali, N; Riahi, K, Balancing clean water-climate change mitigation trade-offs. *Environmental Research Letters*.
- 2018 **Rao, ND**, P. Sauer, M. Gidden, K. Riahi, Income inequality projections for the Shared Socioeconomic Pathways, *Futures*. [doi](#)
- 2018 DeFries, R., K. Davis, **ND Rao**, et al. Assessment of opportunities to reduce iron-deficient anemia from coarse cereals in the Indian diet, *Food and Nutrition Bulletin*. [doi](#)
- 2018 Mastrucci, A., **ND Rao**, Bridging the Indian housing gap: Lowering costs and CO<sub>2</sub> emissions, *Building Research & Information*. [doi](#)
- 2018 McCollum, D, W Zhou, C Bertram, HS de Boer, V Bosetti, S Busch, J Despres, L Drouet, J Emmerling, M Fay, O Fricko, S Fujimori, M Gidden, M Harmsen, D Huppmann, G Iyer, V Krey, E Kriegler, C Nicolas8, S Pachauri, S Parkinson, M Poblete-Cazenave, P Rafaj, **ND Rao**, J Rozenberg, A Schmitz, W Schoepp, D van Vuuren, K Riahi. Energy investment needs for fulfilling the Paris Agreement and achieving the Sustainable Development Goals. *Nature Energy*. [doi](#)
- 2018 Dubash, N; R. Khosla; **ND Rao**; A. Bhardwaj. India's energy and emissions future: An interpretive analysis of model scenarios, *Environment Research Letters* 13(7) 074018. [doi](#)
- 2018 Pachauri, S., **ND Rao**, C. Cameron, Outlook for modern cooking energy access in Central America, *PLOS One*. [doi](#)
- 2018 Grübler, A, C Wilson, N Bento, B Boza-Kiss, V Krey, D McCollum, **ND. Rao**, K Riahi, J Rogelj, S De Stercke, J Cullen, S Frank, O Fricko, F Guo, M Gidden, P Havlík, D Huppmann, G Kiesewetter, P Rafaj, W Schoepp, H Valin. A Low Energy Sustainable Development Scenario for 1.5°C target without Negative Emission Technologies. *Nature Energy*. [doi](#)
- 2018 Byers, E., M. Gidden, P. Burek, K. Ebi, P. Greve, P. Havlik, A. Hillers, N. Johnson, T. Kahil, V. Krey, S. Langan, D. Leclère, N. Nakicenovic, R. Novak, M. Obersteiner, S. Pachauri, A. Palazzo, S. Parkinson, **ND Rao**, J. Rogelj, Y. Satoh, Y. Wada, B. Willaarts, K. Riahi, Global exposure and vulnerability to multi-sector development and climate change hotspots. *Environmental Research Letters* 13 055012. [doi](#)
- 2018 Creutzig, F, J. Roy, WF Lamb, IML Azevedo, WB de Bruin, H Dalkmann, OY Edelenbosch, FW Geels, A Grübler, C Hepburn, E Hertwich, R Khosla, L Mattauch, JC Minx, A Ramakrishnan, **ND Rao**, J Steinberger, M Tavoni, D Ürges-Vorsatz, EU Weber. Towards demand-side solutions for mitigating climate change. *Nature Climate Change* 8(4):268-271. [doi](#)
- 2018 **Rao, ND.**, J. Min, R. DeFries, SH Ghosh, H. Valin, J. Fanzo. Healthy, affordable and climate-friendly diets in India. *Global Environmental Change*, 49: 154-165. [doi](#)
- 2018 **Rao, ND**, J. Min. Less global inequality can improve climate outcomes. *WTREs Climate Change*. 10.1002/wcc.513 [doi](#)
- 2017 **Rao, ND**, B.V Ruijven, K. Riahi, V. Bosetti. Improving poverty and inequality modeling in climate research. *Nature Climate Change*. 7(12), 857-862. [doi](#)
- 2017 Min, J., **ND Rao**. Estimating uncertainty in household energy footprints, *J. of Industrial Ecology*. [doi](#)
- 2017 Mastrucci A & **Rao ND**. Decent housing in the developing world: Reducing life-cycle energy requirements. *Energy and Buildings* 152, 629-642. [doi](#)

- 2017 **Rao, ND**, J. Min. Decent living standards: material requirements for basic human wellbeing. *Social Indicators Research*, 1-20. [doi](#)
- 2017 Longe, OM., **ND Rao**, F. Omowole, AS Oluwalami, OT Oni. A case study of off-grid microgrid for universal electricity access in the eastern Cape of South Africa *International Journal of Energy Engineering*. 7(2): 55-63. [doi](#)
- 2017 **Rao, ND**, K. Ummel. White goods for white people? Drivers of electric appliance growth in emerging economies. *Energy Research and Social Science* 27. [doi](#)
- 2017 Steckel J., **ND Rao**, M. Jakob, Infrastructure access: global trends and drivers, *Utilities Policy* 45,109-117. [doi](#)
- 2017 **Rao, ND**, S. Pachauri. Energy access and living standards: Some observations on recent trends. *Environmental Research Letters*, 12 (2), 025011. [doi](#).
- 2016 Parkinson S, Johnson N, **Rao ND**, Jones B, van Vliet M, Fricko O, Djilali N, Riahi K, et al. Climate and human development impacts on municipal water demand: A spatially-explicit global modeling framework. *Environmental Modelling & Software*, 85. pp. 266-278. [doi](#)
- 2016 Fuss S., C. Chen, M. Jakob, A. Marxen, **ND Rao**, O. Edenhofer, Could resource rents finance universal access to infrastructure? A first exploration of needs and rents. *Environment and Development Economics* (21)6, 691-712. [doi](#)
- 2016 Jakob, M., C. Chen, S. Fuss, A. Marxen, **ND Rao**, O. Edenhofer, Carbon Pricing Revenues Could Close Infrastructure Access Gaps, *World Development*. [doi](#)
- 2016 Cameron, C., S. Pachauri, **ND Rao**, D. Mccollum, J. Rogelj, K. Riahi, Policy trade-offs between climate mitigation and clean cook-stove access in South Asia. *Nature Energy*. Volume 1. [doi](#)
- 2016 Groh, S., S. Pachauri, **ND Rao**. What are we measuring? An empirical analysis of household electricity access metrics in rural Bangladesh. *Energy for Sustainable Development*, (30) 21:31. [doi](#)
- 2015 Lamb, W., **ND Rao**. Human development in a climate constrained world: what the past says about the future, *Global Environmental Change*, 33, 14-22 [.doi](#)
- 2014 **Rao, ND**, K. Riahi, A. Grubler. Climate Impacts of Poverty Eradication, *Nature Climate Change* 4, 749–751 [doi](#)
- 2014 Mainali, B., S. Pachauri, **ND Rao**, S. Silveira. Assessing rural energy sustainability in developing countries. accepted to *Energy for Sustainable Development*, (19) 15:28. [doi](#)
- 2013 **Rao, ND**. Distributional impacts of climate change mitigation in Indian Electricity: the influence of governance. *Energy Policy*, (61) 1344:1356. [doi](#)
- 2013 **Rao, ND**. Does (better) electricity supply boost household enterprise income in India? *Energy Policy*, (57) 532:541. [doi](#)
- 2013 **Rao, ND**. International and intranational equity in burden-sharing agreements for climate change mitigation. *International Environmental Agreements: Politics, Law and Diplomacy*, 14(2) 129:146. [doi](#)
- 2013 Pachauri, S., **ND. Rao**. Gender impacts and determinants of energy poverty: are we asking the right questions? *Current Opinions on Environmental Sustainability*, 5(2):205-215. [doi](#)
- 2012 **Rao, ND**. Kerosene subsidies: when energy policy fails as social policy. *Energy for Sustainable Development*, 16 (1) 35-43. [doi](#)
- 2012 **Rao, ND.**, P. Baer, Decent living emissions: a conceptual framework. *Sustainability* 4 (4), 656-681. [doi](#)

- 2009 Khanna, M, **ND Rao**. Electricity supply and demand in developing countries. *Annual Review of Resource Economics* (1), 567-595. [doi](#)
- 2008 Dubash, NK, **ND Rao**. Regulatory practice and politics: Lessons from independent regulation in Indian electricity. *Utilities Policy* (16), 321-331. [doi](#)
- 2000 **Rao, ND**, R. Tabors, Transmission markets: stretching the rules for fun and profit. *Electricity Journal*, 13(5), 20-29. [doi](#)

### Manuscripts in Review

**Rao, ND**, J. Min, Mastrucci, A. Energy for Development: a bottom-up approach.

### Policy Reports

- 2016 **ND Rao**, A. Agarwal, D. Wood. The effects of small scale electricity systems on rural communities in South Asia. World Resources Institute, Washington D.C.
- 2015 **ND Rao**, D. McCollum, NK Dubash, R.Khosla. Development and climate policy synergies: insights from global modeling studies, Policy brief, Center for Policy Research, Climate Initiative, New Delhi.
- 2015 Dubash, NK, R.Khosla, **ND Rao**, R.Sharma. Informing India's energy and climate debate: policy lessons from modelling studies. Center for Policy Research, Climate Initiative, New Delhi.
- 2012 Pachauri, S., **ND Rao**, Y. Nagai and K. Riahi. Access to modern energy: assessment and outlook for developing and emerging regions. IIASA, Laxenburg, Austria
- 2009 **Rao ND**., G. Sant, S.C. Rajan. An overview of Indian energy trends: low carbon growth and development challenges. Prayas Energy Group
- 2005 **Rao, ND**. Capacity planning in Maharashtra using integrated resource planning (IRP) principles. Greenpeace India
- 2004 **Rao, ND**, S. Gupta. Regulatory framework for infrastructure. India Resident Mission Policy Brief No. 8, Asian Development Bank

### Books

- 2007 Dubash, NK, **ND Rao**. The practice and politics of regulation: regulatory governance in Indian electricity, Macmillan, New Delhi, India.

### Book Chapters

- 2011 **Rao, ND**. Climate change and equity: different metrics and views. In *A Handbook on Climate Change and India*, Oxford University Press, New Delhi, India.
- 2011 **Rao, ND**. Carbon tax vs. cap and trade. In *Encyclopedia of Climate and Weather*, Oxford University Press, New York, USA
- 2011 **Rao, ND**. Developing countries: India. In *Encyclopedia of Climate and Weather*, Oxford University Press, New York, USA
- 2006 **Rao, ND**. Power sector development. In *Karnataka Development Report 2007*, Planning Commission of India, New Delhi, India

### Book Reviews

- 2014 Electrifying India: Political economy of regional development, by Sunila S. Kale, *Journal of Development Studies*, 50(10), 1464-1465

- 2006 Privatization in India, by T.T. Ram Mohan, *The Book Review*, 30(4), 23-24
- 2004 Governing Power, by SL Rao, *Journal of Social and Economic Development*, 6 (1), 137-139.

### Op Eds

- 2013 **Rao, ND**, N. Sreekumar. Not fully empowered, yet. *Hindu Business Line*, Jul 31. [link](#)
- 2010 **Rao, ND**. India and climate change: if actions could speak louder than words. Center for the Advanced Study of India. University of Pennsylvania. [link](#)
- 2009 **Rao ND**, G. Sant, S.C. Rajan. Climate change: an equity question. *Frontline*, 26 (25) Dec 05-18. [link](#)
- 2007 Dubash, NK., **ND. Rao**. From technocracy to democracy? *The Hindu*. Aug 3. [link](#)
- 2004 **Rao, ND**. Consumer involvement a must. *The Hindu*. Apr 26. [link](#)
- 2003 **Rao, ND**. Balancing economic efficiency and equity. *The Hindu*. Jul 21. [link](#)

### REVIEWER ACTIVITIES

Journals: *Climate Policy, Climatic Change, Climate and Development, Ecological Economics, Energy Economics, Energy Policy, Energy for Sustainable Development, Energy Research and Social Sciences, Environmental Values, Current Opinions on Environmental Sustainability, Environment and Development Economics, Global Environmental Change, International Environmental Agreements, Nature, Nature Climate Change, Nature Communications, Nature Energy, Nature Sustainability, Proceedings National Academy of Sciences, Policy Sciences, Regional Environmental Change, Renewable Energy and Sustainability.*

### AWARDS AND HONORS

- 2014 European Research Council (ERC) Starting Grant Recipient.
- 2011 Amulya KN Reddy Prize, Best Paper, *Energy for Sustainable Development*.
- 2010 Centennial Teaching Assistant Award, Stanford University.
- 1996 Alfred Keil Fellowship for the Wiser Uses of Science and Technology, Massachusetts Institute of Technology.

### GRANTS

- 2015-18 European Research Council Starting Grant, Decent Living Energy: energy and emissions thresholds for providing decent living standards to all. €869,000.
- 2012-14 Co-Principal Investigator. Aspen Network of Development Entrepreneurs (ANDE), Spillover benefits of rural energy enterprises in India. \$120,000.
- 2007-10 Philip and Jennifer Arnold Satre Doctoral Fellowship, Stanford University.
- 2006 Co-Principal Investigator. UK Foreign and Commonwealth Office. An assessment of accountability and good governance in the electricity sector. UK 36,611.

### POLICY ENGAGEMENT

- 2018 Presenter and participant, Roundtable on Reimagining PDS: from food to nutrition security, Indian School of Business, Hyderabad, India, February 2018

- 2017 Presenter, policy forum on Decent Living Energy in India: at Center for Policy Research, New Delhi, India, January 2017
- 2015 Co-organizer, policy forum on Indian climate policy with Center for Policy Research, New Delhi, April.
- 2013 Participant in the panel discussions at the High Level Meeting on Energy and the post-2015 Development Agenda. Oslo, Norway. April 9.
- 2012 Panel member, Session on future directions. Equity and Climate Change Workshop, Belgium-Sweden Governments, Brussels, November.
- 2009 Briefed US Senate Staff and stakeholders on Indian energy and climate policy.
- 2005 Provided written testimony on behalf of the Government of India in an International Arbitration involving a Power Purchase Agreement.
- 2004-6 Organized and facilitated workshops between government agencies, civil society and academics on the Electricity Act 2003, and the Greater Bangalore Water and Sanitation Project (GBWASP) in India.

### **SELECT SCIENTIFIC CONFERENCES**

- 2018 Keynote Speaker, Decent Living emissions pathways: Using Input-Output to quantify human well-being?, International Input-Output Association (IIOA), June 26, Juis de Fora, Brazil
- 2018 Panelist, Can interdisciplinarity push disruptive junctures beyond business-as-usual reassembly, Political Ecology Network (POLLEN), June 22, Oslo, Norway.
- 2018 Speaker, Decent Living Standards for All: Energy needs and climate impacts, Gordon Society Conference (GRC) On Industrial Ecology, May 20, Les Diablerets, Switzerland
- 2017 Speaker, Decent housing energy requirements using lifecycle analysis, Sino-Europa Resources Forum, Exploring linkages of Sustainability Challenges, U. of Denmark
- 2017 Co-author, Applying LCA to estimate development energy needs: The cases of India and Brazil, Lifecycle Management (LCM) Conference, Luxembourg.
- 2017 Co-author, Explaining income inequality: an integrated approach, Society for the study of Economic Inequality (ECINEQ) conference, New York City.
- 2017 Panel presenter, Climate mitigation and development, ATREE@20, Ashoka Trust for Ecology and Environment 20<sup>th</sup> year anniversary, Bangalore, India.
- 2017 Panel speaker, How much energy do we need? Girish Santh Memorial, Pune, India.
- 2016 Panel speaker, The Great Debate, 'Is global economic growth compatible with a habitable climate', European Geophysics Union, Vienna, Austria.
- 2015 Panel speaker, Inequality and climate change, European Alpbach Forum, Austria.
- 2015 Keynote speaker, Visions of development, Our Common Future under Climate Change, Paris, France.
- 2015 Paper presentation, Energy-centered view of climate justice, Our Common Future under Climate Change, Paris, France.
- 2015 Paper presentation, Interaction of climate and development policy, Our Common Future under Climate Change, Paris, France.
- 2015 Co-authored paper presentation, Human development in a climate-constrained world, European Ecological Economics Conference, Leeds, UK.

- 2015 Panel speaker, Climate and development, Global Climate Policy Conference, New Delhi.
- 2015 Poverty and Climate Change Conference, World Bank, Washington DC, USA.
- 2013 Paper presenter, Development beyond Basic Needs: Decarbonization and the Material Basis for Decent Living. *Transformation in a Changing Climate*. Oslo University, Oslo, Norway.
- 2012 Paper presenter, Decent living emissions: an application to BASIC countries. *International Conference on Inequality and Sustainability*. Stockholm Environmental Institute, Medford, USA.
- 2012 Paper presenter, Does (better) electricity supply boost household enterprise income? *International Association for Energy Economists (IAEE)*. Perth, Australia.
- 2009 Paper presenter, Per capita emissions entitlements – justice in implementation. *International Scientific Congress on Climate Change*. Copenhagen, Denmark.

### INVITED SYMPOSIA

- 2013 DISCCRS VIII Symposium (Dissertation Initiative for the Advancement of Climate Change Research): *National Science Foundation* program to foster inter-disciplinary research and peer interactions in climate change research. Colorado, US.
- 2010 EXIOPOL Summer school: Environmental Accounting: Externality Evaluation and Input-Output Tools for Policy Analysis. European Commission, Venice, Italy.

### TEACHING EXPERIENCE

- 2012 Guest lecturer. Energy access, development, and climate ethics. International School for Energy Systems. Seon, Germany, Sept 4-8.
- 2010 Teaching assistant. Environmental ethics. Stanford University.
- 2009 Course development assistant. Political economy of energy. Stanford University.
- 2007 Teaching assistant. Climate change in the 21<sup>st</sup> century. Stanford University.
- 2002-06 Visiting Faculty, Center for Public Policy, Indian Institute of Management, Bangalore. Course instructor for Privatization and Competition in Utilities; Technology, Infrastructure and Market Reforms. Taught courses to post graduate students, civil servants and in executive programs.

### INSTITUTIONAL SERVICE & LEADERSHIP

- 2015,18 Elected member, Internal Research Committee (IRC), IIASA
- 2014 Deputy Chair, Committee on Diversity and Building a Positive Work Environment
- 2014 Member, Staff Association Committee
- 2012 Chair, Poster Review Committee. IIASA conference: From Science to Policy
- 2010 Co-founder and Coordinator, Environmental Norms Workshop, Stanford University.