Publications That Cite AVERT

Updated April 3, 2024

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Report	National	April 2014	This report evaluates the effects of implementing four energy saving policies (an energy efficiency savings target, national model building codes, combined heat and power systems, and efficiency standards for products/equipment) on reducing emissions from the power sector. They find that nationwide implementation would result in a 26% reduction in CO2 emissions and a 25% decrease in power demand by 2030, relative to 2012. The authors used AVERT to generate these results, and they explain how AVERT analyzes hourly changes in demand based on historical data to project future emissions.	http://climateandenergy.org/resources/ACEEE111droleofefficiency.pdf	Hayes, S., G. Herndon, J.P. Barrett, J. Mauer, M. Molina, M. Neubauer, ... and L. Ungar. 2014. Change is in the air: How states can harness energy efficiency to strengthen the economy and reduce pollution. American Council for an Energy-Efficient Economy. ACEEE: Washington, DC.	American Council for an Energy-Efficient Economy
White paper	National	May 2014	This white paper lays out the environmental benefits of wind energy, using AVERT to calculate state-by-state emission reductions attributed to wind energy in 2013. The analysis concludes that the 167.7 million MWh of wind energy produced in 2013 resulted in 126.8 million tons of CO2 reduction. This paper also details the benefits of wind energy for specific states and regions.	http://awea.files.cms-plus.com/FileDownloads/pdfs/AWEA_Clean_Air_Benefits_WhitePaper%20Final.pdf	American Wind Energy Association. 2014. The clean air benefits of wind energy.	American Wind Energy Association
White paper	National	May 2014	This report explains how increasing solar energy usage will provide numerous benefits, including a decrease in carbon emissions, meeting Clean Air Act requirements, improving grid reliability, reducing water consumption, balancing compliance costs, and creating local jobs. The authors use AVERT to calculate the reductions in CO2, NOx, and SO2 emissions resulting from current solar energy deployment levels for all 10 AVERT regions.	https://www.energy.gov/eere/solar/downloads/cutting-carbon-emissions-under-111d-case-expanding-solar-energy-america	Solar Industries Association. 2014. Cutting carbon emissions under 111(d): The case for expanding solar energy in America.	Solar Energy Industries Association
Comment letter	Great Lakes/Mid-Atlantic (AVERT 2.3 regions)	June 2014	This publication from the Hoosier Environmental Council contains recommendations for energy efficiency and demand-side management in the state of Indiana. The authors use AVERT to demonstrate the SO2, NOx, and CO2 emission reductions of implementing a 1.5% annual energy savings target and a combination of four energy efficiency policy options.	http://www.in.gov/iurc/files/Hoosier_Environmental_Council.pdf	Kharbanda, J., and R.K. Johnson. 2014. Comments of the Hoosier Environmental Council with technical assistance from ACEEE regarding IURC energy efficiency and demand-side management recommendations.	Hoosier Environmental Council, Inc.
Report	Three regions (AVERT 2.3 regions)	December 2014	This report presents EPRI's assessment of AVERT and provides a detailed comparison of analytical results generated by AVERT, EPRI's EE-CO2 tool, and EPA's eGRID for several end-use EE projects implemented in different geographic regions of the country.	http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002004606	Electric Power Research Institute. 2014. A comparative assessment of the U.S. EPA's Avoided Emissions and geneRation Tool (AVERT): Estimating emissions and energy displacement associated with end-use energy efficiency.	Electric Power Research Institute

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Report	Northeast (AVERT 2.3 regions)	April 2015	In response to the Act to Support Solar Energy Development in Maine, the authors of this study assess the value of distributed solar energy generation in Maine as well as several implementation options. The authors used AVERT to estimate the displaced SO2, NOx, and CO2 emissions for 2011–2013, which they used to calculate a net social cost.	http://www.ripuc.org/eventsactions/docket/4568-WED-Ex6-MaineSolarReport(11-23-15).pdf	Maine Public Utilities Commission. 2015. Maine distributed solar valuation study.	Sustainable Energy Advantage, LLC
Published paper	National	August 2015	This article estimates the impact of mechanisms that EPA proposed to regulate carbon emissions from existing sources of noncriteria pollutants—specifically the impact of Building Block 3 of the Clean Power Plan, which sets a target for increasing renewable generation. The authors use AVERT to calculate the emission reductions potential of Building Block 3 for all U.S. states. The authors also provide a detailed description of AVERT's methodology, assumptions, limitations, and how they used AVERT to conduct their analysis.	http://www.sciencedirect.com/science/article/pii/S1040619015001608	Ohler, A.M., and C.L. Ta. 2015. Modeling impacts from EPA's Clean Power Plan and Building Block 3 for renewable energy. The Electricity Journal 28(7): 72-82.	Illinois State University in Normal
Report	National	January 2016	This detailed report and corresponding summary article analyze the historical impacts of aggregated state renewable portfolio standard (RPS) policies, focusing on greenhouse gas emissions, air pollution, and water pollution, with attention also to employment impacts, wholesale electricity market price suppression, and natural gas price suppression. Using AVERT, the authors concluded that new renewable sources used for RPS compliance in 2013 resulted in a 3.6% reduction in total fossil fuel-fired generation.	http://climate-xchange.org/wp-content/uploads/2015/11/Renewable-Energy-Standards-Study.pdf; http://www.sciencedirect.com/science/article/pii/S0301421516303408	Wiser, R., G. Barbose, J. Heeter, T. Mai, L. Bird, M. Bolinger, ... and A. Mills. 2016. A retrospective analysis of the benefits and impacts of U.S. renewable portfolio standards.	Lawrence Berkeley National Laboratory
Published paper	National	February 2016	In this paper, the authors use AVERT to estimate energy savings and emission reductions associated with increasing residential insulation for 665,000 homes built in the United States in 2013. The results show that the increased insulation would result in reductions of 180 GWh of electricity and 840 million SCF of natural gas per year, among other results, leading to annual emission reductions of 470,000 tons of CO2, 1,100,000 pounds of SO2, and 770,000 pounds of NOx.	http://www.sciencedirect.com/science/article/pii/S0360132315301712	Levy, J.I., M.K. Woo, and Y. Tambouret. 2016. Energy savings and emissions reductions associated with increased insulation for new homes in the United States. Building and Environment 9: 72-79.	Boston University
Published paper	National	March 2016	This paper describes a study that used AVERT to simulate emission reduction impacts of increased residential insulation. The authors assess the SO2, NOx, and CO2 emission reductions from electric generating units (EGUs) to find that increasing insulation for all single-family homes in the United States in 2013 would have led to annual reductions of 80 million tons of CO2 from EGUs and other co-benefits, such as preventing 320 premature deaths associated with criteria pollutant emissions.	http://iopscience.iop.org/article/10.1088/1748-9326/11/3/034017/pdf	Levy, J.I., M.K. Woo, S.L. Penn, M. Omary, Y. Tambouret, C.S. Kim, and S. Arunachalam. 2016. Carbon reductions and health co-benefits from U.S. residential energy efficiency measures. Environmental Research Letters 11(3): 034017.	Boston University

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Report	National	May 2016	This study assessed the emissions and water use effects of the U.S. Department of Energy's SunShot Initiative to make solar electricity cost-competitive. The authors modeled solar capacity installed by the end of 2014; used AVERT to estimate emission reductions; and estimated the impact on water withdrawal and consumption based on displaced fossil generation as projected by AVERT. This study included rooftop and utility-scale PV as well as concentrated solar power, which the authors entered into AVERT based on individual plants' hourly generation profiles. The authors used EPA's COBRA tool to calculate corresponding health benefits.	http://eta-publications.lbl.gov/sites/default/files/65628.pdf	Wiser, R., T. Mai, D. Millstein, J. Macknick, A. Carpenter, S. Cohen, W. Cole, B. Frew, and G. Heath. 2016. On the path to SunShot: The environmental and public health benefits of achieving high penetrations of solar energy in the United States. Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory.	Lawrence Berkeley National Laboratory
Report	Texas (AVERT 2.3 regions)	July 2016	This report provides an update from Northeast Texas Air Care on their participation in EPA's Ozone Advance Program, including information about current emission levels and measures and programs that are being implemented or considered to further reduce emissions. The report uses AVERT to estimate NOx emission reductions from one municipality's energy efficiency program: the City of Tyler's ongoing Energy Management and Modernization Program. Estimates include a reduction of NOx by 0.4 tons per year.	https://www.epa.gov/sites/production/files/2016-07/documents/2016_update.pdf	Kemball-Cook, S., and G. Yarwood. 2016. Northeast Texas Air Care Ozone Advance action plan 2016 update.	ENVIRON International Corporation
Student master's project	Southeast (AVERT 2.3 regions)	July 2016	This master's thesis analyzes the effects of adding 1,644 MW of solar PV to the electrical grid in North Carolina. The study concludes that adding this much PV would lead to 2,337,400 MWh of fossil-fueled generation being displaced, thereby decreasing emissions for CO2, NOx, and SO2 by 3.2%, 3.5%, and 3.9%, respectively.	https://repository.lib.ncsu.edu/bitstream/handle/1840.20/33249/etd.pdf?sequence=1&isAllowed=y	Turner, J.E.. 2016. The effect of adding solar photovoltaic electricity generators to the Duke Energy service area in North Carolina on the emissions of fossil fueled generators.	North Carolina State University
Published paper	National	July 2016	This article describes the Emissions Quantification Tool (EQT), a publicly accessible web calculator developed by the Pacific Northwest National Laboratory (PNNL). This screening tool estimates the emissions impacts of a variety of "smart grid" technologies and project types. The EQT uses the AVERT algorithm, and the article explains how AVERT has been integrated, details AVERT's capabilities, and explains its methodology.	https://ieeexplore.ieee.org/abstract/document/7741364/	Studarus, K., T. Hardy, B. Thayer, and R. Pratt. 2016. Quantifying the emissions impacts of smart grid projects with a publically available web calculator. 2016 IEEE Power and Energy Society General Meeting (PESGM).	Pacific Northwest National Laboratory
Report	Northwest	July 2016	The Clark County, Nevada, Department of Air Quality used AVERT for their Ozone Advance Program Progress Report Updates. The DAQ used AVERT to assess changes in NOx emissions from already completed wind and solar projects.	https://www.epa.gov/sites/default/files/2016-07/documents/2016update.pdf	Clark County Department of Air Quality. 2016. Clark County Department of Air Quality Ozone Advance Program Progress Report Update.	Clark County Department of Air Quality

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Published paper	National	August 2016	This paper presents the results of an analysis of the short-term effects of time-based electricity tariffs on consumer and retailer costs and CO2 emissions in Ireland. The authors used the PNNL's EQT, which uses the AVERT algorithm, to model the estimated system load of their consumers under flat-rate and experimental pricing schemes. Although AVERT is designed for use in the contiguous 48 states, the authors attempted to apply the same approach to Ireland by using system load data from Ireland along with a scaling factor.	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2826055	Ata, B., A.S. Duran, and O. Islegen. 2016. An analysis of time-based pricing in electricity supply chains.	University of Chicago
Published paper	National	August 2016	This publication assesses various methods for quantifying emissions from electricity loads, including AVERT. The authors describe AVERT and review its functionality, tractability, and appropriate use. In addition, the authors present a case study quantifying CO2 emission factors for electric vehicle charging using 10 different methods, including AVERT.	http://pubs.acs.org/doi/abs/10.1021/acs.est.5b05216?journalCode=esthag	Ryan, N.A., J.X. Johnson, and G.A. Keoleian. 2016. Comparative assessment of models and methods to calculate grid electricity emissions. Environmental Science and Technology 50(17): 8937-8953.	University of Michigan
Published paper	Great Lakes/Mid-Atlantic, Upper Midwest (AVERT 2.3 regions)	August 2016	This paper presents an analysis of the CO2, NOx, and SO2, emission reductions and corresponding monetary benefits associated with constructing a 300 MW offshore wind farm in Lake Michigan. The authors used AVERT to calculate emission reductions, then used two different approaches to monetize the benefits of these reductions. They present a benefit of $33MWh based on marginal damages of pollution and a benefit of $987/kW based on market prices for pollution allowances. The study compares different locations for the wind farm to examine the impact of siting on generation and corresponding displaced emissions.	http://www.sciencedirect.com/science/article/pii/S0921800916304657	Chiang, A.C., M.R. Moore, J.X. Johnson, and G.A. Keoleian. 2016. Emissions reduction benefits of siting an offshore wind farm: A temporal and spatial analysis of Lake Michigan. Ecological Economics 130: 263-276.	University of Michigan
Report	Southeast (AVERT 2.3 regions)	December 2016	This publication analyzes the emission impacts of increasing electric vehicle usage in North and South Carolina. It considers the net result of avoided gasoline consumption along with added emissions from electric power generation. The authors use AVERT to simulate the added emissions from the increased load due to electric vehicle charging. They find that the reduced tailpipe emissions from the adoption of electric vehicles would offset NOx emissions from increased electricity use, but would not offset the increased emissions of SO2 and CO2 across the AVERT Southeast region.	https://www.advancedenergy.org/wp-content/uploads/2016/12/EV_to_Air-Quality-003.pdf	North Carolina Department of Environmental Quality and South Carolina Energy Office. 2016. Electric vehicles and air quality.	Advanced Energy
Blog post	Northeast (AVERT 2.3 regions)	February 2017	This blog post provides information about communities designated as Clean Energy Communities by the New York State Energy Research and Development Authority (NYSERDA), which signifies that they are taking actions to save energy and money while reducing greenhouse gas emissions. The authors mention a NYSERDA report that uses AVERT to estimate a 254,000 metric ton reduction in greenhouse gas emissions that would result from retrofitting 1.4 million street lights with LEDs—one of several energy-saving measures being considered.	http://courtneystrong.com/2017/02/mid-hudson-region-sweeps-clean-energy-communities-first-designations-ulster-county-city-kingston-village-dobbs-ferry-town-new-castle-recognized-commitment-cut/	Strong, C. 2017. Mid-Hudson region sweeps Clean Energy Communities "first" designations.	Courtney Strong Inc.

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Report	Great Lakes/Mid-Atlantic, Upper Midwest (AVERT 2.3 regions)	May 2017	This publication is an appendix to a report by Focus on Energy that summarizes the economic development impacts of energy efficiency and renewable energy programs in Wisconsin. The authors use AVERT to calculate avoided emissions resulting from Focus on Energy programs, combining this information with the cost of carbon set by the Public Service Commission of Wisconsin to calculate monetized emission reduction benefits on the order of $100 million per year.	https://www.focusonenergy.com/sites/default/files/Wisconsin%20Focus%20on%20Energy%20CY%202016%20Appendices.pdf	Public Service Commission of Wisconsin. 2017. Focus on Energy: Calendar year 2016 evaluation report: Appendices.	Cadmus
Report	Great Lakes/Mid-Atlantic (AVERT 2.3 regions)	June 2017	This report analyzes the potential impacts of the adoption of an opt-out policy for utility-scale energy efficiency programs in Ohio. Such a policy would allow large customers to choose not to participate in or help to fund energy efficiency programs. The authors use AVERT to assess the air pollution effects, estimating the increase in SO2, NOx, and CO2 emissions under scenarios in which opt-outs reduce energy efficiency savings by 20%, 35%, and 45%.	https://www.sciencedirect.com/science/article/pii/S1040619017302440	Baatz, B., G. Relf, and M. Kelly. 2017. Large customer opt-out: An Ohio example.	American Council for an Energy-Efficient Economy
White paper	National	July 2017	This paper reviews and analyzes successful residential retrofit energy efficiency programs nationwide to identify the models and strategies that made them effective. Using AVERT and other tools, the authors calculate emission reductions attributable to direct install retrofits, HVAC replacement and early retirement, and comprehensive whole-home retrofits.	http://escholarship.org/uc/item/18d545f1	Grevatt, J., et al. 2017. Keys to the house: Unlocking residential savings with program models for home energy upgrades.	Energy Futures Group
Published paper	National	August 2017	This article quantifies the monetary benefits of wind and solar energy in the United States from 2007 to 2015. The authors used AVERT to estimate displaced emissions from historical solar and wind power generation, then applied a suite of cost/benefit approaches to find that between 2007 and 2015, wind and solar nationwide displaced enough emissions of CO2, NOx, SO2, and PM2.5 to provide billions of dollars in health- and climate-related benefits. The authors also discuss the economic incentives for these renewable technologies and the impact of cap-and-trade programs on emission benefits.	https://www.nature.com/articles/nenergy2017134.epdf?author_access_token=uYr0473RE7N8qJCivi6eKNRgN0jAjWel9jnR3ZoTv0O9NQQavv-jglBpgJVQy91sl6ZpWXil0zPIZ8H2tvWaSoZi9rrMjTx9l2FLIqAykV00GsKxOpkwjZM1RpGmND_BuVZCRc2dDL42qJnMAq4DGw%3D%3D	Millstein, D., et al. 2017. The climate and air-quality benefits of wind and solar power in the United States.	Lawrence Berkeley National Laboratory
Fact sheet	Northeast (AVERT 2.3 regions)	September 2017	This publication from the Connecticut Green Bank explains the methods this organization uses to assess their programs' effectiveness in improving air quality, specifically reducing emissions of CO2, NOx, and SO2. The report uses AVERT to measure the emission impacts of adding 60 MW of solar PV, wind energy, and energy efficiency savings.	http://www.ctgreenbank.com/wp-content/uploads/2017/10/CGB-Eval-IMPACT-091917-B.pdf	Connecticut Green Bank. 2017. Evaluation framework: Societal performance.	Connecticut Green Bank
News article	National	September 2017	This article summarizes a Sierra Club analysis that estimates the emissions benefits of replacing fossil-fired (predominantly coal) EGUs with renewable sources. The study uses AVERT to estimate the U.S. electric sector emissions reduction that would result from planned and targeted EGU retirements and a tripling of renewable energy installations; it concludes that CO2 emissions would be reduced by at least 500 million metric tons by 2025.	http://www.huffingtonpost.com/entry/analysis-maintaining-pace-of-coal-retirements-faster_us_59bc2625e4b0390a1564dd3c	Hitt., M.A. 2017. Maintaining pace of coal retirements and faster clean energy growth will yield another half billion tons of carbon reduction.	Sierra Club

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Published paper	National	November 2017	This article presents a decision algorithm to help users determine the most appropriate method to estimate CO2 emissions from an electricity load. Among the factors considered are region size, temporal resolution, average or marginal approaches, and time scales. AVERT is one of 32 options presented.	http://onlinelibrary.wiley.com/doi/10.1111/jiec.12708/full	Ryan, N.A., J.X. Johnson, G.A. Keoleian, and G.M. Lewis. 2017. Decision support algorithm for evaluating carbon dioxide emissions from electricity generation in the United States. Journal of Industrial Ecology.	University of Michigan
Published paper	Northeast, Great Lakes/Mid-Atlantic, Southeast (AVERT 2.3 regions)	November 2017	This paper analyzes air quality and public health impacts from PM2.5 emission reductions as a result of replacing 17% of electricity generation with solar PV across the eastern United States. The authors used AVERT to generate this result and to test emission reduction sensitivity, as they compared emission reductions from years between 2007 and 2015 as well as varying amounts of solar integration.	https://www.sciencedirect.com/science/article/pii/S1352231017308105	David, A., T. Holloway, M. Harkey, A. Rrushaj, G. Brinkman, P. Duran, M. Janssen, and P. Denholm. 2017. Potential air quality benefits from increased solar photovoltaic electricity generation in the Eastern United States. Atmospheric Environment.	University of Wisconsin – Madison
Published paper	National	December 2017	This article analyzes the impact of increasing residential insulation on energy consumption and corresponding life-cycle emissions by estimating payback periods for CO2, NOx, and SO2 emissions, as well as emissions associated with insulation manufacturing and transportation. The study uses AVERT to estimate the emission reductions that would result from marginal changes in electricity demand and generation.	https://link.springer.com/article/10.1007/s11367-017-1412-x	Levy, J.I., M.K. Woo, R.D. Tebbens, and Y. Nishioka. 2017. Emission payback periods for increased residential insulation using marginal electricity modeling: A life cycle approach. The International Journal of Life Cycle Assessment.	Boston University
Report	National	February 2018	This study analyzes the health impacts of a hypothetical 15% flat reduction in electricity consumption nationwide. The authors used AVERT to estimate the emission reductions that would result from this scenario, finding annual emission reductions of 11% for PM2.5, 18% for NOx, 23% for SO2, and 14% for CO2. Next, they used COBRA to model health impacts. The publication ranks the states and cities where AVERT indicates change will have the largest positive impact on public health.	https://www.psr.org/wp-content/uploads/2018/04/renewables-report.compressed.pdf	Hayes, S., and C. Kubes. 2018. Saving energy, saving lives.	American Council for an Energy-Efficient Economy
Published paper	California, Southwest, Great Lakes/Mid-Atlantic, and Southeast (AVERT 2.3 regions)	February 2018	This study used the PNNL's EQT along with prototypical distribution feeders to explore the CO2, SO2, and NOx impacts of energy storage deployed with solar PV, where the energy storage system is operated to minimize load variation assuming hourly dispatch. The authors used 2015 AVERT data for the California, Southwest, Great Lakes/Mid-Atlantic, and Southeast regions to estimate emissions implications of PV and energy storage installations at varying levels of penetration.	http://ieeexplore.ieee.org/abstract/document/8274550/?reload=true	Barrett, E., B. Thayer, K. Studarus, and S. Pal. 2017. The varied impacts of energy storage and photovoltaics on fossil fuel emissions. 2017 IEEE Power and Energy Society General Meeting.	Pacific Northwest National Laboratory

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Published paper	Northeast, Great Lakes/Mid-Atlantic, Southeast (AVERT 2.3 regions)	April 2018	This study analyzes the economic value of offshore wind within electricity markets along the U.S. east coast. The authors use AVERT to estimate emissions reductions associated with offshore wind. They also model the reduction in natural gas prices resulting from displaced gas-fired generation suppressing natural gas demand.	https://www.energy.gov/sites/prod/files/2018/04/f50/offshore_erl_lbnl_format_final.pdf	Mills, A.D., D. Millstein, S. Jeong, L. Lavin, R. Wiser, and M. Bolinger. 2018. Estimating the value of offshore wind along the United States' eastern coast.	Lawrence Berkeley National Laboratory
Published paper	Great Lakes/Mid-Atlantic (AVERT 2.3 regions)	May 2018	This paper assesses the optimal siting of wireless charging stations for an electric bus network in terms of life-cycle costs, greenhouse gas emissions, and energy use. The authors used AVERT with the Great Lakes/Mid-Atlantic region to quantify temporal differences in emissions and energy intensities of the electric grid in order to optimize charging siting to minimize emissions.	https://www.sciencedirect.com/science/article/pii/S030626191830789X	Bi, Z., G.A. Keoleian, and T. Ersal. 2018. Wireless charger deployment for an electric bus network: A multi-objective life cycle optimization. Applied Energy 225: 1090-1101.	University of Michigan
Published paper	Great Lakes/Mid-Atlantic (AVERT 2.3 regions)	September 2018	This paper compares life cycle assessment models that use different levels of temporally resolved data and average and marginal electricity generation mixes. The authors used AVERT data in the models that estimate environmental impacts due to marginal emissions. They demonstrate that using dynamic grid data generates more refined estimates of a building's use-phase environmental impact.	https://pubs.acs.org/doi/abs/10.1021/acs.est.7b06535	Collinge, W.O., H.J. Rickenbacker, A.E. Landis, C.L. Thiel, and M.M. Bilec. 2018. Dynamic life cycle assessments of a conventional green building and a net zero energy building: Exploration of static, dynamic, attributional and consequential electricity grid models. Environmental Science and Technology, in press. DOI: 10.1021/acs.est.7b06535	University of Pittsburgh
Dissertation	National	2019	This dissertation contains several analyses of the health benefits of displaced electricity generation. The author uses AVERT in two of these analyses, which are also published as independent papers. See the summaries for: - Abel, D.W., T. Holloway, M. Harkey, A. Rrushaj, G. Brinkman, P. Duran, M. Janssen, and P. Denholm. 2017. Potential air quality benefits from increased solar photovoltaic electricity generation in the eastern United States. Atmospheric Environment. - Abel, D.W., T. Holloway, J. Martínez-Santos, M. Tao, C. Kubes, and S. Hayes. 2019. Air quality-related health benefits of energy efficiency in the United States. Environmental Science & Technology. DOI: 10.1021/acs.est.8b06417	https://www.environment.wisc.edu/sage/docs/profiles/thesis_2206.pdf	Abel, D.W. 2019. Understanding linkages between the power sector, air quality, and human health (doctoral dissertation).	University of Wisconsin – Madison
Report	California (AVERT 2.3 regions)	January 2019	This report is an economic analysis of proposed new performance standards for spray sprinkler bodies (SSB) in California and was conducted for Pacific Gas and Electric Company. The authors used AVERT to analyze avoided emissions associated with the new water efficiency standard for SSB. The total value of avoided SO2, NOx, CO2, and PM2.5 emissions from reduced water use was determined to be $18.7 million in 2029.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227859&DocumentContentId=59233	Evergreen Economics. 2019. Economic impact analysis of the water efficiency standards for spray sprinkler bodies.	Evergreen Economics

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Report	Midwest	April 2019	The Arkansas Department of Environmental Quality, in conjunction with the Regulatory Assistance Project (RAP), developed a concept paper that used AVERT to evaluate the emissions benefits of energy efficiency programs. The paper seeks support from EPA where "Arkansas Public Service Commission's EE rules could be quantified and credited under the Regional Haze program." In the analysis, AVERT was used to predict emissions changes from these programs and to show the spatial distribution of these changes.	https://www.adeq.state.ar.us/air/planning/sip/pdfs/regional-haze/energy-efficiency-rh-pp2-emerge-concept-paper-final-with-cover-letter.pdf	Arkansas Department of Environmental Quality. 2019. Accounting for Energy Efficiency Measures in Regional Haze Planning.	Arkansas Department of Environmental Quality
Published paper	National	June 2019	This paper discusses and quantifies the synergies of the concurrent deployment of four technologies (wireless charging, shared mobility services, autonomous driving, and battery electric vehicles), i.e., a wireless charging and shared autonomous battery electric vehicle (W+SABEV) system. The authors use AVERT to calculate average nighttime and daytime electricity emission intensities in kg CO2 equivalent per kWh. They compare a W+SABEV system with a plug-in charging BEV system only and find that the greenhouse gas payback time is five years or less when the ratio of en-route charging time vs. trip time is greater than or equal to 19%.	https://link.springer.com/article/10.1007/s11027-019-09870-9	Bi, Z., M.A. Reiner, G.A. Keoleian, Y. Zhou, M. Wang, and Z. Lin. 2019. Wireless charging and shared autonomous battery electric vehicles (W+SABEV): Synergies that accelerate sustainable mobility and greenhouse gas emission reduction. Mitig. Adapt. Strateg. Glob. Change. DOI: 10.1007/s11027-019-09870-9	University of Michigan
Report	Northwest	August 2019	The Clark County, Nevada, Department of Air Quality used AVERT for their Ozone Advance Program Progress Report Updates. The DAQ used AVERT to assess changes in NOx emissions from already completed wind and solar projects.	https://www.epa.gov/sites/default/files/2019-08/documents/2019update.pdf	Clark County Department of Air Quality. 2019. Clark County Department of Air Quality Ozone Advance Program Progress Report Update.	Clark County Department of Air Quality
Published paper	National	October 2019	This paper compares the benefits ($) per MWh across the 10 AVERT regions and for three renewable energy (RE) resources: wind energy, utility solar PV, and rooftop solar PV. The authors use AVERT to calculate the emission reductions associated with increasing capacity of each of the three renewable resources by 100, 300, 400, 500, 1,000, 1,500, 2,000, 2,500, and 3,000 MW in each region. For each scenario, they used EASIUR and a $11.2 million value of statistical life to estimate the monetized health benefits of reduced emissions of SO2, NOx, and PM2.5 and used a $41.80/short ton CO2 social cost of carbon to estimate monetized benefits of reduced emissions of CO2. They find that benefits per MWh vary more between regions than they do between RE types, reflecting differences in primary fuel types of EGUs displaced, emissions displaced, and benefits per emission reduction.	https://iopscience.iop.org/article/10.1088/1748-9326/ab49bc/pdf	Buonocore, J.J., E.J. Hughes, D.R. Michanowicz, J. Heo, J.G. Allen, and A. Williams. 2019. Climate and health benefits of increasing renewable energy deployment in the United States. Environmental Research Letters 14(11). DOI: 10.1088/1748-9326/ab49bc	Harvard University

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Published paper	National	October 2019	This paper compares the benefits ($) per MWh across the 10 AVERT regions and for three renewable energy (RE) resources: wind energy, utility solar PV, and rooftop solar PV. The authors use AVERT to calculate the emission reductions associated with increasing capacity of each of the three renewable resources by 100, 300, 400, 500, 1,000, 1,500, 2,000, 2,500, and 3,000 MW in each region. For each scenario, they used EASIUR and a $11.2 million value of statistical life to estimate the monetized health benefits of reduced emissions of SO_2, NO_x, and $PM_{2.5}$ and used a $41.80/short ton CO_2 social cost of carbon to estimate monetized benefits of reduced emissions of CO_2. They find that benefits per MWh vary more between regions than they do between RE types, reflecting differences in primary fuel types of EGUs displaced, emissions displaced, and benefits per emission reduction.	https://iopscience.iop.org/article/10.1088/1748-9326/ab49bc/pdf	Buonocore, J.J., E.J. Hughes, D.R. Michanowicz, J. Heo, J.G. Allen, and A. Williams. 2019. Climate and health benefits of increasing renewable energy deployment in the United States. Environmental Research Letters 14(11). DOI: 10.1088/1748-9326/ab49bc	Harvard University
Book excerpt	National	October 2019	This book chapter addresses pros and cons of wind energy, including reductions to emissions from fossil fuel power plants. The author uses AVERT to calculate the emissions avoided due to electricity generated by wind turbines in 2015 and finds that wind was responsible for 132,000,000 metric tons of avoided CO2 emissions, 176,000 metric tons of avoided SO2 emissions, and 106,000 metric tons of avoided NOx emissions.	https://link.springer.com/chapter/10.1007/978-3-319-75134-4_6	Rao, K.R. 2019. Conservation and efficiency issues in wind energy for power generation. Springer, Cham.	KRRao Consulting
Dissertation	Upper Midwest, Great Lakes/Mid-Atlantic (AVERT 2.3 regions)	2020	This work evaluates in monetary terms the implementation of two energy-saving scenarios. The authors use Illinois as a case study to quantify the potential benefits of energy efficiency on air quality and human health. Using AVERT and COBRA, the authors demonstrate that a 0.2% increase in annual energy efficiency savings will reduce PM2.5 emissions by 8.8 tons and result in $1.2 million to $3.2 million in avoided health impacts.	https://digitalcommons.mtu.edu/cgi/viewcontent.cgi?article=2174&context=etdr	Turegeldin, A. 2020. Linking energy efficiency and public health: A case study of Illinois (master's dissertation).	Michigan Technological University
Published paper	National	2020	In this work, the authors present an end-to-end computational framework for distributed energy resource (DER) modeling, REopt Lite™. They describe the model's purpose and scope, the building blocks of the model, the scaling capabilities of the design, the optimization formulation, and the accessibility of the model. The authors use AVERT's regional hourly emission factors as part of their CO2 analysis.	https://arxiv.org/ftp/arxiv/papers/2008/2008.05873.pdf	Mishra, S., J. Pohl, N. Laws, D. Cutler, T. Kwasnik, W. Becker, A. Zolan, K. Anderson, D. Olis, and E. Elgqvist. 2020. Computational framework for behind-the-meter DER techno-economic modeling and optimization—REopt Lite.	National Renewable Energy Laboratory
Poster	Carolinas	2020	The North Carolina Office of Air Quality commissioned an analysis of different electricity scenarios to inform discussions regarding their Clean Energy Standard update. AVERT was used to model five different energy scenarios and estimate potential emission changes. NOX, SO2, and PM2.5 results were entered into COBRA to quantify health impacts of the energy scenarios. The AVERT Statistical Module was used to retire plants in some scenarios.	https://publicpolicy.unc.edu/wp-content/uploads/sites/107/2020/06/NC-DEQ-Renewable.pdf	Bishop, M., G. Hahn, C. Hardy, J. Litynski, and M. Morrison. 2020. Renewable Energy in North Carolina [Poster presentation].	University of North Carolina at Chapel Hill

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Published paper	Northeast (AVERT 2.3 regions)	March 2020	This paper compares the costs for installing weatherization retrofits, such as air sealing and insulation, both with and without adequate ventilation. The paper quantifies costs associated with decreased electricity use, decreased natural gas use, and health impacts due to changes in indoor and outdoor air quality. The authors use AVERT to estimate the change in emissions of NOx, SO2, and PM2.5 from EGUs in the Northeast region in the summer, winter, and annually under the scenarios considered. They find that the monetized value of resident-level health impacts is of a much higher magnitude than the value of population-level health impacts and energy impacts.	https://www.sciencedirect.com/science/article/abs/pii/S036013231930719X	Underhill, L.J., C.W. Milando, J.I. Levy, W.S. Dols, S.K. Lee, and M.P. Fabian. 2020. Simulation of indoor and outdoor air quality and health impacts following installation of energy-efficient retrofits in a multifamily housing unit. Building and Environment 170. DOI: 10.1016/j.buildenv.2019.106507	Boston University
Published paper	Northeast (AVERT 2.3 regions)	March 2020	This paper compares the costs for installing weatherization retrofits, such as air sealing and insulation, both with and without adequate ventilation. The paper quantifies costs associated with decreased electricity use, decreased natural gas use, and health impacts due to changes in indoor and outdoor air quality. The authors use AVERT to estimate the change in emissions of NO_x, SO_2, and $PM_{2.5}$ from EGUs in the Northeast region in the summer, winter, and annually under the scenarios considered. They find that the monetized value of resident-level health impacts is of a much higher magnitude than the value of population-level health impacts and energy impacts.	https://www.sciencedirect.com/science/article/abs/pii/S036013231930719X	Underhill, L.J., C.W. Milando, J.I. Levy, W.S. Dols, S.K. Lee, and M.P. Fabian. 2020. Simulation of indoor and outdoor air quality and health impacts following installation of energy-efficient retrofits in a multifamily housing unit. Building and Environment 170. DOI: 10.1016/j.buildenv.2019.106507	Boston University
Report	National	March 2020	This U.S. DOE-sponsored report reviews methods for quantifying non-energy impacts of energy efficiency programs, with emphasis on transferability of methods used in various states. The authors estimated health benefits per kWh (BPK) of project/programs/policies by running scenarios in AVERT, then using AVERT outputs as inputs into EPA's COBRA tool.	https://www.osti.gov/biblio/1631673	Sutter, M., J. Mitchell-Jackson, S.R. Schiller, L. Schwartz, and I. Hoffman. 2020. Applying non-energy impacts from other jurisdictions in cost-benefit analyses of energy efficiency programs: Resources for states for utility customer-funded programs.	Lawrence Berkeley National Laboratory
Published paper	National	November 2020	This study estimates the public health impacts of light-duty vehicle electrification, with a focus on the tradeoff between displaced emissions from internal combustion engine vehicles and additional emissions from electric power plants. The authors used AVERT as a primary source of emissions data, which they did by modeling multiple electric vehicle charging scenarios as different load shapes in AVERT. The authors subsequently modeled pollutant concentrations and monetized human health outcomes, with a focus on the 53 largest U.S. metropolitan areas. Results showed that all 53 metropolitan areas could expect to see a net health benefit from vehicle electrification, though the magnitude of the benefit varies widely by location. The authors report these benefits even if all the added electric power generation to charge vehicles comes from fossil fuel-burning units.	https://www.sciencedirect.com/science/article/pii/S016041202031970X	Choma, E.F., J.S. Evans, J.K. Hammitt, J.A. Gómez-Ibáñez, and J.D. Spengler. 2020. Assessing the health impacts of electric vehicles through air pollution in the United States. Environment International 44.	Harvard University

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Report	New York	January 2021	The South Fork Wind Farm and South Fork Export Cable Project Draft Environmental Impact Statement (DEIS) assesses the reasonably foreseeable impacts to physical, biological, socioeconomic, and cultural resources that could result from the construction and installation, operations and maintenance, and conceptual decommissioning of a commercial-scale wind energy project, the South Fork Wind Farm and South Fork Export Cable Project. The authors use AVERT to estimate avoided emissions associated with bringing the proposed project onto the grid.	https://www.boem.gov/sites/default/files/documents/renewable-energy/SFWF-DEIS_0.pdf	U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. 2021. South Fork Wind Farm and South Fork Export Cable Project draft environmental impact statement.	Bureau of Ocean Energy Management, Office of Renewable Energy Programs
Published paper	Mid-Atlantic	February 2021	In this work, the authors present a model framework for considering the feasibility of renewable natural gas projects and apply it to New Jersey, specifically investigating landfills and wastewater treatment plants. The authors use the 2019 regional grid factor for AVERT's Mid-Atlantic region to calculate avoided CO2 emissions.	https://www.mdpi.com/2071-1050/13/4/1618/htm	Dyer, A., A.C. Miller, B. Chandra, J.G. Maza, C. Tran, J. Bates, V. Olivier, and A.R. Tuininga. 2021. The feasibility of renewable natural gas in New Jersey. Sustainability 13(4): 1618. https://doi.org/10.3390/su13041618	PSEG Institute for Sustainability Studies
Published paper	National	June 2021	The authors developed a classification methodology using artificial intelligence and quantum theory to automatically determine whether abandoned areas would be suitable for the settlement of renewable energy-based power plants. The authors use AVERT to determine that the 81,533 points analyzed in their study have an estimated solar generation potential of more than 6,775 GW, which equates to 44,000,000 avoided tons of carbon dioxide emissions.	https://www.scirp.org/journal/paperinformation.aspx?paperid=109647	Franco, D.G.D.B., and M.T.A. Steiner. 2021. Classification of abandoned areas for solar energy projects using artificial intelligence and quantum mechanics. Journal of Geographic Information System 13(3): 318–339. https://doi.org/10.4236/jgis.2021.133018	Universidade Federal do Tocantins
Report series	Multiple regions	July 2021	In these reports prepared for the U.S. Department of Energy, the Pacific Northwest National Laboratory used AVERT in a cost-effectiveness analysis of ASHRAE Standard 90.1-2019, a state energy code, for North Carolina, South Carolina, North Dakota, and West Virginia. The authors used marginal emission factors from AVERT in their analysis.	1) https://www.energycodes.gov/sites/default/files/2021-07/Cost-effectiveness_of_ASHRAE_Standard_90-1-2019-NorthCarolina.pdf 2) https://www.energycodes.gov/sites/default/files/2021-07/Cost-effectiveness_of_ASHRAE_Standard_90-1-2019-SouthCarolina.pdf 3) https://www.energycodes.gov/sites/default/files/2021-07/Cost-effectiveness_of_ASHRAE_Standard_90-1-2019-NorthDakota.pdf 4) https://www.energycodes.gov/sites/default/files/2021-07/Cost-effectiveness_of_ASHRAE_Standard_90-1-2019-WestVirginia.pdf	1) Tyler, M., Y. Xie, E. Poehlman, and M. Rosenberg. 2021. Cost-Effectiveness of ANSI/ASHRAE/IES Standard 90.1-2019 for North Carolina. 2) Tyler, M., Y. Xie, E. Poehlman, and M. Rosenberg. 2021. Cost-Effectiveness of ANSI/ASHRAE/IES Standard 90.1-2019 for South Carolina. 3) Tyler, M., Y. Xie, E. Poehlman, and M. Rosenberg. 2021. Cost-Effectiveness of ANSI/ASHRAE/IES Standard 90.1-2019 for North Dakota. 4) Tyler, M., Y. Xie, E. Poehlman, and M. Rosenberg. 2021. Cost-Effectiveness of ANSI/ASHRAE/IES Standard 90.1-2019 for West Virginia.	Pacific Northwest National Laboratory

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Report	Texas	September 2021	This report is part of a series published by the U.S. Department of Energy and Lawrence Berkeley National Laboratory to inform state and local governments about specific barriers to adopting and implementing Commercial Property Assessed Clean Energy (C-PACE) financing programs. In this report, AVERT is featured as part of a case study. The Texas PACE Authority partnered with the Houston Advanced Resaerch Center (HARC) to create the TX-PACE Energy and Emissions Tracker, which allows stakeholders and the public to see the impact that C-PACE is having in Texas and see which types of outcomes can be measured. HARC uses AVERT to determine emissions reductions.	https://eta-publications.lbl.gov/sites/default/files/cpace-demonstrating-energy-savings.pdf	Leventis, G. and J. Deason. 2021. Practices for demonstrating energy savings from commercial PACE projects. Lawrence Berkeley National Laboratory.	Lawrence Berkeley National Laboratory
Report	Multiple regions	2021	JPMorgan Chase's Sustainable Bond Framework governs its issuance of green, social, and sustainability bonds. JPMorgan Chase allocates an amount equal to the net proceeds of any Green Bond issuance to "Eligible Green Projects." This report documents the impact of funded projects, including the annual estimated tons of CO2e avoided. These calculations were performed using AVERT.	https://www.jpmorganchase.com/content/dam/jpmc/jpmorgan-chase-and-co/documents/green-bond-annual-report-2021.pdf	JPMorgan Chase and Co. 2021. Green Bond Annual Report.	JPMorgan Chase and Co.
Report	New York	February 2022	This report builds on a 2017 report that contained recommendations for effective state policy to combat climate change, improve the lives of working people, strengthen New York State's economy, and build more equitable, resilient communities. This abbreviated report contains one highlighted recommendation per sector; the recommendation for the energy sector contains an estimated emissions reduction for CO2 calculated with AVERT.	https://ecommons.cornell.edu/handle/1813/110948	Skinner, L., M. Shetler, M. Valdivia, A.H. Spaans, and A. Raman. 2022. Climate for change: a climate jobs roadmap for New York City. ILR Worker Institute.	ILR Worker Institute
Report	Southwest	March 2022	This report uses data from a new-construction residential community equipped with rooftop solar and storage in Arizona to analyze the customer electricity cost savings and emissions impacts of rooftop solar and storage. The authors compare emissions impacts of the modeled residential solar plus storage systems using marginal emission factors for grid-purchased electricity from NREL's Cambium data set and from AVERT.	https://www.osti.gov/biblio/1860235	O'Shaughnessy, E., D. Cutler, A. Farthing, E. Elgqvist, J. Maguire, M. Blonsky, X. Li, S. Ericson, S. Jena, and J.J. Cook. 2022. Savings in Action: Lessons from Observed and Modeled Residential Solar Plus Storage Systems. National Renewable Energy Laboratory. NREL/TP-6A20-82103. https://doi.org/10.2172/1860235	National Renewable Energy Laboratory

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Report	National	March 2022	This report presents the findings from an evaluation of the Building Energy Modeling (BEM) program in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, Building Technologies Office. A qualitative analysis was performed for the development of residential building energy efficiency codes and energy efficiency incentive programs, which the BEM program supports. To assess emissions and environmental health impacts, the evaluation calculated avoided emissions by multiplying BEM program energy savings by AVERT emissions factors.	https://www.energy.gov/sites/default/files/2022-07/Evaluation%20of%20Building%20Energy%20Modeling%20Technology%20Research%20and%20Development%20Activities%20for%20Building%20Technologies%20Office.pdf	Owens, M., M. Leh, L. McGuire, T. Michalke, T. Razi, and J. Gubert. 2022. Evaluation of Building Energy Modeling Technology Research and Development Activities for Building Technologies Office. U.S. Department of Energy.	U.S. Department of Energy
Thesis	New York	May 2022	This thesis investigates the energy and carbon savings of minimum energy standards for rental units as well as an assessment of costs to the city of Rochester, New York. To calculate the carbon emission reduction from a minimum energy standard for rentals, the research used a carbon emission rate from AVERT.	https://scholarworks.rit.edu/cgi/viewcontent.cgi?article=12255&context=theses	Stricker, B. 2022. Addressing Energy Efficiency in Rental Units: A Preliminary Cost Assessment of Minimum Energy Standards and Policy Alternatives for Rochester, NY. Rochester Institute of Technology.	Rochester Institute of Technology
Published paper	n/a	June 2022	This paper describes a methodology for quantifying non-energy benefits of a microgrid powered by renewable energy. Metrics include utility bill savings, value of resilience, social cost of carbon, public health costs, and jobs associated with the construction and operation of microgrids. The authors of this paper used AVERT to generate hourly regional marginal emissions factors for grid-purchased electricity as part of their social cost of carbon calculations.	https://www.sciencedirect.com/science/article/abs/pii/S1755008422000047	Anderson, K., A. Farthing, E. Elgqvist, and A. Warren. 2022. Looking beyond bill savings to equity in renewable energy microgrid deployment. Renewable Energy Focus, 41:15–32. https://doi.org/10.1016/j.ref.2022.02.001	National Renewable Energy Laboratory
Published paper	California	June 2022	This paper discusses the design and application of a Model Predictive Control strategy for controlling the average temperature of the large scale Mojave solar plants. These solar projects are aimed at fulfilling an objective that 33% of the overall electricity produced in California should come from renewable energy sources. These projects should prevent the emission of 423,800 tons of CO2 to the atmosphere, as calculated using AVERT.	https://www.sciencedirect.com/science/article/pii/S0967066122000491	Gallego, A.J., M. Macías. F. de Castilla, and E.F. Camacho. 2022. Model Predictive Control of the Mojave solar trough plants. Control Engineering Practice, 123.	University of Seville
Report	Midwest	June 2022	This report used AVERT to generate short-run marginal emissions rates and changes in GHG emissions for a benefit-cost analysis of a hypothetical residential EV managed charging program in the Midwest. The benefit-cost analysis showed a slight increase in GHG emissions as a result of the shift from on-peak daytime charging to off-peak nighttime charging. The analysis showed the hypothetical program has net benefits.	https://www.nationalenergyscreeningproject.org/resources/case-studies/	Strickland, K., B. Trietch, D. Pudleiner, A. Jain, and K. Van Horn. Benefit-Cost Analysis Case Studies: Examples of Distributed Energy Resource Use Cases. 2022, June. National Eergy Screening Project.	National Energy Screening Project

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Report	Midwest	July 2022	This report applies methods and frameworks to two real-world distributed wind reference systems as case studies. To determine the overall benefits to costs of the Iowa Lakes Electric Cooperative wind reference system, the authors calculated the environmental benefits of the Cooperative's wind turbines using marginal emission factors from AVERT.	https://www.osti.gov/biblio/1875831	Reilly, J., S. Barrows, M. Culler, C. Clark, J. Rane, B. Naughton, K. Mongird, A. Orrell, and A. Barker. 2022. Fiscal Year 2021 Isolated Grids and Grid-Connected Turbine Reference Systems. National Renewable Energy Laboratory.	National Renewable Energy Laboratory
Published paper	Northwest	August 2022	By coupling the AVERT and COBRA model, this study assesses potential emission reductions from fossil fuels owing to Nevada's renewable portfolio standards and regional health benefits via improved air quality, as well as how these benefits vary spatially under high and low projected electricity demands in 2030.	https://www.mdpi.com/2073-4433/13/9/1387	Rezaee, A., L.-W.A Chen., G. Lin, M.P. Buttner, M. Gakh, and E.F. Bloomfield. 2022. Air Quality Health Benefits of the Nevada Renewable Portfolio Standard. Atmosphere 13(9) 1387. https://doi.org/10.3390/atmos13091387	University of Nevada Las Vegas
Published paper	Northeast (AVERT 2.3 regions)	August 2022	To evaluate the positive impacts of four laboratory energy optimization programs on emissions, the authors of this paper calculated avoided electric emissions (in lb CO2/year) for each energy optimization program using AVERT 2018 values for the Northeast.	https://pubs.acs.org/doi/full/10.1021/acs.chas.1c00095	McCarthy, J.F., M.A. Fragala, and B.J. Baker. 2022. Analyzing the Risk: Balancing Safety and Efficiency in Laboratory Ventilation. ACS Chemical Health & Safety 29(5): 434-440. ttps://doi.org/10.1021/acs.chas.1c00095	Environmental Health & Engineering, Inc.
Published paper	n/a	September 2022	This paper assesses how a technology to turn a waste gas stream into usable grid power could generate electricity and decrease the emissions into the atmosphere. The authors used AVERT to estimate the decrease in emissions and determined their case study application would reduce GHG emissions by approximately 3,400 lb. in a one-year timeframe.	https://onepetro.org/SPEATCE/proceedings-abstract/22ATCE/3-22ATCE/D022S087R002/509170	Cottingham, B., Z. Bowman, and P. Kirch. 2022. "A Case Study of Flare Gas Reduction and Power Generation." Paper presented at the SPE Annual Technical Conference and Exhibition. https://doi.org/10.2118/210156-MS	SPE Annual Technical Conference and Exhibition
Published paper	California	November 2022	This study used AVERT and COBRA to model the net emissions and air quality impacts of residential building electrification in California. When modeling future years in AVERT, the authors of this paper used a published fossil fuel EGU retirement schedule to account for future reductions in fossil fuel EGUs due to renewable portfolio standards. This paper found that electrification can create localized air-pollution hot-spots in places where fossil fuel EGUs output the marginal demand from electrification, despite the net emissions reductions and overall net benefits from electrification.	https://www.sciencedirect.com/science/article/pii/S2210670722004413#bib0021	Fournier, E.D., F. Federico, R. Cudd, S. Pincetl, A. Ricklefs, M. Costa, M. Jerrett, and D. Garcia-Gonzales. 2022. Net GHG emissions and air quality outcomes from different residential building electrification pathways within a California disadvantaged community. Sustainable Cities and Society, 86.	University of California Los Angeles

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Working paper	National	January 2023	This paper evaluates the effect of electricity market structure on technology adoption in the U.S. solar and wind power industries. The authors simulate counterfactual adoption of one technology, solar axis tracking, if all states had restructured markets. They determined that all states restructuring increased carbon emissions by reducing the adoption of axis-tracking. They used avoided emission rates from AVERT to calculate the increase in CO2 emissions from all states restructuring and reducing axis-tracking adoption relative to the status quo.	https://www.gauravecon.com/uploads/Renewable_Tech_GD_SJ.pdf	Doshi, G., and S. Johnston. 2023. Market Structure and Technology Adoption in Renewable Energy. Working paper. University of Wisconsin-Madison.	University of Wisconsin-Madison
Paper	Midwest	March 2023	This paper evaluates combined cooling, heating, and power (CCHP) system design options for large central utility plants to minimize operating costs and emissions. The study used grid emission factors from AVERT to calculate the grid emissions produced for a case study location, the International Airport of Houston central utility plant in Texas. The study calculated the grid CO2 and NOx emissions savings from multiple CCHP system design options, which all had significant emission reductions compared with the baseline case.	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4376354	Abeyawardhane, K.B., A. Ugursal, and D.E. Claridge. 2023. Combined Cooling, Heating, and Power (CCHP) System Design Economic and Emissions Benefit Evaluation for Existing Central Utility Plants. https://doi.org/10.2139/ssrn.4376354	Texas A&M University
Report	All regions	April 2023	This report discusses the importance of accurate 45V tax credit design, recommendations to ensure accurate lifecycle greenhouse gas emissions accounting under the 45V tax credit, and the financial viability of accurate 45V tax credit guidance. Congress included a production tax credit for clean hydrogen in Section 45V of the Inflation Reduction Act. The report used AVERT to assess the emissions impact of requiring electrolyzers to draw electricity from new sources of clean electricity induced as a result of an electrolyzer coming online. The report found that electrolysis that takes credit from existing clean generation would incur 22 to 40 kgCO2/kgH2 across all of the AVERT regions. The study also considers the emissions impact of pairing electrolyzers and new clean energy projects in different AVERT regions. Using an example of an electrolyzer built in Colorado and a corresponding new, hourly-matched clean energy resources built in Texas, the AVERT analysis showed that this project would produce hydrogen with a GHG emissions intensity of over 12 kgCO2/kgH2. The report recommends that the Treasury use the AVERT tool to estimate emissions from any power consumed by electrolyzers that do not fully meet the authors' recommended design principles.	https://energyinnovation.org/wp-content/uploads/2023/04/Smart-Design-Of-45V-Hydrogen-Production-Tax-Credit-Will-Reduce-Emissions-And-Grow-The-Industry.pdf	Esposito, D., E. Gimon, and M. O'Boyle. 2023. Smart Design of 45V Hydrogen Production Tax Credit Will Reduce Emissions and Grow the Industry. Energy Innovation.	Energy Innovation

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Published paper	National	April 2023	This paper evaluates the potential energy, cost, and carbon savings from different MRI scanner power management strategies. Using the AVERT national marginal emissions rate for CO2, the study calculated the carbon emissions savings of switching to the lowest MRI scanner activity modes when MRI units are not in use.	https://pubs.rsna.org/doi/full/10.1148/radiol.230441	Woolen, S.A., A.E. Becker, A.J. Martin, R. Knoerl, V. Lam, J. Folsom, C. Eusemann, C.P. Hess, and V. Deshpande. 2023. Ecodesign and Operational Strategies to Reduce the Carbon Footprint of MRI for Energy Cost Savings. Radiology, 307(4): e230441. https://doi.org/10.1148/radiol.230441	University of California–San Francisco
Published paper	California	May 2023	This paper analyzes how the Clean Vehicle Rebate Project (CVRP), an existing program in California that provides rebates for the purchase or lease of electric vehicles, affects the amount and distribution of greenhouse gas and criteria air pollutant emissions. The study evaluated the distribution of CVRP rebates allocated to "Disadvantaged Communities" and "Least Disadvantaged Communities." Using yearly emissions estimates from the California EMFAC database, the authors calculated avoided emissions from replacing internal combustion engine vehicles with electric vehicles due to CVRP rebates. The authors estimated the total additional electricity demand from new CVRP-subsidized elective vehicles. The share of the additional demand that would be sourced from existing fossil fuel power plants was input into AVERT v3.1.1 to calculate changes in power plant emissions. The study found that CVRP resulted in net statewide emissions reductions of CO2, SO2, and NOx, and a net statewide emissions increase of primary PM2.5. Due to the low allocation of vehicle rebates to "Disadvantaged Communities" and their proximity to fossil fuel power plants, "Disadvantaged Communities" are disproportionately more likely to experience either larger net increases or smaller net reductions in primary PM2.5, NOx, and SO2 emissions as a result of the CVRP.	https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000183	Mejía-Duwan, J., M. Hino, and K.J. Mach. 2023. Emissions redistribution and environmental justice implications of California's clean vehicle rebate project. PLOS Clim, 2(5): e0000183. https://doi.org/10.1371/journal.pclm.0000183	University of California–Berkeley
Report	n/a	May 2023	This report describes a framework for how to assess climate mitigation and adaptation investments and their impact on human health. The fifth step of the framework is to identify suitable methods and models for estimating the health impacts of an investment and the economic valuation of those health impacts. The report presents several examples of available models, including the environmental policy simulation tool for electrical grid interventions v2.0 (EPSTEIN 2.0) that was developed in a separate study. The report describes how EPSTEIN 2.0 consists of AVERT, the social cost of carbon, and estimating air pollution social impacts using regression.	https://iris.who.int/bitstream/handle/10665/367385/9789240057906-eng.pdf?sequence=1	World Health Organization. A framework for the quantification and economic valuation of health outcomes originating from health and non-health climate change mitigation and adaptation action. 2023.	World Health Organization

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Published paper	National	May 2023	This paper quantifies the excess electrical energy consumption and greenhouse gas emissions from increased air temperature increases around air conditioning condensers due to roof thermal properties. The study used the EPA Greenhouse Gas Equivalencies Calculator, which is based on AVERT, to convert the estimated excess electricity consuption to the mass of greenhouse gases and their energy equivalent.	https://www.mdpi.com/2073-4433/14/6/945	Santillán-Soto, N., A.A. Lambert-Arista, D.E. Flores-Jiménez, S. Ojeda-Benítez, S.E. Cruz-Sotelo, N. Velázquez-Limón, and R. López-Zavala. 2023. Air Temperature Variations Due to Different Roofs and Their Impact on Energy Consumption and Emissions: Mexicali University Campus Case Study. Atmosphere, 14(6): 945. https://doi.org/10.3390/atmos14060945	Universidad Autónoma de Baja California
Published Paper	Northeast (AVERT 2.3 regions)	June 2023	This paper examines the optimization of a microgrid system in buildings with critical loads that is connected to the general power grid and can provide backup power during power outages. The research evaluates the feasibility of installing the proposed microgrid system at Massachusetts General Hospital in Boston, MA. AVERT electricity grid emission factors were used in a REopt Lite analysis tool simulation for this case study.	https://www.sciencedirect.com/science/article/pii/S2352710223002759	Rosales-Asensio, E., D. Icaza, N. Ganzález-Cobos, and D. Borge-Diez. 2023. Peak load reduction and resilience benefits through optimized dispatch, heating and cooling strategies in buildings with critical microgrids. Journal of Building Engineering, 68: 106096. https://doi.org/10.1016/j.jobe.2023.106096	University of Las Palmas de Gran Canaria
Published paper	California	June 2023	This paper assesses the economic value and environmental benefit of replacing diesel backup generators in public buildings in California with paired solar photovoltaic (PV) and energy storage technology microgrid systems. To calculate emissions from grid electricity, the study used AVERT hourly emission rates for the AVERT California region. The study calculated and compared the grid emissions from a PV-plus-storage microgrid configuration with the grid and diesel fuel emissions from a diesel backup generator configuration. The study demonstrated that replacing a diesel backup generator in one building in California with a PV-plus-storage microgrid would save almost $3 million and reduce CO2 emissions by more than 10,000 tons over a 20-year period.	https://www.sciencedirect.com/science/article/abs/pii/S235255092300074X	Hwang, S., S. Tongsopit, and N. Kittner. 2023. Transitioning from diesel backup generators to PV-plus-storage microgrids in California public buildings. Sustainable Production and Consumption, 38: 252–265. https://doi.org/10.1016/j.spc.2023.04.001	University of North Carolina at Chapel Hill
Report	Midwest	July 2023	This paper examines the deployment potential for installing new combined heat and power (CHP) systems in six Midwestern states: Illinois, Indiana, Kentucky, Michigan, Missouri, and Ohio. The authors used AVERT Web Edition to estimate the CO2 savings from expanding CHP systems in Midwestern manufacturing industries. When also accounting for the additional CO2 emissions from the new CHP installations, they found that new CHP installations would save the Midwest region 18 million tons of CO2 emissions annually.	https://www.mwalliance.org/sites/default/files/meea-research/assessment_of_combined_heat_and_power_systems_in_the_midwests_top_manufacturing_industries.pdf	Ricchiuto, J., and G. Ehrendreich. 2023. Assessment of Combined Heat and Power Systems in the Midwest's Top Manufacturing Industries. Midwest Energy Efficiency Alliance.	Midwest Energy Efficiency Alliance

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Student master's project	National	August 2023	This thesis aims to determine the potential systemic impacts of solar projects on urban, low-income communities in the United States. The study used existing solar potential and adoption datasets in urban, low-income communities to assess feasibility of solar panel installation, potential for positive impact, predicted adoption rates, and predicted generation capacity and air pollution reductions. The 2022 AVERT average national emission rates were used to calculate the reduction in emissions and air pollution under different adoption scenarios.	https://www.theseus.fi/handle/10024/813085	Modekurty, S. 2023. Assessing the Systemic Impact of Solar Energy Projects for Low-Income Communities in the United States. Joint Programme of Master in Urban Climate and Sustainability.	International Erasmus Mundus Joint Master in Urban Climate & Sustainability
Published paper	All regions	August 2023	This paper investigates the regional air quality and health impacts of replacing an existing grid boiler (GB) with a combined heat and power (CHP) system (with and without emission controls). CHP systems are more energy efficient, but they also combust more fuel onsite and can increase local air emissions. The study used AVERT v3.2 to estimate emissions changes from changes in electricity consumption due to replacing a GB with a CHP system in each of the 14 AVERT regions. The authors found that shifting from an existing GB to a CHP system (with or without emission controls) results in lower electricity consumption and lower electricity-associated emissions. Shifting to a CHP system increased local emissions from natural gas usage. As a result, the study found that 10 out of 14 AVERT regions would experience health burdens from shifting from an uncontrolled GB to an uncontrolled CHP, but all 14 AVERT regions would experience health benefits when replacing an existing uncontrolled GB with a CHP that has an emissions control system.	https://www.tandfonline.com/doi/abs/10.1080/10962247.2023.2248922	Safaei Kouchaksaraei, E., A. Khosravani Semnani, K.M. Powell, and K.E. Kelly. 2023. Regional impacts on air quality and health of changing a manufacturing facility's grid-boiler to a combined heat and power system. Journal of the Air and Waste Management Association, 73(10): 760–776. https://doi.org/10.1080/10962247.2023.2248922	University of Utah
Published Paper	National	August 2023	This paper develops a framework for data-driven decision-making in the energy sector. To demonstrate how to apply the framework, the paper uses a case study of an energy organization managing a wind farm project. As part of the framework, the organization identified and measured key performance indicators. For the health, safety, and environmental aspects indicator, the energy production at the wind farm was assessed using the AVERT U.S. national weighted CO2 marginal emission rate.	https://www.mdpi.com/1996-1073/16/17/6272	Konstas, K., P.T. Chountalas, E.A. Didaskalou, and D.A. Georgakellos. 2023. A Pragmatic Framework for Data-Driven Decision-Making Process in the Energy Sector: Insights from a Wind Farm Case Study. Energies, 16(17): 6272. https://doi.org/10.3390/en16176272	Hellenic Open University
Conference Paper	n/a	September 2023	This paper provides a holistic overview of the sustainability of electric motors. To assess how electric motors contribute to CO2 emissions, the paper includes a description of how to calculate the equivalent amount of CO2 avoided or consumed. An emission rate from AVERT is used in calculating the amount of CO2 emissions avoided when upgrading from a less efficient motor to a more efficient one.	https://ieeexplore.ieee.org/abstract/document/10414330	Stockton, C.A., R.F. McElveen, and E. Chastain. 2023. The Integral Role of Electric Motors in Achieving Sustainability. Paper presented at the 2023 IEEE IAS Petroleum and Chemical Industry Technical Conference (PCIC): 169–177. https://doi.org/10.1109/PCIC43643.2023.10414330	ABB

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Report	California and Carolinas	November 2023	This report evaluates the development of ventilation and indoor air quality system retrofit packages in buildings for two climate zones, Northern California and North Carolina. Energy efficiency measures were combined into the system packages. AVERT hourly grid emission rates for the modeled regions were used to model the CO2 emissions savings of each package.	https://escholarship.org/uc/item/0cb6b4ds	Shackelford, J., A. Robinson, C. Regnier, and S.H. Lee. 2023. Getting Beyond Widgets: Performance of Efficient Indoor Air Quality System Retrofit Packages for Schools A report on the modeled energy, greenhouse gas, and cost savings of several multi-measure retrofit packages for energy efficiency and indoor air quality in primary schools. Lawrence Berkeley National Laboratory. https://doi.org/10.20357/B7531X	Lawrence Berkeley National Laboratory
Paper	All regions	November 2023	This paper estimates supply and demand elasticities for new rooftop solar installations resulting from state-level incentives. To identify supply and demand parameters and compute counterfactual emissions, this paper used data on emissions from AVERT. AVERT was used to estimate the marginal reduction in emissions caused by an additional 1 MW of rooftop solar capacity.	https://jmbvgarcia.github.io/assets/pdf/SolarProject.pdf	Garcia, J. 2023. Optimizing Incentives for Rooftop Solar: Accounting for Regional Differences in Marginal Emissions.	Joao Garcia, PhD candidate at Brown University
Paper	California, New York, New England, Mid-Atlantic, Midwest, Texas, and Central	November 2023	This paper proposes a framework to assess the accuracy of marginal emission factor models, which are used to estimate how much a change in electricity load will affect total emissions. This paper compares seven publicly obtainable marginal emissions factor models, including AVERT v3.2, against U.S. government-managed primary data sources and sees if they align with the expected behavior. The authors developed and applied a series of tests to measure the accuracy of the seven models.	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4631565	Koebrich, S., J. Cofield, G. McCormick, I. Saraswat, and N. Steinsultz. 2023. Towards Objective Evaluation of the Accuracy of Marginal Emissions Factors. https://dx.doi.org/10.2139/ssrn.4631565	WattTime
Paper	n/a	November 2023	This paper presents a framework for decarbonaization within electric power systems. The paper provides a summary of existing carbon accounting methods and lists AVERT as an example of a data source for marginal emissions data.	https://arxiv.org/abs/2308.03268	Chen, X., H. Chao, W. Shi, and N. Li. 2023. Towards Carbon-Free Electricity: A Flow-Based Framework for Power Grid Carbon Accounting and Decarbonization. https://doi.org/10.48550/arXiv.2308.03268	Texas A&M University

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Paper	Mid-Atlantic	December 2023	This paper examines the impact of long interconnection queues on electricity generators applying to connect to the U.S. power grid. Interconnection queues with long waiting times and high costs can be a barrier for generators wishing to connect, and most wind and solar powered generators do not complete the process. The authors developed a model of the interconnection queue and assessed proposed reforms. They found that reforming the interconnection process would increase renewable generation capacity. To quantify the impact on emissions, the authors used AVERT to calculate the CO2 emissions avoided by adding more utility-scale renewable generation capacity to the grid.	https://www.nber.org/system/files/working_papers/w31946/w31946.pdf	Johnston, S., Y. Liu, and C. Yang. 2023. An Empirical Analysis of the Interconnection Queue. National Bureau of Economic Research.	National Bureau of Economic Research
Technical article	All regions	January 2024	This article describes what marginal carbon values are, how they relate to the dispatching of electric generation resources, and how to calculate them using marginal emissions rates. The article presents AVERT as a resource to estimate marginal carbon reductions and explains how to use AVERT marginal emission rates to perform a simple carbon impact calculation.	https://www.proquest.com/openview/2d273e16aad1c8fd77147ca1d68be20e/1?pq-origsite=gscholar&cbl=41118	Ryan, W. 2024. Understanding Marginal Carbon Factors and Why They Matter. ASHRAE Journal, 66(1): 32–39.	ASHRAE
Report	Northeast (AVERT 2.3 regions)	January 2024	This report quantifies value streams of solar plus storage systems using field data from a solar plus storage deployment in the McKnight Lane community in Vermont. The study modeled the McKnight Lane homes under five scenarios with different objectives and calculated metrics that represent the benefits of solar plus storage systems. The emissions reduction metric was calculated from the change in annual CO2 emissions between a given scenario and a baseline using AVERT hourly marginal emissions factors for the Northeast region. The study found that the existing McKnight Lane homes, when compared against equivalent homes without solar-plus-storage, reduced CO2 emissions by 32 metric tons per year across all 14 homes.	https://www.nrel.gov/docs/fy24osti/84660.pdf	Manogaran, I., A. Farthing, J. Maguire, and K. Gruchalla. 2024. Savings in Action: Lessons Learned from a Vermont Community with Solar Plus Storage. National Renewable Energy Laboratory. NREL/TP-7A40-84660.	National Renewable Energy Laboratory
Environmental assessment	Rocky Mountains	February 2024	This environmental assessment analyzes and discloses potential environmental impacts of an interconnection to an existing Western Area Power Administration transmission line from Philip Wind Partners' proposed Philip Wind Facility in Philip, South Dakota. The assessment used AVERT Web Edition to determine how much annual fossil fuel generation a 300-MW wind facility would displace in the Rocky Mountains region. AVERT was also used to calculate the CO2, VOC, PM2.5, and NOx emissions avoided by replacing that amount of fossil generation with a wind facility.	https://www.energy.gov/sites/default/files/2024-02/draft-ea-2094-philip-wind-farm-2024-02.pdf	Western Area Power Administration. 2024. Philip Wind Energy Center Draft Environmental Assessment Haakon County, South Dakota. DOE/EA-2094.	Western Area Power Administration

Publication type	AVERT region	Date published	Summary	URL	Citation	Organization or author affiliation
Published paper	New York, Mid-Atlantic, California, and Midwest	February 2024	This paper analyzes changes in air pollutant concentration across the four most populated cities in the United States--New York, Los Angeles, Chicago, and Houston--under different vehicle electrification scenarios. The study used chemical transport models to analyze changes in PM2.5, ozone, and their associated precursors at the neighborhood level. The study used AVERT's Main Module to model changes in grid emissions due to vehicle electrification. The study found that the adoption of electric vehicles led to the reduction of PM2.5 and ozone-linked mortalities in New York, Chicago, and Houston, as well as in Los Angeles under some scenarios. The study found that the full vehicle electrification scenario in Los Angeles increased PM2.5 and MDA8 ozone levels and related mortalities.	https://www.sciencedirect.com/science/article/abs/pii/S0048969723082074	Mousavinezhad, S., Y. Choi, N. Khorshidian, M. Ghahremanloo, and M. Momeni. 2024. Air quality and health co-benefits of vehicle electrification and emission controls in the most populated United States urban hubs: Insights from New York, Los Angeles, Chicago, and Houston. Science of The Total Environment, 912. https://doi.org/10.1016/j.scitotenv.2023.169577	University of Houston
Webpage	National	No date	This study used AVERT to estimate nationwide SO2, NOx, and CO2 emission reductions from existing and planned wind energy capacity. A subesequent study is now available, in which the authors report that the electricity generated by wind in 2017 displaced approximately 188,000 metric tons of SO2 and over 122,000 tons of NOx, representing more than $8 billion in avoided health costs.	https://www.awea.org/wind-101/benefits-of-wind/environmental-benefits	American Wind Energy Association. n.d. Wind energy reducing greenhouse gas emissions.	American Wind Energy Association
Webpage	Great Lakes/Mid-Atlantic (AVERT 2.3 regions)	No date	This publication discusses the benefits of increasing renewable energy in Maryland as part of a campaign to expand the state's RPS policy. The authors use AVERT and COBRA to assess the effects of reaching the state's renewable goal of 50% by 2030, finding that a reduction of 8.1 million tons of CO2, will lead to the prevention of 290 premature deaths and more than 3,000 asthma attacks annually.	http://chesapeakeclimate.org/maryland/clean-energy/	Chesapeake Climate Action Network. Forward with 50% renewable electricity.	Chesapeake Climate Action Network