

NATHAN E. HULTMAN

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Associate Professor, School of Public Policy
University of Maryland

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AREAS OF EXPERTISE

United States climate and energy policy; International climate policy; National climate target setting and assessment; Low-carbon energy technologies; Comparative energy policy.

HISTORY OF EMPLOYMENT

University of Maryland

Founding Director, Center for Global Sustainability (2016-)
Associate Professor, School of Public Policy (2012-)*
Assistant Professor, School of Public Policy (2008-12)
Dep. Assoc. Director for Energy & Climate Change (2014-16)
Assistant Professor, School of Foreign Service (2003-2007)
Consultant (2003, 2011-2012)
Research Assistant, Env. Energy Tech. Division (2000)
Graduate Research Assistant (1996)

White House Council on Env Quality
Georgetown University
World Bank
Lawrence Berkeley National Laboratory
NASA Goddard Space Flight Center

*on leave 2014 -2016

EDUCATION

Ph.D. University of California, Berkeley Energy & Resources (2003)
M.S. University of California, Berkeley Energy & Resources (1999)
B.A. Carleton College Physics (1996), *magna cum laude*, conc. Environment & Technology Studies

AWARDS

2012 **Best Comparative International Paper** Assn. of Public Policy Analysis and Mgmt., & International Comparative Analysis Forum, for “Factors in Low-Carbon Energy Transformations: Comparing Nuclear and Bioenergy in Brazil, Sweden, & the U.S.”
1996 **Lawrence McKinley Gould Prize in Natural Science, Carleton College**

PUBLICATIONS IN ACADEMIC JOURNALS

- Hsu, A., N. Höhne, T. Kuramochi, M. Roelfsema, A. Weinfurter, Y. Xie, K. Lütkehermöller, S. Chan, J. Corfee-Morlot, P. Drost, P. Faria, A. Gardiner, D.J. Gordon, T. Hale, N.E. Hultman, J. Moorhead, S. Reuvers, J. Setzer, N. Singh, C. Weber, O. Widerberg (2018). A research roadmap for quantifying non-state and subnational climate mitigation action. *Nature Climate Change* 9:11-17.
- Iyer, G., K. Calvin, L. Clarke, J. Edmonds, N. Hultman, C. Hartin, H. McJeon, J. Aldy, B. Pizer (2018). “Implications of sustainable development considerations for comparability across NDCs” *Nature Climate Change* 8:124-129.
- Malone, E.L., N.E. Hultman, K. Anderson, V. Romeiro. Stories about ourselves: How national narratives influence the diffusion of large-scale energy technologies. *Energy Research & Social Science* 31:70-76. doi:10.1016/j.erss.2017.05.035
- Koomey, J.G., N.E. Hultman, and A. Grübler (2017). A reply to “Historical construction costs of global nuclear power reactors”. *Energy Policy* 102:640-643. doi:10.1016/j.enpol.2016.03.052
- Iyer, G.C., L.E. Clarke, J.A. Edmonds, N.E. Hultman, Do national-level policies to promote low-carbon technology deployment pay off for the investor countries? (2016). *Energy Policy* 98:400-411. doi:10.1016/j.enpol.2016.08.017
- Dutta, V., P. Dasgupta, N.E. Hultman, G. Gadag (2016). Evaluating expert opinion on India's climate policy: opportunities and barriers to low-carbon inclusive growth. *Climate and Development* doi: 10.1080/17565529.2015.1067181

- Fawcett, A.A., G.C. Iyer, L.E. Clarke, J.A. Edmonds, N.E. Hultman, H.C. McJeon, J. Rogelj, R. Schuler, J. Alsalam, G.R. Asrar, J. Creason, M. Jeong, J. McFarland, A. Mundra, W. Shi (2015). Can Paris Pledges Avert Severe Climate Change? *Science* 350(6265):1168-1169 doi: 10.1126/science.aad5761
- Iyer, G.C., J.A. Edmonds, L.E. Clarke, G.R. Asrar, N.E. Hultman, M. Jeong, A. Mundra, W. Shi, J. Alsalam, J. Creason, A.A. Fawcett, J. McFarland, H.C. McJeon (2015). The contribution of Paris to limit global warming to 2°C. *Environmental Research Letters*. 10(125002). doi: 10.1088/1748-9326/10/12/125002
- Iyer, G.C., L.E. Clarke, J.A. Edmonds, B.P. Flannery, N.E. Hultman, H.C. McJeon, D.G. Victor (2015), Improved Representation of Investment Decisions in Integrated Assessment Models, *Nature Climate Change*. 5(36-440) doi:10.1038/nclimate2553
- Iyer, G.C., N.E. Hultman, J. Eom, H. McJeon, P. Patel, L. Clarke (2015). "Diffusion of low-carbon technologies and the feasibility of long-term climate targets." *Technological Forecasting and Social Change*. DOI: 10.1016/j.techfore.2013.08.025
- Iyer, G.C., L. E. Clarke, J. A. Edmonds, N. E. Hultman, and H. C. McJeon (2015), Long-term payoffs of near-term low-carbon deployment policies, *Energy Policy*, 86, 493-505, doi:10.1016/j.enpol.2015.08.004.
- Iyer, G.C., N.E. Hultman, S. Fetter, S.H. Kim (2014). Implications of small modular reactors for climate change mitigation. *Energy Economics* 45: 144-154. DOI: 10.1016/j.eneco.2014.06.023
- Hultman, N.E. and Koomey, J.G. (2013). "Three Mile Island: The driver of US nuclear power's decline?" *Bulletin of the Atomic Scientists*. 69(3) 63-70. doi: 10.1177/0096340213485949.
- Hultman, N.E., E.L. Malone, E.L., P. Runci, G. Carlock, K. Anderson (2012). "Factors in low-carbon energy transformations: Comparing nuclear and bioenergy in Brazil, Sweden, and the U.S." *Energy Policy* 40:131-146. doi:10.1016/j.enpol.2011.08.064
- Hultman, N.E., E. Sulle, C. Ramig, S. Sykora-Bodie (2012). "Biofuels Investments in Tanzania: Policy Options for Sustainable Business Models." *Journal of Environment & Development* 21(3) 339-361.
- Hultman, N.E., S. Pulver, R. Deshmukh, L. Guimarães, and J. Kane (2012). "Carbon market risks and rewards: Firm perceptions of CDM investment decisions in Brazil and India." *Energy Policy* 40: 90-102.
- Hultman, N.E., D. Rebois, M. Scholten, C. Ramig (2011). "The greenhouse gas footprint of unconventional gas for electricity generation" *Environmental Research Letters* 6(04408): 1-9. doi:10.1088/1748-9326/6/4/044008.
- Hultman, N.E., S. Pulver, S. Pacca, S. Saran, L. Powell, V. Romeiro, T. Benney (2011). "Carbon Markets and Low-carbon Investment in Emerging Economies: Experiences with CDM in Brazil and India" *Energy Policy*, 39: 6698-6700. DOI: 10.1016/j.enpol.2011.08.006.
- Hultman, N.E. (2011). "The Political Economy of Nuclear Energy." *Wiley Interdisciplinary Reviews: Climate Change* 2(3) 397-411. DOI 10.1002/wcc.113
- Hultman, N.E., Hassenzahl, D.M., and Rayner, S. "Climate Risk" (2010). *Annual Reviews of Environment and Resources*, 35: 283-303.
- Pulver, S., N.E. Hultman, and L. Guimaraes. "The CDM, carbon markets, and environmental entrepreneurship in Brazil's sugar sector." (2010). *Climate and Development* 2: 248-262.
- Bozmoski, A. and N.E. Hultman (2010). "Carbon-forestry in Rural Tanzania: Local & Institutional Perceptions of Risk & Benefit in Pursuit of CDM Approval." *Journal of Environment and Development* 19: 4-27.
- Hultman, N.E., Emily Boyd, J. Timmons Roberts, John Cole, Esteve Corbera, Johannes Ebeling, Katrina Brown, and Diana M. Liverman (2009), "How can the Clean Development Mechanism better contribute to sustainable development?" *Ambio* 38(2): 120-122.
- Boyd, E., N.E. Hultman, J.T. Roberts, E. Corbera, J. Cole, A. Bozmoski, J. Ebeling, R. Tippman, K. Brown, D.M. Liverman (2009). "Reforming the Clean Development Mechanism for Sustainable Development: Lessons learned and future prospects." *Environmental Science & Policy* 12(3): 820-831.
- Hultman, N.E. (2007) "Can the world wean itself from fossil fuels?" (Invited). *Current History* Nov: 376-383. Reprinted in A. Bennett and G. Shambaugh, Eds. (2010) *Taking Sides: Clashing Views in American Foreign Policy*. 5th Ed. London: McGraw-Hill.
- Hultman, N.E. and J.G. Koomey (2007). "The risk of surprise in energy technology costs." *Env. Research Letters* 2 (034002): 1-6.
- Koomey, J.G. and N.E. Hultman (2007). "A Reactor-level analysis of busbar costs for U.S. nuclear plants, 1970-2005." *Energy Policy* 35(11): 5630-5642. doi:10.1016/j.enpol.2007.06.005.

- Hultman, N.E., J.G. Koomey, and D.M. Kammen (2007). "What history can teach us about the future costs of nuclear power." *Env. Science & Technology*, 41(7): 2088-2093.
- Hultman, N.E. (2007). "Science and society: To advocate or arbitrate? A review of *The Honest Broker: Making Sense of Science in Policy and Politics*." *Science* 317: 900-901.
- Hultman, N.E. (2006). "Geographic Diversification of Carbon Risk: A Methodology for Assessing Carbon Investments using Eddy Correlation Measurements." *Global Environmental Change* 16: 58-72.
- Hultman, N.E. and A.S. Bozmoski (2006). "The Changing Face of Normal Disaster: Risk, Resilience, and Natural Security in a Changing Climate." *Journal of International Affairs*, 59 (2): 25-41.
- Law, B.E., A.H. Goldstein, P.M. Anthoni, M.H. Unsworth, J.A. Panek, M.R. Bauer, J.M. Fracheboud, N.E. Hultman. (2001) "CO₂ and water vapor exchange by young and old ponderosa pine ecosystems during a drought year." *Tree Physiology*, 21, 299-308.
- Baer, P., J. Harte, B. Haya, A.V. Herzog, J. Holdren, N.E. Hultman, D.M. Kammen, R.B. Norgaard, and L. Raymond (2000). "Climate change: Equity and greenhouse gas responsibility." *Science* 289 (5488): 2287.
- Goldstein, A.H., N.E. Hultman, J.M. Fracheboud, M.R. Bauer, J.A. Panek, M. Xu, Y. Qi, A.B. Guenther, W. Baugh (2000). Effects of climate variability on the carbon dioxide, water, and sensible heat fluxes above a ponderosa pine plantation in the Sierra Nevada (CA), *Agricultural and Forest Meteorology* 101(2-3):113-129.
- Bauer, M.R., J.A. Panek, N.E. Hultman, and A.H. Goldstein (2000) "Ozone deposition to a ponderosa pine plantation in the Sierra Nevada Mountains (CA): a comparison of two different climatic years." *J. Geophys. Res.*, 105(D17): 22123-22136.

OTHER PUBLICATIONS AND PAPERS (SELECTED)

- Hultman, N, K. Calhoun, P. Bodnar, K. Kennedy, M. Manion, P. Hansel, T. Crys, K. Igusky, C. Bowman, J. DeWeese, A. Sen, J. Lou, K. Chen, J.Y. Akopian, S. Russell, N. Keohane, D. Francis, D. Ribeiro, W. Berg, S. Smarripas, S. Vaidyanathan, P. Kiely, C. Jiang, M. Brownstein, M. Watson, J. Peress, D. Lyon, Mulligan, T. Clevenger, J. Thwaites, H. Hull, A. Benn, E. Franconi, E.J. Klock-McCook, M. Liebman, W. Krawczyk, J. Frech, F. Sanchez, A. Prada, A. Clapper, L. Cervantes Valdivieso, Z. Abdullah, I. van der Vlugt, J. Crowe, E. Waggoner, G. Stevens, M. Gordon, E. Messer, N. Veilleux, J. Koo. (2018). *Fulfilling America's Pledge: How States, Cities and Businesses are Leading the United States to a Low-Carbon Future*. The America's Pledge Initiative on Climate with the University of Maryland Center for Global Sustainability, Rocky Mountain Institute, World Resources Institute, Environmental Defense Fund, American Council on an Energy Efficient Economy, CDP, and the Cadmus Group. 281 pp., available at www.americaspledgeonclimate.com/fulfilling-americas-pledge/
- West, T. O., N. P. Gurwick, M. E. Brown, R. Duren, S. Mooney, K. Paustian, E. McGlynn, E. L. Malone, A. Rosenblatt, N. Hultman, and I. B. Ocko, 2018: Chapter 18: Carbon cycle science in support of decision making. In *Second State of the Carbon Cycle Report (SOCCR2): A Sustained Assessment Report* [Cavallaro, N., G. Shrestha, R. Birdsey, M. A. Mayes, R. G. Najjar, S. C. Reed, P. Romero-Lankao, and Z. Zhu (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 728-759, <https://doi.org/10.7930/SOCCR2.2018.Ch18>.
- Cui, R.Y., N Hultman, H. McJeon, L. He, A. Sen, K. Surana, X. Tan, S. Kennedy. The State of Global Coal Power: Proposed New Capacity and Power Sector Decarbonization (2018). Technical report (48 pp.), website, Summary for Policy Makers (19 pp.), and Fact Sheet, available at CGS StateOfGlobalCoal.org.
- Hultman, N. and Edmonds, J. (2018). Scenarios to model long term climate strategies can help focus action today." UN Development Programme/WRI Long-Term Climate Strategies Expert Perspectives; pp. 100-105.
- Binsted, M., N. Hultman, W. Hanson, A. Miller, T. St. Clair (2017). "Climate Change Risk and the Maryland State Retirement and Pension System." Center for Global Sustainability Report, 49 pp.
- Hultman, N.E., T. McGarvey, M. Binsted, C. Bowman, L. He, P. Sapatnekar, J. Stillwell, W. Hanson, L. Jin (2016). Delivering on Paris: Accelerating Ambition beyond 2025 through Improved Global NDC Practice. Poster presented at Oxford 1.5 Degrees Conference (invited), Environmental Change Institute, Oxford UK.
- Hultman, N.E., Jacobson, A., N. Lam, T. Bond, N. Hultman. (2013). "Black Carbon and Kerosene Lighting: An Opportunity for Rapid Action on Climate Change and Clean Energy for Development." Washington DC: The Brookings Institution, Global Economy and Development, *Global Views* 2013-03, 13 pp.
- Hultman, N.E., K. Sierra, J. Eis, and A. Shapiro (2012). "Green Growth Innovation: New Pathways for International Cooperation" Washington DC: The Brookings Institution, 65 pp.

Ebinger, C., N.E. Hultman, K. Massy, G. Avasarala, D. Rebois (2011). "Options for low-carbon development in the countries of the Gulf Cooperation Council." Energy Security Initiative Policy Brief 11-02, The Brookings Institution, Washington D.C., 29 pp.

COMMENTARY AND PUBLIC ENGAGEMENT (SELECTED)

Hultman, N. and P. Bodnar. "U.S. government is refusing to disclose climate information." *The Hill*, 28 Oct 2018.

Hultman, N. and P. Bodnar. "Trump isn't reporting CO₂ emissions, ending an era of global transparency." *The Hill*, 18 Jan 2018.

Hultman, N.E., Commentaries, podcasts, videos on Climate and Energy published by The Brookings Institution: IPCC 1.5 report (2018), Series on Trump and energy/climate change (2016-), Marrakech climate conference (2016), SDGs and signing of Paris Agreement (2016); Series on COP19 Warsaw, Nov 2013; Doha Climate Conference, Dec 2012; Series on Rio+20 Conference, June 2012; Series on Durban Climate Conference, Dec 2011; "Revisiting the Gulf of Mexico Oil Spill" Apr 2011; "Japan's Fukushima disaster slows plans for nuclear renaissance" (Podcast) April 2011; "Fukushima and the global 'Nuclear Renaissance'" Mar 2011; Series on The Cancun Climate Conference (Dec 2010); "Beyond Petroleum: The broader effects of the Deepwater Horizon oil spill" Aug 2010; "International climate governance: Will redefining 'insiders' enable global progress?" Apr 2010; "Five Years of Kyoto." Feb 2010; "Copenhagen Focus" series of 9 commentaries on COP-15, Dec 2009;

Hultman, N. and A. Miller, "Climate Change A Risk to Maryland's Pension System." Op-Ed, *Annapolis Daily Record*, 30 Nov 2017.

Hultman, N.E. (2016). "The Pivotal Role of the Next U.S. Administration in Delivering Global Climate Action." Advice to the Next Administration Series, Brookings Institution, Washington DC.

INVITED LECTURES AND OTHER INVITED PRESENTATIONS (SELECTED)

2018: Invited lecture, Harvard University, Radcliffe Institute for Advanced Study **2017:** Invited lecture, MIT Energy Initiative **2016:** Keynote Speaker, World Bank Treasury Annual Meeting; Keynote Speaker, EPA Forestry and Agriculture GHG Modeling Forum; Invited lecture, London School of Economics; Invited lecture, US DOE - US EPA Energy Horizons series. **2013 and earlier:** Global Green Growth Summit, Seoul; University of São Paulo Center on Carbon Policy & Regulation; Georgetown University - Qatar; Center for Global Development: UN Conference on Sustainable Development (Rio+20); World Bank and Inter-American Development Bank; Korea Foundation Global Seminar; Observer Research Foundation, New Delhi; COP16 Cancun; University of São Paulo Institute for Advanced Studies; Doha Carbon & Energy Forum; University of Bahrain / US Department of State East-West Cultural Dialogue; COP15 Copenhagen; The Atlantic Council; British Embassy: US Agency for International Development.

INTERNATIONAL POLICY MEETINGS

U.N. Framework Convention on Climate Change

United States Delegation: 21st Conference of Parties, Paris (2015). COP20 Lima (2014).

Non-Governmental: COP24 Katowice (2018). COP23 Fiji/Bonn (2017), COP22 Marrakesh (2016), SBSTA Bonn 2016, COP19 Warsaw (2013), COP18 Doha (2012), COP17 Durban (2011), COP16 Cancun (2010), COP15 Copenhagen (2009), Subsidiary Body for Scientific and Technological Advice (SBSTA) Bonn (2007), COP7 Marrakesh (2001), COP6 The Hague (2000), COP4 Buenos Aires (1998), COP3 Kyoto (1997).

U.N. Conference on Sustainable Development: *Non-Governmental.* Rio+20 meeting, Rio de Janeiro (2012)

COURSES TAUGHT

University of Maryland: Energy Policy (PUAF 699); Climate Science and Policy (PUAF 798); Global Environmental Problems (PUAF 741); Practicing Public Policy (PUAF 688); Cross-examining Climate Change
Georgetown University: Climate Science and Policy (STIA 412); The Future of World Energy (STIA 458); Quantitative Methods for Policy (STIA 108); Science and Technology in the Global Arena (STIA 305); Science, Nature, and Environmental Values (INAF 100)

PROFESSIONAL SERVICE (SELECTED)

Legislative Testimony and other Direct Input to Policy Discussions:

State of Maryland General Assembly: 22 Feb 2018 (Invited), "Testimony on House Bill 993: Maryland Pension Climate Change Risk Act," Appropriations Comm; 11 Jan 2018 (Invited), "Trump Administration's proposed repeal of the Clean Power Plan" (joint hearing with Office of AG); Senate Finance Comm & House Economic Matters Comm, "Solar PV and RPS policy in Maryland: Evaluating the Rationale for increased support." 16 Feb 2010; Senate Finance Comm, SB 1067 "Task Force on Solar Hot Water Systems in Prince George's County." 23 Mar 2010; Joint Comm on IT & Biotechnology, "Clean Energy Innovation: International Experience and Lessons for Maryland." 07 Oct 2009.
United Nations General Assembly: "Science, Technology, & Innovation for Development" ECOSOC 2012.

Reviewer: Academic Journals: *Science, Global Env. Change; Nature Climate Change; Energy Policy; Climate Policy, Env. Sci. & Tech.; Ecol. Econ.; Accounting, Organizations, & Society; J. of Env. & Dev.; J. of Greenhouse Gas Measurement & Mgmt.; Atmosphere; Policy Studies J.; The Geog. J.; Env. Sciences; Rev. of Policy Res.; Envt. & Planning C; Afr. J. of Env. Sci. & Tech.; Georgetown J. of Intl. Affairs.* **Academic Presses:** Cambridge Univ. Press; Routledge Press; Earthscan Press; **Funding Agencies:** National Science Foundation; AAAS India-US Science & Technology Forum. **International Organizations:** Intergovernmental Panel on Climate Change (AR5); World Bank.

Intergovernmental Panel on Climate Change. Contributing Author: Fifth Assessment Report; Special Report on Renewable Energy

Media. TV: BBC World Service, PBS NewsHour, CNN, C-SPAN Washington Journal, Bloomberg, Al Jazeera, Marketplace, Fox Business, NHK Japan, German Television News. **Radio:** BBC, Bloomberg, Diane Rehm (NPR), Kojo Nnamdi (NPR), Deutsche Welle. **Print:** *New York Times, Financial Times, Washington Post, Economist Intelligence Unit, Los Angeles Times, Science, WIRED, Neue Zürcher Zeitung, Xinghua, Exame (Brazil), Correio Braziliense (Brasilia), Al-Riyadh (Saudi Arabia), Sankei Shimbun (Japan), Auckland Herald, Washington Observer, Washington Times.*

Ph.D. Dissertations Advised

Chair

Sha Yu, 2017. Heterogeneity and Mitigation Potential of the Chinese Buildings Sector
Minji Jeong, 2017. National Renewable Energy Policy in a Global World
Ryna Cui, 2016. Risks to Food Availability and Access from Climate Policies (co-Chair)
Gokul Iyer, 2015. Low-carbon Technologies and Climate Change Mitigation Policy in an Imperfect World
Halley Aelion, 2013. Environmental Stewardship in the Private Sector: Arriving at a Green Hands Theory
Dissertation Committee: A. Birky, M. Borowitz, F. de la Chesnaye, C. Delhotal, D. Karetnikov, M. Gillenwater (Princeton), P. Hannam (Princeton), L. Liu, H. McJeon, J. Nurmis, V. Romeiro (University of Sao Paulo), J. Wayland, J. Zhu