

DANILO J. SANTINI

Section Leader
Technology Analysis Section
Center for Transportation Research (CTR)
Energy Systems Division (ES)
Argonne National Laboratory

Educational Background

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| Ph.D. | 1976 | Urban Systems Engineering and Policy Analysis, Northwestern University.
Thesis: Urban Growth and Function in the North Central U.S. |
| M.S. | 1972 | Business and Economics, Illinois Institute of Technology: Major: Urban and Regional Economics, Minor: City and Regional Planning |
| B. ARCH. | 1968 | Architecture, Massachusetts Institute of Technology |

Professional Experience

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| 2003–present | Senior Economist, Energy Systems Division, Argonne National Laboratory |
| 1992–present | Section Leader, Center for Transportation Research, Energy Systems Division, Argonne National Laboratory |
| 1979–1991 | Economist, Energy and Environmental Systems Division/Energy Systems Division, Argonne National Laboratory |

In the late 1990s, Dr. Santini's Technology Assessments section managed a technology assessment of hybrid electric vehicles (HEVs) which also included an evaluation of plug-in hybrid electric vehicles (PHEVs). Simultaneously, Dr. Santini and his staff also participated in a comprehensive multi-stakeholder study of PHEVs managed by the Electric Power Research Institute. Both studies — each of which assumed use of nickel metal hydride batteries — were completed in 2001. Since 2001, Dr. Santini has represented the United States Department of Energy (DOE) Office of FreedomCAR and Vehicle Technologies (OFCVT) as a country expert to an International Energy Agency (IEA) authorized multi-nation information exchange on HEVs and electric vehicles (EVs). This information exchange study – the so called “Annex I” is authorized and managed under the authority of the IEA Hybrid and Electric Vehicles Implementing Agreement (HEV & EV IA). While participating in the IEA HEV & EV IA Annex I, Dr. Santini worked with the support of the Electric Power Research Institute (EPRI) to encourage a start of Phase III of “Annex VII” on HEVs, so long as Annex VII included a task on

PHEVs. In 2004 Annex VII was restarted and Dr. Santini became the U.S. country expert for that Annex, with co-responsibility (with Dr. Mark Duvall of EPRI) for preparation of a chapter of the final study (due end of 2007) addressing PHEVs. In May 2006 Dr. Santini and Dr. Duvall gave presentations at the first DOE OFCVT Workshop on PHEVs. Later in May Dr. Santini testified before the U.S. Congress House Committee on Science Energy Subcommittee Hearing on PHEVs. A joint Argonne and EPRI “update/reevaluation” study of PHEVs — this time using lithium ion battery chemistries — was also begun in 2006, funded by OFCVT, under Dr. Santini’s management. Since the late 1990s Dr. Santini has delivered numerous papers and presentations on various HEV, PHEV and fuel cell vehicle (FCV) topics at conferences, meetings and workshops generally dedicated to the assessment of electric drive technologies. Recently, Dr. Santini had the opportunity to study multi-disciplinary literature on the diffusion of technology and wrote a 2005 report intended to convert knowledge from that area into a better understanding of the recent market successes of HEVs.

Dr. Santini’s interest in the prospects of electric drive technologies arose from prior research on the problem of accomplishing transitions from one major transportation technology to another. Since 1983, Dr. Santini published several analyses of economic problems associated with, and the behavior of the transportation sector during, a transition from one transportation fuel and/or system to another. This work includes examinations of the U.S. economy and transportation system in the 19th and 20th centuries. He has worked on developing and proving theories that involve energy’s role in long-term growth and in short-term fluctuations of the business cycle, with an emphasis on energy’s macroeconomic influence acting through transportation systems. This aspect of Dr. Santini’s research emphasizes the interplay of fuel price shocks, environmental and safety regulation, transportation technology adaptation, and economic growth. After substantially developing his theories in the 1980s, he was successful in anticipating — in conference presentations and papers and in a 1998 journal article — the two major upward movements of world oil prices since 1985. His predictions of coming major oil price increases, which appeared in 1998 and 1999 when oil prices temporarily collapsed, were based on models of the behavior of transportation fuel prices developed from a long historical perspective.

Dr. Santini served as chair of the Alternative Fuels Committee of the National Research Council’s Transportation Research Board from 1996 to 2002. In 2003, he was awarded the title senior economist. In 2006 he was made Member Emeritus of the Alternative Fuels Committee. From 1992 to 2004, Dr. Santini was section leader of the Technology Assessments section within the Center for Transportation Research at Argonne National Laboratory, and he is now leader of the Technology Analysis section. From 2003 to 2006, he was a member of the American Transportation Research Institute’s Research Advisory Committee. Dr. Santini has authored, co-authored, or edited over 150 articles, reports, and conference papers.

A defining feature of research done by the Technology Assessment section was the comprehensiveness of its assessments. Transportation technology assessments that have been conducted range from evaluations of individual vehicle and fuel technology combinations to examinations/projections of costs and emissions of all land motor vehicles and fuels. Under Dr. Santini, section members have conducted full-fuel-cycle analyses of energy use, greenhouse gas emissions, and criteria pollutant emissions. Section members have also compared multiple transportation technologies on a consistent basis. Methods of valuing diverse characteristics of transportation technologies have been developed and implemented. Most of the work in Dr.

Santini's sections has been conducted on behalf of the DOE OFCVT and its predecessors. Although section members conduct research primarily for the DOE, they also have done research occasionally for other government agencies, including the EPA and DOT. Research for industry is also conducted, including two "well-to-tank" full fuel cycle analyses of greenhouse gas emissions for the Global Alternative Propulsion Center (GAPC) of General Motors. In the first, ExxonMobil, BPAmoco, and Shell International participated. The Technology Assessment section's *Greenhouse Gas, Regulated Emissions and Energy Use in Transportation* (GREET) model (adapted for the GAPC study) has become internationally known and respected.

During his tenure as a section leader, Dr. Santini has been an occasional lead author and a contributing author to a number of the publications written by section members. He has performed as an administrator, a leader of a team of investigators, a co-investigator, a guide to investigators, and a scientist conducting his own research.

1983–1984	Lecturer in Microeconomics, University of Illinois, Urban Planning Department (1983), and Lewis University Graduate School of Business (1984)
1974–1979	Assistant Environmental Scientist, Energy and Environmental Systems Division, Argonne National Laboratory

Professional Experience

Dr. Santini's work involved examining public service supply problems related to energy facilities in areas of rapid growth. His previous work involved the evaluation of engineering and economic feasibility of district energy (heating/cooling) systems. Other early work involved spatial analysis of locations of major air polluters and pollution. He developed methods to reduce exposure to air pollution.

1972–1974	Full-time student in Ph.D. program at Northwestern University, Evanston, Illinois
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Methodological background includes econometrics, engineering and economic evaluation techniques, economic and sociological versions of cost-benefit analysis, cost-effectiveness and non-monetary evaluative weighting schemes, and demographic techniques.

1971–1972	Architectural and Structural Draftsman
1970–1972	Full-time graduate student. Illinois Institute of Technology
1970	Teaching Assistant, Illinois Institute of Technology
1968–1970	Physics Teacher, George Washington High School, Charleston, WV
1963–1970	Architectural Designer and Draftsman, summers

Professional Societies

Transportation Research Board

Chair, Alternative Fuels Committee, manager of committee reviews and reviewer of Transportation Research Record manuscripts, 1996–2002

Member, Alternative Fuels Committee, 1990–present

Elected Member Emeritus, 2006.

International Association for Energy Economics

(1985–1986 President, Chicago Chapter, past reviewer for Energy Journal)

U.S. Association for Energy Economics, reviewer of papers

American Economic Association

SAE (Society of Automotive Engineers), reviewer of papers

Air and Waste Management Association

Formerly a member of the American Institute of Certified Planners (membership allowed to lapse)

Former memberships — Western Economic, Regional Science Associations, Atlantic Economic Society

Sigma Xi

Honors

Who's Who in the Midwest (1980s), in the World (recent issues)

Argonne National Laboratory Pacesetter Award, 1995

Graduate Fellowship, Northwestern University

Graduate Scholarship, Illinois Institute of Technology (IIT)

Sigma Iota Epsilon, Management Honorary (IIT)

National Merit Scholar, MIT

One Patent

Community Service

Trustee and Building Committee Member, Friendship United Methodist Church, 1982–1993

Former Assistant Coach, Pony-Colt Baseball, 1980s

Host of German foreign exchange student, 1989–1990

Finance Committee, Faith United Methodist Church, 2002–2003

Profession-Related Service

Member of the Research Advisory Committee,
American Trucking Research Institute, 2003–2006

Publications: Journal Articles and Book Contributions

Santini, D.J., and A.D. Vyas, *Introduction of Hybrid and Diesel Vehicles: Status within the Life Cycle of Technology Adoption*, Transportation Research Record 1941, pp. 18–25 (Dec. 2005).

Larsen, R., M. Wang, D. Santini, M. Mintz, Y. Wu, and A. Vyas, *Might Canadian Oil Sands Promote Hydrogen Production for Transportation? Greenhouse Gas Implications of Oil Sands Recovery and Upgrading*, World Resource Review, 17(2):220–242 (2005).

An, F., and D. Santini, *Mass Impacts on Fuel Economies of Conventional vs. Hybrid Electric Vehicles*, SAE 2004-01-0572, SAE 2004 Transactions — Journal of Fuels and Lubricants, Society of Automotive Engineering (SAE), Warrendale, PA.

An, F., and D. Santini, *Assessing Tank-to-Wheel Efficiencies of Advanced Technology Vehicles*, Journal of Passenger Cars – Mechanical Systems, SAE paper 2003-01-0412.

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Santini, D.J., A.D. Vyas, R. Kumar, and J.L. Anderson, *Comparing Estimates of Fuel Economy Improvement via Fuel-Cell Powertrains*, SAE Transactions, Journal of Engines, 111(3):2395–2404, SAE International, Warrendale, PA (Sept. 2003).

Santini, D.J., A.D. Vyas, J.L. Anderson, and F. An, *Hybridizing with Engine Power Reduction*, Transportation Research Record, 1815:19–26, National Academy of Sciences, Washington, D.C. (Nov. 2002).

Brown, E. (via interviews of D. Santini), *Argonne economist predicts gas price bump and following recession*, Logos, 19(1): 4–8, Argonne National Laboratory, Argonne, IL (summer 2001).

An, F., A. Vyas, J. Anderson, and D. Santini, *Evaluating Commercial and Prototype HEVs*, SAE 2001 Transactions, Journal of Engines, Section 3, 110:769–780, Society of Automotive Engineers, Warrendale, PA (2001).

Santini, D.J., A.D. Vyas, J.L. Anderson, and F. An, *Partnership for a New Generation of Vehicles' Goal: Evaluation of Trade-Offs Along the Path*, Transportation Research Record, 1750:3–12, National Academy of Sciences, Washington, D.C. (Oct. 2001).

Santini, D., P. Patterson, and A.D. Vyas, *Importance of Vehicle Costs, Fuel Prices, and Fuel Efficiency in Hybrid Electric Vehicle Market Success*, Transportation Research Record, 1738: 11–19 (2000).

Wang, M.Q., C. Saricks, and D. Santini, *Greenhouse Gas Emissions of Fuel Ethanol Produced from Corn and Cellulosic Biomass*, Environmental Manager, Magazine of the Air and Waste Management Association (Oct. 1999).

Santini, D., and K. Kurani, ed., *Transportation, Energy and Environment: Policies to Promote Sustainability*, Transportation Research Circular No. 492, Transportation Research Board, National Research Council (Aug. 1999).

Santini, D., and K. Kurani, *Overview*, in Santini, D., and K. Kurani, ed., *Transportation, Energy and Environment: Policies to Promote Sustainability*, Transportation Research Circular No. 492, Transportation Research Board, National Research Council, pp. 1–22 (Aug. 1999).

Santini, D., T. Lipman, and D. Sperling, 1997 Asilomar Conference Summary, in Santini, D., and K. Kurani, ed., *Transportation, Energy and Environment: Policies to Promote Sustainability*, Transportation Research Circular No. 492, Transportation Research Board, National Research Council, pp. 199–271 (Aug. 1999).

Santini, D., *An Assessment of Oil Supply and Its Implications for Future Prices*, *Nonrenewable Resources*, 7(2):101–121 (June 1998).

Tompkins, M., D. Bunch, D. Santini, M. Bradley, A. Vyas, and D. Poyer. *Determinants of Alternative Fuel Vehicle Choice in the Continental United States*, *Transportation Research Record*, 1641:130–138 (1998).

Ng, H.K., J.L. Anderson, and D.J. Santini, *Electric and Hybrid Vehicles: a 25-Year Forecast*, *Automotive Engineering*, 104(2):66–70 (February 1996).

Wang, M.Q., and D.J. Santini, *Monetary Values of Air Pollutant Emissions in Various U.S. Regions*, *Transportation Research Record*, 1475:33–44 (1995).

Santini, D., *Verification of Energy's Role as a Determinant of Economic Activity*, in “Advances in the Economics of Energy and Resources,” Vol. 8, *Energy Prices and Production*, J.R. Moroney, ed., JAI Press, Greenwich, CT, pp. 159–194 (1994).

Santini, D., and J. Anderson, *Some Evidence on Determinants of Fuel Economy as a Function of Driving Cycle and Test Type*, SAE 931804, SAE Transactions (1993).

Santini, D., and J. Anderson, *Determinants of Multiple Measures of Acceleration*, SAE 931805, SAE Transactions (1993).

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Wang, Q., and D.J. Santini, *Magnitude and Value of Electric Vehicle Emission Reductions for Six Driving Cycles in Four U.S. Cities and Varying Air Quality Problems*, *Transportation Research Record*, 1416:33–42 (1993).

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Harrison, W., D.J. Santini, and G. Aubrey, *Assessing the Impacts of Potential Accelerating Sea-Level Rise on Coastal Energy Facilities, U.S.A.*, *International Journal of Energy Environment Economics*, 1(1):63–69 (1991).

Streets, D.G., C.N. Bloyd, G.A. Boyd, D.J. Santini, and T.D. Veselka, *Climate Change and U.S. Energy Policy*, *Energy*, 16(11/12):1437–1466 (1991).

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Santini, D.J., *Interactions among Transportation Fuel Substitution, Vehicle Quantity Growth, and National Economic Growth*, *Transportation Research A*, 23(3):183–207 (May 1989).

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Santini, D.J., *An Econometric Model of Transportation Infrastructure as a Determinant of Intraurban Location*, Journal of Regional Science, 18(1): 73-85 (1978).

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Santini, D.J., and A.D. Vyas, *Suggestions for a New Vehicle Choice Model Simulating Advanced Vehicle Introduction Decisions (AVID): Structure and Coefficients*, Argonne National Laboratory Report ANL/ESD/05-1 (Jan. 2005).

Plotkin, S., D. Santini, A. Vyas, J.L. Anderson, M. Wang, J. He, and D. Bharathan, *Hybrid Electric Vehicle Technology Assessment: Methodology, Analytical Issues, and Interim Results*, Argonne National Laboratory Report ANL/ESD/02-2 (Oct. 2001).

Vyas, A., H.K. Ng, D.J. Santini, and J.L. Anderson, *Electric and Hybrid Electric Vehicles: A Technology Assessment Based on a Two-Stage Delphi Study*, Argonne National Laboratory Report ANL/ESD-36 (Dec. 1997).

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Santini, D.J., and A.D. Vyas, *Theoretical Basis and Parameter Estimates for the Minority Transportation Expenditure Allocation Model (MITRAM)*, Argonne National Laboratory Report ANL/ES-159 (Dec. 1988).

Santini, D.J., *Verification of Energy's Role as a Determinant of U.S. Economic Activity*, Argonne National Laboratory Report ANL/ES-153 (Oct. 1987).

Santini, D.J., *The Petroleum Problem: Managing the Gap*, Argonne National Laboratory Report ANL/CNSV-58 (Aug. 1986).

Santini, D.J., E.A. Tanzman, and C.A. Hotchkiss, *Education and Other Financial Problems of Areas Experiencing Energy-Induced Boom Growth*, Argonne National Laboratory Report ANL/AA-25 (July 1980).

Santini, D.J., and D. Wernette, *Construction Employment Opportunities for Four Oil Replacing Space-Heating Alternatives for Core Areas of Thirteen Major Northeastern and Midwestern Cities*, Argonne National Laboratory Report ANL/CNSV-19 (Aug. 1979).

Santini, D.J., W. Harrison, A. Frigo, C. Kartsounes, S. Labelle, and F. Davis, *District Heating and Cooling Utilizing Temperature Differences of Local Waters: Preliminary Feasibility Study for the Chicago 21, South Loop New Town Development*, Argonne National Laboratory Report ANL/WR-77-1 (May 1977).

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Publications: National Laboratory Technical Memoranda

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Santini, D.J., and E.J. Stenehjem, *An Assessment of the Relative Socioeconomic Effects of Increased Coal Development in the United States*, Argonne National Laboratory Report ANL/EES-TM-75 (Dec. 1979).

Santini, D.J., and D. Wernette, *Construction Employment Opportunities for Four Oil-Replacing Space-Heating Alternatives for Core Areas of Thirteen Major Northeastern and Midwestern Cities*, Argonne National Laboratory Report ANL/CNSV-19 (Aug. 1979).

Santini, D.J., A.A. Davis, and S.M. Marder, *Economic and Technical Analysis of Retrofit to Cogenerating District Energy Systems: North Central Cities*, Argonne National Laboratory Report ANL/CNSV-TM-11 (June 1979).

Santini, D.J., D.W. South, and E.J. Stenehjem, *Evidence of Future Increases in the Impact of Conventional Electric Facilities on Rural Communities*, Argonne National Laboratory Report ANL/EES-TM-52 (May 1979).

Santini, D.J., A.A. Davis, S.M. Marder, and S.S. Bernow, *Analysis of Costs and Scarce Fuel Savings Associated with Nine Eastern and North Central Center City Conversions to a District Energy System*, Argonne National Laboratory Report ANL/CNSV-TM-12 (Feb. 1979).

Kron, N.F. Jr., C.L. Filewicz, V.A. Rable, and D.J. Santini, *A Compendium of Hourly Service and Energy Demand Profiles for Buildings*, Argonne National Laboratory Report ANL/ICES-TM-18 (Nov. 1978).

Baldwin, T.E., L.G. Hill, D.J. Santini, and E.J. Stenehjem, *Economic and Demographic Issues Related to Deployment of the Satellite Power System: (SPS)*, Argonne National Laboratory Report ANL/EES-TM-23 (Oct. 1978).

Hill, L.G., T.L. McNeil, D.J. Santini, and E.J. Stenehjem, *An Analysis of the Likely Economic Effects of Commercialization of Alternative Heat Engines*, Argonne National Laboratory Report ANL/CNSV-TM-9 (Sept. 1978).

Santini, D.J., A.A. Davis, and S.M. Marder, *Feasibility of District Heating of Northern U.S. Cities by Cogeneration*, presented at the First International Conf. on Energy and Community Development, Athens, Greece, Argonne National Laboratory Report ANL/EES-CP-18 (July 1978).

Santini, D.J., E.J. Stenehjem, and P. Meguire, *Methods of Eliminating Potential Socioeconomic Constraints to Near-Term Coal Energy Development*, Argonne National Laboratory Report ANL/EES-TM-47 (April 1978).

Davis, A.A., S.M. Marder, and D.J. Santini, *Costs of Urban Area Retrofit to District Heating and Cooling Systems: North-Central Cities*, Argonne National Laboratory Report ANL/ICES-TM-9 (March 1978).

Davis, A.A., and D.J. Santini, *A Test Case for the Potential Application of District Energy Systems Using Thermal Energy Cogenerated at Existing Electric Power Plants*, Argonne National Laboratory Report ANL/ICES-TM-12 (Jan. 1978).

Santini, D.J., W. Harrison, A. Frigo, C. Kartsounes, S. LaBelle, and F. Davis, *District Heating and Cooling Utilizing Temperature Differences of Local Waters: Preliminary Feasibility Study for the Chicago 21, South Loop New Town Development*, Argonne National Laboratory Report ANL/WR-77-1 (May 1977).

Argonne Contractor Reports

Santini, D., and B. Smith, project managers, *The California Greenhouse Gas Initiative and Its Implications to the Automotive Industry*, prepared by Center for Automotive Research, Ann Arbor, MI, for Argonne National Laboratory, Contractor Report ANL-06/05 (Sept. 2005).

Vyas, A., and D. Santini, *Final Report to Congress on Benefit and Costs of the Clean Air Act, 1970 to 1990*, United States Environmental Protection Agency Report EPA 410-R-97-002, Contributed to On-Highway Emissions Modeling and Analysis, Appendix B, Washington, D.C. (October 1997).

Other Documents

Santini, D., Statement to the U.S. Congress House Committee on Science: Energy Subcommittee, Hearing on Plug-in Hybrid Electric Vehicles, Rayburn Office Building, Washington, D.C. (May 17, 2006).

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Santini, D., *USA Hybrid Electric Vehicle and Electric Vehicle Market Patterns 2000*, contribution to forthcoming IEA Implementing Agreement for Hybrid and Electric Vehicle Technologies and Programmes: Information Exchange IEA Technical Report, produced by NEDO, Tokyo, Japan.

Santini, D., and K. Abdalla, *Report on the United Nations International Roundtable on Transportation Energy Efficiency and Sustainable Development*, undertaken in cooperation with the World Bank. Hosted by the Ministry of Transport, Egypt. Sponsored by the Government of Denmark, Scania, the Organization of Islamic Capitals and Cities, Daimler-Chrysler, and the Arab Contractors. Cairo, Egypt (5–7 December 1999).

Lipman, T., D. Santini, and D. Sperling, *Policies for Fostering Sustainable Transportation Technologies*, conference summary, 14 pp., University of California at Davis Institute of Transportation Studies Report UCD-ITS-RR-98-8, University of California at Davis, Davis, CA (May 1998).

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*Santini, D.J., *Beyond "Sustaining" Health and Safety – North American Long-term Success Stories in Promoting Sustainable Transportation*, Environment 2005 Exhibition and Conference: Transport, Health and Environment, Abu Dhabi, United Arab Emirates (Jan. 29–Feb. 2, 2005).

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An, F., and D. Santini, *Assessing Tank-to-Wheel Efficiencies of Advanced Technology Vehicles*, SAE paper 2003-01-0412.

An, F., D. Santini, and J. Anderson, *Assessing and Modeling Direct Hydrogen and Gasoline Reforming Fuel Cell Vehicles and Their Cold-Start Performance*, SAE paper 2003-01-2252.

Santini, D.J., A.D. Vyas, J. Moore, and F. An, *Comparing Cost Estimates for U.S. Fuel Economy Improvement by Advanced Electric Drive Vehicles*, Proc. of EVS-19: The Answer for Clean Mobility, Busan, Korea, (Oct. 19–23, 2002).

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