Ren Orans

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ENERGY AND ENVIRONMENTAL ECONOMICS, INC. San Francisco, CA
Managing Partner

Dr. Orans founded Energy and Environmental Economics, Inc. (E3) in 1989. An economist and engineer, he has focused throughout his career on the challenges facing the electricity industry. He is a trusted advisor to a broad range of clients that have included government agencies, utilities, system operators, regulators, independent power producers, energy technology companies, public interest organizations, and investors. He has led E3 teams on numerous high-impact and high-profile projects that have required both rigorous technical analysis and the ability to effectively distill actionable insights to help E3's clients make informed decisions as they develop innovative projects, programs, or policies.

Dr. Orans' pioneering work in utility planning has centered on the design and use of area and time-specific (ATS) marginal costs for both pricing and evaluation of grid infrastructure alternatives. This seminal work has led to detailed area costing applications in pricing, marketing, and planning for many utilities throughout North America. He is an expert in designing wholesale transmission tariffs and has served as an expert witness in regulatory proceedings on retail rate design and wholesale transmission pricing, including for Canada's three largest utilities: BC Hydro, TransEnergie, and Ontario Power Generation.

In a recent forward-looking study, Dr. Orans provided his expertise to California's energy and environmental regulators in evaluating the operational challenges, feasibility, and cost consequences of a higher Renewables Portfolio Standard (RPS) in California by 2030.[1] This assessment included technical input from the California Independent System Operator (CAISO) as well as independent reviews from a distinguished four-member advisory panel and utilized E3's best-in-class Renewable Energy Flexibility (REFLEX) model. Additionally, in consultation with advisors to California's Governor and principals and staff from the energy agencies and the CAISO, Dr. Orans and E3 staff developed a set of technology deployment scenarios that meet California's goal of reducing greenhouse gas (GHG) emissions to 80 percent below 1990 levels by 2050.[2] This analysis leveraged E3's California PATHWAYS model, an economy-wide, infrastructure-based GHG and cost analysis tool that captures interactions among the buildings, industry, transportation, and electricity sectors in a low-carbon future.

Dr. Orans has also guided E3's national deep decarbonization analysis, most notably in the influential report *Pathways to Deep Decarbonization in the United States*.[3] Co-authored with Lawrence Berkeley National Laboratory (LBNL) and Pacific Northwest National Laboratory (PNNL), its principal finding is that multiple pathways exist to achieving deep decarbonization by midcentury at manageable cost. The report was published for the Deep Decarbonization Pathways Project (DDPP), an initiative led by the United Nations Sustainable Development Solutions Network (SDSN) and the Institute for Sustainable

[1] https://www.ethree.com/projects/modeling-californias-50-percent-renewables-portfolio-standard/
[2] https://ethree.com/public_projects/energy_principals_study.php
[3] http://unsdsn.org/wp-content/uploads/2014/09/US_DDPP_Report_Final.pdf

Development and International Relations (IDDRI) to explore how countries can transform their energy systems by 2050 to achieve needed greenhouse gas reductions.

Dr. Orans is a respected thought leader who is often asked to share his expertise and vision for the energy industry. He regularly publishes in refereed journals and has taught a graduate course on electric utility planning at Stanford University. He received his Ph.D. in Civil Engineering from Stanford University and his B.A. in Economics from the University of California at Berkeley.

DEPARTMENT OF ENERGY Washington, DC
NATIONAL RENEWABLE ENERGY LABORATORY 1992 – 1993
ELECTRIC POWER RESEARCH INSTITUTE
Lead Consultant

Dr. Orans developed new models to evaluate small-scale generation and DSM placed optimally in utility transmission and distribution systems.

PACIFIC GAS & ELECTRIC COMPANY San Francisco, CA
Research and Development Department 1989 – 1991

Dr. Orans developed an economic evaluation method for distributed generation alternatives. The new approach shows that targeted, circuit-specific, localized generation packages or targeted DSM can in some cases be less costly than larger generation alternatives. He also developed the evaluation methodology that led to PG&E's installation of a 500kW photovoltaic (PV) facility at their Kerman substation. This is the only PV plant ever designed to defer the need for distribution capacity.

ELECTRIC POWER RESEARCH INSTITUTE Palo Alto, CA
Consultant 1988 – 1992

Dr. Orans developed the first formal economic model capable of integrating DSM into a transmission and distribution plan; the case study plan was used by PG&E for a $16 million pilot project that was featured on national television**.**

DEPARTMENT OF ENERGY Washington, DC
Lead Consultant 1989 – 1990

Dr. Orans was the lead consultant on a cooperative research and development project with the People's Republic of China. The final product was a book on lessons learned from electric utility costing and planning in the United States.

PACIFIC GAS & ELECTRIC COMPANY San Francisco, CA
Corporate Planning Department 1989 – 1992

Dr. Orans was the lead consultant on a joint EPRI and PG&E research project to develop geographic differences in PG&E's cost-of-service for use in the evaluation of capital projects. Developed shared savings DSM incentive mechanisms for utilities in California**.**

PACIFIC GAS & ELECTRIC COMPANY San Francisco, CA
Rate Department Economist 1981 – 1985

As an economist at PG&E, Dr. Orans was responsible for the technical quality of testimony for all electric rate design filings. He was also responsible for research on customers' behavioral response to conservation and load management programs. The research led to the design and implementation of the first and largest residential time-of-use program in California and a variety of innovative pricing and DSM programs.

Education

Stanford University Palo Alto, CA
Ph.D., Civil Engineering

Stanford University Palo Alto, CA
M.S., Civil Engineering

University of California Berkeley, CA
B.A., Economics

Citizenship

United States

Refereed Papers

1. *Orans, R., F. Kahrl, and D. Aas (2017) "Envisioning the Electric Utility in 2030: 'Fat' or 'Skinny'?" Public Utility Fortnightly, March 2017.*

2. *Li, M., R. Orans, J. Kahn-Lang and C.K. Woo (2014) "Are Residential Customers Price-responsive to an Inclining Block Rate? Evidence from British Columbia, Canada," The Electricity Journal, 27(1), 85-92.*

3. *Orans, R., A. Olson, J. Moore, J. Hargreaves, R. Jones, G. Kwok, F. Kahrl and C.K. Woo (2013) "Energy Imbalance Market Benefits in the West: A Case Study of PacifiCorp and CAISO," The Electricity Journal, 26(5), 26-36.*

4. *Woo, C.K., I. Horowitz, B. Horii, R. Orans, and J. Zarnikau (2012) "Blowing in the wind: Vanishing payoffs of a tolling agreement for natural-gas-fired generation of electricity in Texas," The Energy Journal, 33:1, 207-229.*

5. *Mahone, A., B. Haley, R. Orans, J. Williams (2011) "Electric Vehicles and Gas-Fired Power: A Strategic Approach to Mitigating Rate Increases and Greenhouse Price Risk," Public Utilities Fortnightly (Dec 2011) 42-50, available at: http://www.fortnightly.com/exclusive.cfm?o_id=918*

6. *Alagappan, L., R. Orans, and C.K. Woo (2011) "What Drives Renewable Energy Development?" Energy Policy, 39: 5099-5104.*

7. *R. Orans, F. Pearl, A. Mahone (2010) "A Modest Proposal: After Cap and Trade," Brookings Institute.*

8. *Orans, R., C.K. Woo, B. Horii, M. Chait and A. DeBenedictis (2010) "Electricity Pricing for Conservation and Load Shifting," Electricity Journal, 23:3, 7-14.*

9. *Olson A., R. Orans, D. Allen, J. Moore, and C.K. Woo (2009) "Renewable Portfolio Standards, Greenhouse Gas Reduction, and Long-line Transmission Investments in the WECC," Electricity Journal, 22:9, 38-46*

10. *Orans, R., M. King, C.K. Woo and W. Morrow (2009) "Inclining for the Climate: GHG Reduction via Residential Electricity Ratemaking," Public Utilities Fortnightly, 147:5, 40-45.*

11. *Woo, C.K., E. Kollman, R. Orans, S. Price and B. Horii (2008) "Now that California Has AMI, What Can the State Do with It?" Energy Policy, 36, 1366-74.*

12. *Orans, R., S. Price, J. Williams, C.K. Woo and J. Moore (2007) "A Northern California - British Columbia Partnership for Renewable Energy" Energy Policy, 35:8, 3979-3983.*

13. *Lusztig, C., P. Feldberg, R. Orans and A. Olson (2006) "A Survey of Transmission Tariffs in North America," Energy - The International Journal, 31, 1017-1039.*

14. *Woo, C.K., A. Olson and R. Orans (2004) "Benchmarking the Price Reasonableness of an Electricity Tolling Agreement," Electricity Journal, 17:5, 65-75.*

15. *Orans, R., Woo, C.K., Clayton, W. (2004) "Benchmarking the Price Reasonableness of a Long-Term Electricity Contract," Energy Law Journal, 25: 2, 357-383.*

16. *Orans, R., Olson, A., Opatrny, C. (2003) "Market Power Mitigation and Energy Limited Resources," Electricity Journal, 16:2, 20-31.*

17. *Woo, C.K., D. Lloyd-Zannetti, R. Orans, B. Horii and G. Heffner (1995) "Marginal Capacity Costs of Electricity Distribution and Demand for Distributed Generation," The Energy Journal, 16:2, 111-130.*

18. *Pupp, R., C.K. Woo, R. Orans, B. Horii, and G. Heffner (1995) "Load Research and Integrated Local T&D Planning," Energy - The International Journal, 20:2, 89-94.*

19. *Chow, R.F., Horii, B., Orans, R. et. al. (1995) "Local Integrated Resource Planning of a Large Load Supply System," Canadian Electrical Association.*

20. *Feinstein, C., Orans, R. (1995) "The Distributed Utility Concept," The Annual Energy Review.*

21. *Woo, C.K., R. Orans, B. Horii and P. Chow (1995) "Pareto-Superior Time-of-Use Rate Options for Industrial Firms," Economics Letters, 49, 267-272.*

22. *Woo, C.K., B. Hobbs, Orans, R. Pupp and B. Horii (1994) "Emission Costs, Customer Bypass and Efficient Pricing of Electricity," Energy Journal, 15:3, 43-54.*

23. *Orans, R., C.K. Woo, R. Pupp and I. Horowitz (1994) "Demand Side Management and Electric Power Exchange," Resource and Energy Economics, 16, 243-254.*

24. *Woo, C.K., R. Orans, B. Horii, R. Pupp and G. Heffner (1994) "Area- and Time-Specific Marginal Capacity Costs of Electricity Distribution," Energy - The International Journal, 19:12, 1213-1218.*

25. *Orans, R., C.K. Woo and B. Horii (1994) "Targeting Demand Side Management for Electricity Transmission and Distribution Benefits," Managerial and Decision Economics, 15, 169-175.*

26. *Orans, R., C.K. Woo and R.L. Pupp (1994) "Demand Side Management and Electric Power Exchange," Energy - The International Journal, 19:1, 63-66.*

27. *Orans, R., Seeto, D., and Fairchild, W., (1985) "The Evolution of TOU Rates," Pergamon Press.*

Research Reports

1. *R. Orans, Woo, C.K., L. Alagappan, M. Madrigal, Creating Renewable Energy-Ready Transmission Networks, World Bank, September 2010*

2. *CPUC Staff, Olson, A., Orans. R., 33% Renewables Portfolio Standard Implementation Analysis Preliminary Results, California, June 2009.*

3. *Orans, R., Olson, A., Load-Resource Balance in the Western Interconnection: Towards 2020, Western Electricity Industry Leaders Group, September 2008.*

4. *Orans, R., Olson, A., Integrated Resource Plan for Lower Valley Energy, December 2004.*

5. *Orans, R., Woo C.K., and Olson, A., Stepped Rates Report, prepared for BC Hydro and filed with the BCUC, May 2003.*

6. *Woo, C.K. and R. Orans (1996) Transmission: Spot Price, Reliability Differentiation and Investment, report submitted to Ontario Hydro.*

7. *Orans, R., Woo, C.K., and B. Horii (1995) Impact of Market Structure and Pricing Options on Customers' Bills, Report submitted to B.C. Hydro.*

8. *Horii, B., Orans, R., Woo, C.K. (1994) Marginal Cost Disaggregation Study, Report submitted to PSI Energy.*

9. *Woo, C.K., L. Woo and R. Orans (1995) Rationing and Area-Specific Generation Costs, Report submitted to Pacific Gas and Electric Company.*

10. *Orans, R., Woo, C.K., and C. Greenwell (1994) Designing Profitable Rate Options Using Area- and Time-Specific Costs, Report No. TR-104375, Electric Power Research Institute.*

11. *Singer, J., Orans, R., Energy Efficiency Lending, A Business Opportunity for Fannie Mae, Report submitted to Fannie Mae.*

12. *Orans, R., Feinstein, C., et. al. (1993) Distributed Utility Valuation Study, submitted to the Electric Power Research Institute, the National Renewable Energy Laboratory, and PG&E.*

13. *Orans, R., Pupp, R. (1993) Menomonee Falls Case Study, Submitted to Wisconsin Electric Power Corporation.*

14. *Orans, R. and C.K. Woo (1992) Marginal Cost Disaggregation Study, Report submitted to Wisconsin Electric Power Corporation.*

15. *Orans, R., C.K. Woo, J.N. Swisher, B. Wiersma and B. Horii (1992) Targeting DSM for Transmission and Distribution Benefits: A Case Study of PG&E's Delta District, Report No. TR-100487, Electric Power Research Institute.*

16. *Orans, R., Swisher, J., Duane, T. (1989) Lessons Learned from U.S. Electric Utilities, Prepared for the Department of Energy for the People's Republic of China.*

17. *Orans, R. (1989) Area-Specific Marginal Costing for Electric Utilities: A Case Study of Transmission and Distribution Costs, Ph.D. Thesis, Stanford University.*

18. *Orans, R. (1987) The Risk of Sales Forecasts: Controllable through Indexation and Careful Disaggregation, Submitted to Stanford University and Pacific Gas and Electric Company.*

19. *C.K. Woo and R. Orans (1983) Transferability of Other Utilities' Time of Use Experiments to PG&E's Service Schedule D-7, Pacific Gas and Electric Company Reports filed with the California Public Utilities Commission.*

Conference Papers

1. *Orans, R. (2011) "Getting to 2050, Pathways to Deep Reductions in GHG Emissions," CFA Society Presentation, San Francisco, CA, October 25, 2011.*

2. *Orans, R. (2010) "Renewable Resource Opportunities in the West," Law Seminars International, British Columbia, August 2010.*

3. *Orans, R. (2009) "California's 33% RPS Implementation Plan," Law Seminars International, San Francisco, September 2009.*

4. *Orans, R. (2009) "Comparable Treatment of Resource Options," FERC Technical Conference, Phoenix, AZ, September 2009.*

5. *Orans, R. (2008) "A GHG Compliant World in 2050," Law Seminars International, San Francisco, CA, September 2008.*

6. *Orans, R. (2007) "Gaps in State Energy Policy Coordination: A View from the Cheap Seats," CFEE, Napa, California, September 2007.*

7. *Orans, R. (2004) "Evaluating Generating Resources based on an Equivalent Reliability Methodology," 2nd Annual Resource Planning Symposium, January 2004, Vancouver, Canada.*

8. *Martin, J., Orans, R., Knapp, K. (2000) "DG Economics and Distribution Rate Design," Western Electric Power Institute, Distributed Generation and the Utility Distribution System Conference, Reno, NV, March 22-23, 2000.*

9. *Orans, R. (1997) "Getting the Transmission Prices Right," Facilitating Cross Border Trade, New Mexico.*

10. *Orans, R. (1997) "Deregulation on the Mainland: What is Happening and What is Not," PCEA Conference, Hawaii.*

11. *Swisher, J., Orans, R. (1995) "A New Utility DSM Strategy Using Intensive Campaigns Based on Area Specific Costs," ECEEE 1995 Summer Study.*

12. *Orans, R., Greenwell, C. (1995) "Designing Profitable Rate Options Using Area and Time-Specific Costs," Prepared for EPRI, Annual DSM Review, Dallas, Texas.*

13. *Orans, R. (1995) "Integrated Local Area Planning," Prepared for NELPA and presented in Calgary.*

14. *Orans, R. "Local Area Planning for Profit: Annual Review of Distributed Resource Studies," Prepared for EPRI, Lake George, New York.*

15. *Orans, R., C.K. Woo, B. Horii and R. Pupp (1994) "Estimation and Applications of Area- and Time-Specific Marginal Capacity Costs," Proceedings: 1994 Innovative Electricity Pricing, (February 9-11, Tampa, Florida) Electric Research Power Institute, Report TR-103629, 306-315.*

16. *Heffner, G., R. Orans, C.K. Woo, B. Horii and R. Pupp (1993) "Estimating Area Load and DSM Impact by Customer Class and End-Use," Western Load Research Association Conference, September 22-24, San Diego, California; and Electric Power Research Institute CEED Conference, October 27-29, St. Louis, Missouri.*