Publications that Cite EPA's CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool

Publication type	Date Published	Location	Summary	URL	Citation
Article	November 2021	Georgia, United States	Uses COBRA to assess source-specific impacts on $PM_{2.5}$ pollution to understand the health impacts of prescribed fire. Estimates that prescribed burning can result in hundreds of cases per year of morbidity and mortality.	https://www.sciencedirect.com/science/article/abs/pii/S0048969721037840	Afrin, S., & Garcia-Menendez, F. (2021). Potential impacts of prescribed fire smoke on public health and socially vulnerable populations in a Southeastern US state. Science of The Total Environment, 794, 148712.
Report	June 2021	New Jersey, United States	Uses COBRA to calculate health benefits under New Jersey's proposed rule: Advanced Clean Trucks Program and Fleet Reporting Requirements. Estimates total health benefits between $288 million - $648 million.	https://njadapt.rutgers.edu/images/NJ_Climate_Change_Alliance_comments_on_ACT_Rule_2_1.pdf	Lowrie, K.W., Kilkelly, E., Herrera, A., & Petrozzo, K. (2021). Health Note on the New Jersey Department of Environmental Protection proposed regulation: Advanced Clean Trucks Program and Fleet Reporting Requirements.
Article	May 2021	United States	Uses COBRA within the Engineering, Economic, and Environmental Electricity Simulation Tool (E4ST) to examine the health impacts and monetized benefits of US tax law policy that provides subsidies for coal that has been "refined" prior to burning with the intention of emitting less nitrogen oxides (NO_x), sulfur dioxide (SO_2), and mercury (Hg). Finds that the policy reduces social welfare because the subsidy extends the operational life of some coal plants.	https://www.sciencedirect.com/science/article/pii/S0140988320303637	Prest, B. C., & Krupnick, A. (2021). How clean is "refined coal"? An empirical assessment of a billion-dollar tax credit. Energy Economics, 97, 105023.
Report	May 2021	Illinois, United States	Uses COBRA to estimate the potential health benefits of avoided $PM_{2.5}$ exposure resulting from decarbonizing Illinois' electricity sector by 2030. Estimates annual health benefits of $293 million - $740 million.	https://resphealth.org/wp-content/uploads/2021/05/Health-Benefits-from-Carbon-Free-Electricity.pdf	Meier, P., & Holloway, T. (2021). Illinois Health Impacts from Transitioning to 100% Carbon-Free Electricity.
Report	April 2021	United States	Uses COBRA for county level population and all-cause mortality incidence rates to estimate national net benefits of climate policies in 2030. Finds the net benefits of such policies range from $72 billion - $156 billion, including avoiding 3,544 – 14,356 premature deaths.	https://globalchange.mit.edu/sites/default/files/MITJPSPGC_Rpt351.pdf	Yuan, M., Barron, A., Selin, N., Picciano, P., Metz, L., Reilly, J., & Jacoby, H. (2021). Meeting Potential New US Climate Goals.

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Publication type	Date Published	Location	Summary	URL	Citation
Master's Project	April 2021	California, Florida, and Massachusetts, United States	Includes a reference to COBRA in a literature review of Net Energy Metering policy benefits.	https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/22629/MP%20Final%20Report_Ghadiri_Krishnan_Li.pdf?sequence=1	Ghadiri, F., Krishnan, A., Li, R. (2021). Reforming Solar Net Metering (Master's thesis).
Article	March 2021	New York, United States	Includes COBRA in a list of a models that can be used to estimate reductions in the numbers and related costs of adverse health-outcomes using exposure outcome relationships.	https://www.sciencedirect.com/science/article/pii/S1309104221000295	Hopke, P. K., & Hill, E. L. (2021). Health and charge benefits from decreasing PM2. 5 concentrations in New York State: Effects of changing compositions. Atmospheric Pollution Research, 12(3), 47-53.
Article	February 2021	United States	Evaluates several Air Pollution Health Risk Assessment tools, including COBRA, taking into account their spatial resolution, technological factors, pollutants addressed, geographical scale, quantified health effects, method of classification, and operational characteristics. Conducts a comparative analysis of these tools, including COBRA.	https://www.mdpi.com/1660-4601/18/4/1935/htm	Hassan Bhat, T., Jiawen, G., & Farzaneh, H. (2021). Air Pollution Health Risk Assessment (AP-HRA), Principles and Applications. International journal of environmental research and public health, 18(4), 1935.
Article	2021	Global	Cites COBRA as a widely used reduced-complexity air quality model.	https://chemrxiv.org/ndownloader/files/27327764	Thakrar, S., Tessum, C., Apte, J., Balasubramanian, S., Millet, D. B., Pandis, S., ... & Hill, J. (2021). Global, High-Resolution, Reduced-Complexity Air Quality Modeling Using InMAP (Intervention Model for Air Pollution).
Report	2021	New York, United States	Uses AVERT and COBRA to estimate the human health benefits of building 5 GW of mid- to large-scale solar in the Northeast Region. Estimates benefits of up to 36 lives saved and a value of up to $345 million.	http://solarroadmap.org/wp-content/uploads/2021/03/LongIslandSolarRoadmapReport_2020_LowRes.pdf	Price, J., Delach, A., Leu, K., Morris, C., Schelly, C., & Thapaliya, R. (2021). Long Island Solar Roadmap: Advancing Low Impact Solar in Nassau and Suffolk Counties. The Nature Conservancy and Defenders of Wildlife. New York, NY.

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Chapter	2020	United States	Given the policy-relevant implications of co-benefits at the city scale, this review evaluates the existing tools/models to assess both carbon and air pollution in urban environments.	https://www.taylorfrancis.com/chapters/edit/10.1201/9781003043461-46/review-fine-scale-air-quality-modeling-carbon-health-co-benefits-assessments-cities-andrew-fang-anu-ramaswami	Fang, A., & Ramaswami, A. (2020). Review of Fine-Scale Air Quality Modeling for Carbon and Health Co-Benefits Assessments in Cities. In Managing Air Quality and Energy Systems (pp. 679-689). CRC Press.
Masters Thesis	November 2020	Southwestern United States	Uses COBRA and BenMAP to compare estimated benefits of different wood biomass energy-use scenarios.	https://www.proquest.com/openview/f9da009ddd0e8cc8085cffa2f22dbcc7/1?pq-origsite=gscholar&cbl=18750&diss=y	Hedgepeth, M. (2020). Quantifying and Monetizing the Benefits of Displacing Fossil Fuels with Woody Biomass Energy for Electricity Generation in the Southwestern United States (Doctoral dissertation, Northern Arizona University).
Report	2020	United States	Uses COBRA to estimate the health impacts of transitioning to electric vehicles along with increasing renewable generation. Estimates 6,300 premature deaths avoided, resulting in $72 billion in benefits.	https://www.lung.org/clean-air/electric-vehicle-report	American Lung Association. 2020. The Road to Clean Air: Benefits of a Nationwide Transition to Electric Vehicles.
Conference proceeding	October 2020	United States	Includes COBRA as a method for benefits estimation in state climate plans, including how COBRA can be used to quantify benefits and demonstrate that climate action and decarbonization can achieve multiple policy objectives.	https://apha.confex.com/apha/2020/meetingapi.cgi/Paper/479753?filename=2020_Abstract479753.pdf&template=Word	Zinsmeister, Emma, David Cooley, Olivia Griot, and Phillip Assmus. "Public health co-benefits of greenhouse gas emission reductions: Methods for benefits estimation in state climate plans." APHA's 2020 VIRTUAL Annual Meeting and Expo.

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Publication type	Date Published	Location	Summary	URL	Citation
Report	September 2020	North Carolina, United States	Uses COBRA to estimate the financial impact on public health from North Carolina's Clean Energy Plan, which includes a 70% reduction in emissions by 2040. Estimates cumulative health-related savings to be between $309,093,000 and $699,712,000 from 2021 to 2040.	https://www.aceee.org/sites/default/files/pdfs/u2007.pdf	Gold, R., Cohn, C., Hoffmeister, A., & Molina, M. (2020). How Energy Efficiency Can Help Rebuild North Carolina's Economy.
Article	September 2020	United States	Uses COBRA for a spatial analysis of the overall health benefits from simultaneous emission reductions. Estimates savings to be between $437 million and $988 million with savings especially in the Eastern half of the United States (with the NAAQS at 10 $\mu g/m^3$ and 25 $\mu g/m^3$). Also estimates the NAAQS at 8 $\mu g/m^3$ and 25 $\mu g/m^3$ and finds estimated savings to be between $1.9 billion and $4.4 billion, especially concentrated in the Northeast United States.	https://jareonline.org/articles/evaluating-the-efficacy-of-ambient-air-quality-standards-at-coal-fired-power-plants/	Raff, Z, & Walter, J.M. (2020) Evaluating the Efficacy of Ambient Air Quality Standards at Coal-Fired Power Plants. Journal of Agricultural and Resource Economics, 45:428-444.
Master's Thesis	August 2020	Massachu-setts, United States	Uses COBRA to evaluate the health savings of eliminated VOC, NO_x, SO_x, and $PM_{2.5}$ emissions from a fleet-wide transition to electric school buses. Estimates total benefits (over 20 years) to be between $1,578,664 and $3,565,071. Other results include savings from avoided mortality ($1,557,552-$3,519,989), non-fatal heart attacks ($2,893-$26,883), hospital admissions ($3,960.6), acute bronchitis ($109), upper respiratory symptoms ($138), lower respiratory symptoms ($61), minor restricted activity days ($8,659), work loss days ($3,390), and asthma exacerbation ($250).	https://capstone.extension.harvard.edu/files/capstone/files/massoli_paola_082120.pdf	Massoli, P. (2020). Clean Ride to School: Viability and Opportunities of School Bus Electrification in Massachusetts

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Report	August 2020	Nebraska, United States	Uses COBRA to evaluate the health benefits from eliminated coal emissions in the Omaha metro area and Nebraska. Monetized benefits from statewide reductions in emissions would result in $62 million to $140 million and $55 million to $125 million in total avoided healthcare costs overs 20 years (at 3% and 7% discount rate, respectively).	https://capstone.extension.harvard.edu/files/capstone/files/lepesuastegui_jose_20.08.23.pdf	Lepesuastegui, J. L., & Wetzler, R. E. (2020). Rethinking Nuclear Waste: Recycling Spent Fuel in the Era of Renewable Energy.
Comments	May 2020	United States	Cites recent EPA air actions that rely on underlying scientific data that would be restricted from consideration based on the proposed rule "Strengthening Transparency in Regulatory Science". COBRA is included in this list.	https://www.nrdc.org/sites/default/files/media-uploads/2020-05-18_censoring_science_supplemental_proposal_-_nrdc_comments_final.pdf	Natural Resources Defense Council. 2020. Comments of Natural Resources Defense Council on "Strengthening Transparency in Regulatory Science (Supplemental notice of proposed rulemaking)."
Comments	April 2020	Missouri, United States	Explains how COBRA can be used to quantify and monetize air quality and health impacts from the displacement of emissions at power plants by energy efficiency and renewable energy. Also explains COBRA's simplified air quality model to convert air pollution changes to air quality impacts.	https://static1.squarespace.com/static/5936d98f6a4963bcd1ed94d3/t/5e8dd9e5c19cc97b1dc2b72e/1586354662259/Sierra+Club+2020+Ameren+IRP+Comments.pdf	Sierra Club. 2020. Sierra Club's Initial Comments on Ameren Missouri's 2020 Integrated Resource Planning Process.
Dissertation	2020	Illinois, United States	Uses COBRA to demonstrate that increased compliance with an energy-efficiency portfolio standard in Illinois will reduce $PM_{2.5}$ emissions by 8.8 tons, contributing to an additional $1.2 million to $3.2 million saved from avoided health impacts.	https://digitalcommons.mtu.edu/cgi/viewcontent.cgi?article=2174&context=etdr	Turegeldin, Azat. "Linking Energy Efficiency and Public Health: A case study of Illinois." Michigan Technological University Dissertations, Master's Theses and Master's Reports.
Article	August 2020	Italy	Uses COBRA to account for the health benefits in an analysis of a hydrogen production facilities for power-to-gas and hydrogen mobility under different renewable sources.	https://www.sciencedirect.com/science/article/pii/S0196890420308700	Fragiacomo, Petronilla, Matteo Genovese. "Technical-economic analysis of a hydrogen production facility for power-to-gas and hydrogen mobility under different renewable sources in Southern Italy." Energy Conversion and Management, 223 (2020), 113332.

Publication type	Date Published	Location	Summary	URL	Citation
Conference proceeding	2020	Illinois, United States	Uses COBRA to evaluate monetized health benefits associated with four ComEd energy efficiency programs from 2018-2034. Researchers worked with EPA to develop a customized COBRA model for ComEd's discount rate of 2.38 percent. Estimates savings to be $70,250,000 from reduced mortality, $500,000 from reduced work loss, $130,000 from reduced other health impacts, and $130,000 from reduced hospital and emergency room visits.	https://www.greenandhealthyhomes.org/wp-content/uploads/How-much-are-non-energy-benefits-worth.pdf	Plympton, Patricia C., Brian Eakin, Jeff Erickson, Sophie Gunderson, Randy Gunn, Grace Halbach, Jessica Minor-Baetens, Molly Podolefsky, Bridget Williams, Ethan Young, Katherine Johnson, William Klein. "How Much are Non-Energy Benefits Worth? Quantifying and Monetizing Values to Include in ComEd's Income Eligible Energy Efficiency Programs' Cost-Effectiveness Tests." ACEEE 2020 Abstract.
Article	June 2020	United States	References COBRA's use in a summary of papers that modeled alternative energy scenarios in North America, China, Taiwan, Europe, or Brazil.	https://iopscience.iop.org/article/10.1088/2515-7620/ab9526	Tham, Rachel, Geoff Morgan, Shyamali Dharmage, Guy Marks, and Christine Cowie. "Scoping review to understand the potential for public health impacts of transitioning to lower carbon emission technologies and policies." Environmental Research Communications, 2, 065003.
Report	May 2020	United States	Lists how two studies have used COBRA. One study provides a detailed example of critical steps in COBRA mortality calculations. Another study uses COBRA to estimate changes in ambient concentrations of air pollution due to changes in emissions of primary $PM_{2.5}$ and precursors of secondary $PM_{2.5}$.	https://escholarship.org/content/qt1924c3g9/qt1924c3g9.pdf?t=qbnieu	Sutter, Mary, Jenn Mitchell-Jackson, Steven R. Schiller, Lisa Schwartz, and Ian Hoffman. "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 Recent Work.
Article	July 2020	United States	Uses COBRA to estimate how changes in NO_x and SO_2 emissions would impact ambient concentrations of $PM_{2.5}$ in the Regional Greenhouse Gas Initiative and neighboring states.	https://ehp.niehs.nih.gov/doi/pdf/10.1289/EHP6706	Perera, Frederica, David Cooley, Alique Berberian, David Mills, and Patrick Kinney. "Co-Benefits to Children's Health of the U.S. Regional Greenhouse Gas Initiative." Environmental Health Perspectives, 128: 077066

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College Senior Thesis Paper	May 2020	South Carolina, United States	References a study that used COBRA to evaluate the health impacts of transitioning public buses from diesel to compressed natural gas in Nevada.	https://scholarcommons.sc.edu/senior_theses/377	James, Eva L., "Assessing the Feasibility, Costs, and Benefits of Transitioning Part of the University of South Carolina Shuttle Fleet to an Alternative Fuel Source and Promoting Anti-idling Strategies" (2020). Senior Theses. 377.
Article	March 2020	United States	References two studies that used COBRA to evaluate the monetary benefits of reduced health incidences from particulate matter exposure.	https://doi.org/10.1016/j.apenergy.2019.114449	Ryan Wiser and Dev Millstein. "Evaluating the economic return to public wind energy research and development in the United States." Applied Energy 261 (2020) 114449.
Working Paper	September 2019	United States	COBRA is listed as one option for estimating the health benefits of changes in air pollution, but the paper does not use COBRA.	https://cdn1.sph.harvard.edu/wp-content/uploads/sites/1273/2019/09/Gilmore-Heo-Muller-Tessum-Hill-Marshall-Adams-2019.pdf	Elisabeth A. Gilmore, Jinhyok Heo, Nicholas Z. Muller, Christopher W. Tessum, Jason D. Hill, Julian D. Marshall, Peter J. Adams. "Developing estimates of the social costs of air pollutants and their uncertainty using Reduced Complexity Models (RCM)." Prepared for Harvard Center for Risk Analysis “Risk Assessment, Economic Evaluation, and Decisions” workshop, September 26-27 2019.
Article	August 2019	Midwest United States	Uses COBRA to evaluate the health impacts of sub-Renewable Portfolio Standards in the United States. Estimates a health co-benefit of $94/ton CO_2 reduced in the Rust Belt Region.	https://doi.org/10.1088/1748-9326/ab31d9	Emil G Dimanchev, Sergey Paltsev, Mei Yuan, Daniel Rothenberg, Christopher W Tessum, Julian D Marshall, and Noelle E Selin. "Health co-benefits of sub-national renewable energy policy in the US." Environmental Research Letters, (2019): 14, 085012.

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Report	July 2019	Colorado, United States	Uses COBRA to estimate the monetized value of the health impacts of the Colorado Advanced Clean Car Program. Estimates the annual value of health benefits, which ranges from $14 million to over $100 million.	http://blogs.edf.org/climate411/files/2019/08/FINAL-EDF-Colorado-ZEV-report-2019.pdf	Richard Rykowski. "Colorado Zero Emission Vehicle Program Will Deliver Extensive Economic, Health and Environmental Benefits."
Report	June 2019	United States	Uses COBRA to evaluate adult mortality risk reductions from $PM_{2.5}$, NO_x, and SO_2 emissions. Estimates benefits to be $8.64-$0.04 million.	https://media.rff.org/documents/Refined_Coal_Report_11.pdf	Brian C. Prest and Alan Krupnick. "How Clean is 'Refined Coal'? An Empirical Assessment of a Billion-Dollar Tax Credit." Resources for the Future, (2019).
Article	September 2019	United States	Uses COBRA for a spatial analysis of the overall health benefits from simultaneous emission reductions of $PM_{2.5}$ and precursors. Estimates savings to be between $437 million and $988 million, with savings especially occurring in the Eastern half of the United States (with the NAAQS at 10 $\mu g/m^3$ and 25 $\mu g/m^3$). Also estimates the NAAQS at 8 $\mu g/m^3$ and 25 $\mu g/m^3$ and finds estimated savings to be between $1.9 billion and $4.4 billion, especially concentrated in the Northeast United States.	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3335401	Zach Raff and Jason M. Walter. "Evaluating the efficacy of ambient air quality standards at coal-fired plants." University of Wisconisn-Stout, (2019).
Report	May 2019	United States	Uses COBRA to evaluate health benefits from different carbon pricing modeling scenarios. Estimates health benefits to be 3,500-80,000 avoided cases of premature morality and 90,000 cases of exacerbated asthma based on an average reduction in SO_2 and NO_x emissions.	https://www.brookings.edu/wp-content/uploads/2019/05/ES_20190507_Morris_CarbonPricing.pdf	Alexander R. Barron, Marc A. C. Hafstead, and Adele C. Morris. "Policy insights from comparing carbon pricing modeling scenarios." Climate and Energy Economics Discussion Paper (2019).
Article	May 2019	United States	Uses COBRA to evaluate the health damages from plans to expand power grid capacity. Estimates health damages to be $1,173 billion. They also estimate approximate health damages for the following regions: New Jersey ($130 billion), MDDE ($145 billion), New York ($160 billion), Northeast ($210 billion), NYC ($225 billion), and RoPJM ($310 billion).	https://doi.org/10.3390/ijerph16101857	Rodgers, Mark D., David W. Coit, Frank A. Felder, and Annmarie Carlton. "A Metamodeling Framework for Quantifying Health Damages of Power Grid Expansion Plans." Int. J. Environ. Res. Public Health 16(10), (2019):1857.

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Article	April 2019	United States	Mentions COBRA as a tool to provide social costs of air quality policy. Discusses COBRA's similarities with Air Pollution Emission Experiments and Policy (AP2).	https://iopscience.iop.org/article/10.1088/1748-9326/ab1ab5/meta	Elisabeth A Gilmore, Jinhyok Heo, Nicholas Z Muller, Christopher W Tessum, Jason Hill, Julian Marshall and Peter J Adams. "An inter-comparison of air quality social cost estimates from reduced-complexity models." Environmental Research Letters, (2019).
Article	February 2019	United States	Uses COBRA as part of an effort to explore the health impacts of freight truck and trail transport under various policy scenarios.	https://www.nature.com/articles/s41893-019-0224-3	Liang Liu, Taesung Hwang, Sungwon Lee, Yanfeng Ouyang, Bumsoo Lee, Steven J. Smith, Christopher W. Tessum, Julian D. Marshall, Fang Yan, Kathryn Daenzer & Tami C. Bond. "Health and climate impacts of future United States land freight modelled with global-to-urban models." Nature Sustainability, 2, 105–112 (2019).
Article	February 2019	Nevada, United States	Uses COBRA to evaluate the health impacts of transitioning from diesel to CNG buses in Clark County, NV. Estimates $0.98-$2.48 billion per year in health benefits, 114-258 premature deaths, and >5000 avoided respiratory and cardiovascular illnesses.	https://www.mdpi.com/1660-4601/16/5/720	Olawepo, John O., and L-W. Antony Chen. "Health Benefits from Upgrading Public Buses for Cleaner Air: A Case Study of Clark County, Nevada and the United States." *International Journal of Environmental Research and Public Health* 16, no. 5 (2019): 720.
Article	December 2018	United States	Uses COBRA to estimate health impacts of rolling back environmental regulations on coal-fired power plants. Estimates 17,000 - 39,000 increased mortalities per year. Compares impacts to voting patterns in 2016 election.	https://www.sciencedirect.com/science/article/pii/S0301421518306277X	Thomson, Vivian, Kelsey Huelsman, and Dominique Ong. "Coal-fired power plant regulatory rollback in the United States: Implications for local and regional public health." Energy Policy: 123: 558-568 (2018).
Article	September 2018	United States	Uses COBRA to evaluate the health impacts of electricity capacity expansion models to incorporate the health impacts into optimization of electricity planning. Estimates $1,013 billion in societal costs.	https://www.sciencedirect.com/science/article/abs/pii/S0360544218317584	Rodgers, Mark D., David W. Coit, Frank A. Felder, and Annmarie Carlton. "Generation expansion planning considering health and societal damages–A simulation-based optimization approach." Energy 164 (2018): 951-963.

Publication type	Date Published	Location	Summary	URL	Citation
Report	July 2018	United States	Uses COBRA to evaluate the health impacts of electricity capacity expansion models to incorporate the health impacts into optimization of electricity planning.	https://www.sciencedirect.com/science/article/pii/S0038012117302823	Rodgers, Mark, David Coit, Frank Felder, and Annmarie Carlton. "Assessing the effects of power grid expansion on human health externalities." (2018).
Report	July 2018	United States	Adds functionality similar to COBRA to Engineering, Economic, and Environmental Electricity Simulation Tool (E4ST). The authors met with Abt Associates to understand the functionality of COBRA, including the S-R Matrix and atmospheric chemistry. Estimates 352-815 premature deaths from additional emissions compared to 24-53 premature deaths when other nuclear power policies are implemented.	http://www.rff.org/files/document/file/RFF%20WP%2018-18.pdf	Shawhan, Daniel, and Paul Picciano. "Retirements and Funerals: The Emission, Mortality, and Coal-Mine Employment Effects of a Two-Year Delay in Coal and Nuclear Power Plant Retirements." (2018)
Article	March 2018	United States	Uses COBRA to estimate the projected health effects for the average reduction in SO_2 and NO_x in 2025 from a $25 carbon tax. Results are on the order of 3,500–8,000 avoided cases of premature mortality and 90,000 avoided cases of exacerbated asthma. This corresponds roughly to a monetized value of $31–71 billion in health benefits (3% discount rate), with the bulk of the benefits accruing in the upper Midwest and East Coast.	https://www.worldscientific.com/doi/pdf/10.1142/S2010007818400031	Barron, Alexander R., Allen A. Fawcett, Marc AC Hafstead, James R. McFarland, and Adele C. Morris. "Policy insights from the EMF 32 study on US carbon tax scenarios." Climate Change Economics 9, no. 01 (2018): 1840003.
Report	March 2018	United States	COBRA is listed and described in "Methodologies for Calculating the Damage per Unit of Emissions for Pollutants that Depend on Time and Location" section. Estimates the dollar value per MWh of SO_2 ($52-171), NO_x ($3-12), and $PM_{2.5}$ ($7-22) and the value of avoided emissions from two natural gas power plants ($30-40/MWh).	http://policyintegrity.org/files/publications/Valuing_Pollution_Reductions.pdf	Shrader, Jeffrey, Burcin Unel, and Avi Zevin. "Valuing Pollution Reductions." (2018).

Publication type	Date Published	Location	Summary	URL	Citation
Report	February 2018	United States	Analyzes the health impacts of a hypothetical 15% reduction in energy consumption nationwide. Uses AVERT to estimate emission reductions and COBRA to find avoided health harms per capita in states and cities with the highest being $184/per capita in West Virginia and $210/per capita in Pittsburgh. Also finds the avoided costs of adult mortality, nonfatal heart attacks, minor restricted-activity days, infant mortality, lost work days, and respiratory-related symptoms totaling $630,431,926.	http://efficiencyforall.org/wordpress/wp-content/uploads/2017/04/h1801.pdf	Hayes, S. and Kubes, C., Saving Energy, Saving Lives. (2018).
Article	February 2018	United States	Analyzes the general equilibrium costs of climate policies that levy taxes on carbon dioxide (CO_2) emissions in the United States and return the revenue in the form of lump-sum rebates and tax relief over the years 2020 to 2040. Uses the US regional version of the Applied Dynamic Analysis of the Global Economy (ADAGE-US) forward-looking dynamic Computable General Equilibrium (CGE) model for this analysis. Uses COBRA to approximate the value of co-benefits to these policies that arise from concomitant reductions in non-greenhouse gas (GHG) emissions. Finds co-benefits per household, including $PM_{2.5}$ co-benefits ($547-$1,234), avoided mortality ($539-$1,217), and avoided morbidity ($3-$12).	https://www.worldscientific.com/doi/abs/10.1142/S2010007818400067	Woollacott, Jared. "The economic costs and co-benefits of carbon taxation: A general equilibrium assessment." Climate Change Economics 9, no. 01 (2018): 1840006.

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Environ-mental Impact Statement	February 2018	New York, United States	Draft EIS for New York State's procurement of 2,400 MW of off-shore wind energy uses COBRA to estimate how the emission reductions from implementation off-shore wind energy would affect ambient air quality and adverse health impacts throughout the coastal region. Finds that the implementation of 2,400 MW of offshore wind energy would result in 8 to 18 fewer premature deaths annually and would avoid multiple adverse health outcomes in 2030 across the northeast United States.	https://tethys.pnnl.gov/publications/draft-generic-environmental-impact-statement-procurement-offshore-wind	New York State Department of Public Service and Ecology and Environment, Inc. "Draft Generic Environmental Impact Statement for Procurement of Offshore Wind" (2018).
Report	January 2018	New York, United States	Final report and master plan for New York State's procurement of 2,400 MW of off-shore wind energy uses COBRA to estimate how the emission reductions from implementation of off-shore wind energy would affect ambient air quality and adverse health impacts throughout the coastal region. Found that the implementation of 2,400 MW of offshore wind energy would result in 8 to 18 fewer premature deaths annually and would avoid multiple adverse health outcomes in 2030 across the northeast United States.	https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Offshore-Wind-in-New-York-State-Overview/NYS-Offshore-Wind-Master-Plan	New York State Energy Research and Development Authority. "New York State Offshore Wind Master Plan: Charting a Course to 2,400 Megawatts of Offshore Wind Energy" (January 2018).
Public Comments	January 2018	United States	Uses results from COBRA in developing public comments on the proposed Glider Vehicles Rule to estimate the potential public health impacts that could occur should glider vehicles go unregulated. Finds that controlling emissions of these vehicles would reduce 70-160 premature deaths and generate $0.3-$1.1 billion worth of health benefits.	https://www.edf.org/sites/default/files/content/Appendix%20B%20-%20Emission%20and%20Health%20Effects%20of%20Glider%20Vehicles.pdf	Environmental Defense Fund Comment on EPA Proposed Glider Vehicles Rule, Docket ID EPA-HQ-OAR-2014-0827. "Appendix B: Potential Emission and Health Impacts of Glider Kits" (Submitted January 5, 2018).

Publication type	Date Published	Location	Summary	URL	Citation
Report	December 2017	Virginia, United States	Uses COBRA to analyze the effects of whether Virginia linked to RGGI and established its CO_2 Budget Trading Program. The EPA uses two sets of assumptions: the RGGI Scenario and the Virginia (VA) Scenario. Finds that the RGGI Scenario would reduce mortality 5.3-12 by 2029 and the VA Scenario would reduce mortality 4.4-10 by 2029.	http://townhall.virginia.gov/L/GetFile.cfm?File=C:%5CTownHall%5Cdocroot%5C1%5C4818%5C8130%5CEIA_DEQ_8130_v2.pdf	Virginia Department of Planning and Budget, Economic Impact Analysis (2017).
Article	November 2017	Ohio, United States	Uses COBRA to estimate the economic value of health effects under various scenarios of opting out of energy efficiency programs. Finds the increase health costs of opting out are $564-$1.3 billion in Ohio and $4.1-$9.3 billion in the greater region.	https://www.sciencedirect.com/science/article/pii/S1040619017302440	Baatz, Brendon, Grace Relf, and Meegan Kelly. "Consequences of large customer opt-out: An Ohio example" The Electricity Journal
Report	October 2017	United States	Uses COBRA to calculate avoidable health care costs for acute myocardial infarctions, other cardiovascular diseases, asthma, and respiratory conditions to measure the benefits of urban tree planting. Finds that the avoidable annual health care costs could be $13.2 million and work loss costs could be $11.9 million (12.5 percent of the estimated annual costs for tree planning and maintenance).	https://global.nature.org/content/funding-trees-for-health	The Nature Conservancy. McDonald, R., Aljabar, L., Aubuchon, C., Birnbaum, H., Chadler, C., Toomey, B., Daley, J., Jimenez, W., Trieschman, E., Paque, J., Zeiper, M. "Funding Trees for Health: An Analysis of Finance and Policy Actions to Enable Tree Planting for Public Health." October 2017.
Article	August 2017	United States	Uses COBRA to estimate the value of reductions to the pollutants SO_2, NO_x, and $PM_{2.5}$, as part of use a suite of models also including EASIUR, the impact factor model developed in Penn et al. and Levy et al., Air Pollution Emission Experiments and Policy analysis model (AP2, formerly APEEP: Muller et al.), and EPA RIA benefits per-tonne estimates. Finds cumulative benefits of $29.7-$112.8 billion from 3,000-12,700 avoided premature mortalities.	https://www.nature.com/articles/nenergy2017134	Millstein, Dev, Ryan Wiser, Mark Bolinger, and Galen Barbose. "The climate and air-quality benefits of wind and solar power in the United States," Nature Energy 6. August 2017.

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Publication type	Date Published	Location	Summary	URL	Citation
Disserta-tion	August 2017	United States	Uses COBRA to estimate the estimate of air-pollution costs by modes of transportation. Finds human health externality unit costs to be $0.57/vehicle mile traveled and $0.91/passenger mile traveled.	http://tigerprints.clemson.edu/all_dissertations/2018/	Sun, Jianan. "External Economic Costs of Intelligent Urban Transportation Systems: A Method to Evaluate the Externalities of Comparative Technology Adoption Pathways in the Urban Mobility Service sector." Clemson University, PhD Thesis. August 2017.
Report	June 2017	Ohio, United States	Uses COBRA to estimate the economic value of health effects under various scenarios of opting out of energy efficiency programs. Finds the increase health costs of opting out are $564-$1.3 billion in Ohio and $4.1-$9.3 billion in the greater region.	https://aceee.org/sites/default/files/publications/researchreports/u1706.pdf	Baatz, Brendon, Grace Relf, and Meegan Kelly. "Large Customer Opt-Out: An Ohio Example." American Council for an Energy-Efficient Economy, Report U1706. June 2017.
Disserta-tion	June 2017	Michigan, United States	Uses COBRA to estimate the health impacts from reductions in SO_2 and NO_x due to energy savings from light programs in Michigan. Finds benefits from avoided pollutants to be $36-$81 million.	http://scholarworks.wmich.edu/dissertations/3145/	Amough, Teryila Ephraim. "A Meta-Analysis of Energy Savings from Lighting Programs in Michigan." Western Michigan University, PhD Thesis. June 2017.
Article	April 2017	N/A	Compares InMAP outputs to outputs from WRF-Chem and COBRA. Finds that COBRA performs similarly to InMAP but not as much spatial detail as WRF-Chem.	http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0176131	Tessum, C. W., Hill, J. D., and Marshall, J. D. "InMAP: A model for air pollution interventions." *PloS one*. April 2017.
Report	January 2017	United States	Does not use COBRA, but explains that this inventory of emissions from agriculture and livestock could be coupled with an air quality screening tool such as COBRA to evaluate potential changes in human health from changes in emissions concentrations.	https://energy.gov/sites/prod/files/2017/02/f34/2016_billion_ton_report_volume_2_chapter_9.pdf	U.S. Department of Energy. January 2017. 2016 Billion-Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy, Volume 2: Environmental Sustainability Effects of Select Scenarios from Volume 1. R.A. Efroymson, M.H. Langholtz, K.E. Johnson, and B.J. Stokes (Leads), ORNL/TM-2016/727. Oak Ridge National Laboratory, Oak Ridge, TN.
Report	January 2017	United States	Uses COBRA to estimate how changes in NO_x and SO_2 affect ambient $PM_{2.5}$. Finds the health impacts of the Regional Greenhouse Gas Initiative to be 300-830 lives saved, 8,200 asthma attacks avoided, 39,000 lost work days avoided, and $5.7 billion in health savings and other benefits.	https://www.abtassociates.com/insights/publications/report/analysis-of-the-public-health-impacts-of-the-regional-greenhouse-gas	Abt Associates (2017). Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative.

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Working Paper	November 2016	United States	Analyzes COBRA as a tool to measure the impacts of energy efficiency in buildings. Finds that COBRA has an interactive approach, with a policy scope, is used at the design stage of policy, and has a targeting city focus.	http://www.sustainablesids.org/wp-content/uploads/2016/12/UNEP-Tools-Energy-Efficient-Buildings-2016.pdf	Petrichenko, K., Aden, N., & Tsakiris, A. (2016). Tools for Energy Efficiency in Buildings. A Guide for policy-makers and experts. Working paper, C2E2, Copenhagen and WRI, Washington DC For further information or to provide feedback, please contact Ksenia Petrichenko.
Article	September 2016	United States	Uses COBRA to calculate reduced morbidity and mortality outcomes and total monetary value from net emissions changes due to state RPS programs. Finds reduced air pollution provide $5.2 billion in health and environmental benefits.	http://www.sciencedirect.com/science/article/pii/S0301421516303408	Barbose, Galen, et al. "A retrospective analysis of benefits and impacts of US renewable portfolio standards." Energy Policy 96 (2016): 645-660.
Working Paper	September 2016	N/A	References COBRA as "an example of a framework for air quality improvements that can be used to quantify changes in air quality and the resulting calculated health outcomes in both epidemiological and monetary terms. COBRA as well as other work from the US EPA suggests that measures for producing both local air quality and associated GHG co-benefits offer compelling value for health and wellbeing that can be pursued irrespective of a climate change agenda. As understanding grows and data become more readily available, frameworks and analyses can consider additional co-benefits such as ecosystem benefits or avoided material damages, as well as potential economic opportunities to develop and deploy innovative clean technologies (US EPA 2004)."	http://eprints.lse.ac.uk/68876/1/Cobenefits_Of_Urban_Climate_Action.pdf	Floater, Graham, et al. "Co-benefits of urban climate action: a framework for cities." (2016).
Article	September 2016	N/A	Analyzes COBRA as part of a survey of tools to measure ambient air pollution health risks. This paper discusses the differences between tools for factors such as information source, format, and technical complexity.	https://www.ncbi.nlm.nih.gov/pubmed/26742852	Anenberg, Susan C., Anna Belova, Jørgen Brandt, Neal Fann, Sue Greco, Sarath Guttikunda, Marie-Eve Heroux et al. "Survey of ambient air pollution health risk assessment tools." *Risk Analysis* (2015).

Publication type	Date Published	Location	Summary	URL	Citation
Article	July 2016	United States	Uses COBRA to analyze the social costs of $PM_{2.5}$ pollution in 3,000 U.S. counties. Finds the marginal social costs for SO_2 ($10^4/t), NO_x ($10^3-10^4/t) and NH_3 ($10^{3.5}-10^{4.5}/t).	http://www.sciencedirect.com/science/article/pii/S1352231016303090	Heo, J., Adams, P. J., & Gao, H. O. (2016). Reduced-form modeling of public health impacts of inorganic PM 2.5 and precursor emissions. *Atmospheric Environment*, *137*, 80-89.
Report	July 2016	Ohio, United States	COBRA is used to model health impacts from each power plant in Ohio using estimated primary $PM_{2.5}$ and historic NO_x and SO_2 emissions. Finds that $PM_{2.5}$ emissions from power plants account for 940- 2130 premature deaths/year and Clean Power Plan implementation would reduce health burdens by $8.1-18.2 billion.	https://www.psehealthyenergy.org/wp-content/uploads/2017/04/CPP.OH_1.pdf	PSE Healthy Energy. The Clean Power Plan in Ohio: Analyzing power generation for health and equity. July 2016.
Report	July 2016	Pennsylvania, United States	COBRA is used to model health impacts from each power plant in Pennsylvania using estimated primary $PM_{2.5}$ and historic NO_x and SO_2 emissions. Found that power plant emissions contribute to 1,000-2,300 premature deaths and the Clean Power Plan will reduce health burdens by $8.9-$20 billion.	https://www.psehealthyenergy.org/our-work/publications/archive/our-air-health-and-equity-impacts-of-pennsylvanias-power-plants/	PSE Healthy Energy. The Clean Power Plan in Pennsylvania: Analyzing power generation for health and equity. July 2016.
Report	June 2016	California, United States	COBRA is used to estimate the health effects from reduced SO_2 or NO_x emissions resultant from the California Energy Commission's 2016 proposed efficiency standards for computers, computer monitors, and signage displays. Estimates health benefits to be $4.7-$10.6 million from 2018-2030.	http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/documents/SRIA_APPEFF_2016_All.pdf	Roland-Host, David; Evans, Samuel; Han Springer, Cecilia; Emmer, Tessa; Prepared for California Energy Commission. "Standardized Regulatory Impact Assessment: Computers, Computer Monitors, and Signage Displays." June 2016.
Article	May 2016	United States	Uses COBRA as part of a reduced-form model to estimate the mortality costs per tonne of PM2.5 inorganic air pollution. Estimates the aggregate social costs to be $1.0 trillion.	http://pubs.acs.org/doi/abs/10.1021/acs.est.5b06125	Heo, J., Adams, P. J., & Gao, H. O. (2016). Public Health Costs of Primary PM2. 5 and Inorganic PM2. 5 Precursor Emissions in the United States. *Environmental science & technology*, *50*(11), 6061-6070.

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Publication type	Date Published	Location	Summary	URL	Citation
Public Comments	May 2016	District of Columbia, United States	COBRA is used to estimate the effect of reduced air pollution on premature deaths and economic growth due to improved health outcomes. Finds clean energy measures will prevent 27-60 premature deaths and increase regional economic growth by $253-$572 million from improved health outcomes.	http://chesapeakeclimate.org/wp/wp-content/uploads/2016/05/CCAN_B21-0650_testimony_DC-RPS.pdf	Chesapeake Climate Action Network. Comments on B21-0650 – Renewable Portfolio Standard Expansion Amendment Act of 2016.
Article	May 2016	United States	COBRA is used to quantify the health and economic impacts of extra NO_x emissions attributable to non-compliant Volkswagen vehicles in the U.S. Finds extra NO_x emissions for one year equal 5-50 premature deaths, 247-1,061 episodes of respiratory symptoms, 3-14 cardiovascular hospital emissions, 3-13 emergency asthma visits, 687-17,526 work days with restricted activity, and economic costs of $43,479-$432,268,502.	http://www.mdpi.com/1660-4601/13/9/891/html	Hou, Lifang; Zhang, Kai; Luthin, Moira A.; Baccarelli, Andrea A. (2016). Public Health Impact and Economic Costs of Volkswagen's Lack of Compliance with the United States' Emission Standards. *Int. J. Environ. Res. Public Health.* 13(9): 891.
Report	May 2016	United States	COBRA is used to estimate air quality benefits of the 20 GW of solar power installed by the end of 2014 by region or state. Finds emissions reductions would result in $420-1,590 million per year in benefits, higher in regions with high population densities and greater power-sector emissions (e.g., Great-Lakes-Mid-Atlantic).	https://www.nrel.gov/docs/fy16osti/65628.pdf	Wiser, Ryan, Trieu Mai, Dev Millstein, Jordan Macknick, Alberta Carpenter, Stuart Cohen, Wesley Cole, Bethany Frew, and Garvin Heath. 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 (LBNL) and National Renewable Energy Laboratory (NREL). Powered by SunShot U.S. Department of Energy. May 2016.

Publication type	Date Published	Location	Summary	URL	Citation
Report	January 2016	United States	Uses COBRA to calculate reduced morbidity and mortality outcomes and total monetary value from net emission changes. Finds health and environmental benefits (primarily from SO_2, NO_x, and $PM_{2.5}$ reductions) to be between $4-$10 billion. Additional benefits include avoiding 160-290 emergency room visits for asthma, 195-310 hospital emissions for respiratory and cardiovascular symptoms, 40-560 non-fatal heart attacks and 38,000-64,000 lost work days.	https://emp.lbl.gov/sites/all/files/lbnl-1003961.pdf	U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) and National Renewable Energy Laboratory (NREL) January 2016 "A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards, released January 2016" https://emp.lbl.gov/sites/all/files/lbnl-1003961.pdf
Report	January 2016	United States	COBRA is used to calculate reduced morbidity and mortality outcomes and total monetary value from net emissions changes due to state RPS programs. Finds health and environmental benefits (primarily from SO_2, NO_x, and $PM_{2.5}$ reductions) to be between $4-$10 billion. Additional benefits include avoiding 160-290 emergency room visits for asthma, 195-310 hospital emissions for respiratory and cardiovascular symptoms, 40-560 non-fatal heart attacks and 38,000-64,000 lost work days.	http://www.nrel.gov/docs/fy16osti/65005.pdf	Wiser, R., G. Barbose, J. Heeter, T. Mai, L. Bird, M. Bolinger, A. Carpenter, G. Heath, D. Keyser, J. Macknick, A. Mills, and D. Millstein. 2016. *A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards*. Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory. NREL/TP-6A20-65005.
Conference proceeding	November 2015	United States	COBRA is used to estimate the health co-benefits from different scenarios of renewable energy deployment in the United States by converting changes in air pollutant emissions to changes population health outcomes.	https://apha.confex.com/apha/143am/webprogram/Paper336283.html	Bast, E. (2015, November). Analyzing the health co-benefits of renewable energy deployment in the United States. In *2015 APHA Annual Meeting & Expo (Oct. 31-Nov. 4, 2015)*. APHA.
Article	September 2015	Utah, United States	Uses COBRA to estimate the benefits associated with a seasonal gas tax to reduce vehicle trips in Cache Valley, Utah. Estimates the total health benefit to be $782,750.	http://link.springer.com/article/10.1007/s10640-015-9968-z	Moscardini, Leo and Arthur J. Caplan (2015) "Controlling Episodic Air Pollution with a Seasonal Gas Tax: The Case of Cache Valley, Utah." Environmental and Resource Economics

Publication type	Date Published	Location	Summary	URL	Citation
White Paper	July 2015	New York, United States	COBRA is used to estimate the marginal cost in health effects of SO_2 or NO_x emissions. The authors run a scenario for each pollutant by specifying a reduction of a fixed amount of emissions from the COBRA control case for electricity generating units in NY. Find the dollar/MWh value for SO_2, NO_x, and CO_2 for 2017-2035. 2035 estimates are $42-78/MWh.	http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/26be8a93967e604785257cc40066b91a/$FILE/Staff_BCA_Whitepaper_Final.pdf	New York Department of Public Service. Staff White Paper on Benefit-Cost Analysis in the Reforming Energy Vision Proceeding (14-M-0101). July 2015.
Article	March 2015	N/A	References COBRA as a computational tool to evaluate energy policy and planning alternatives in order to determine which scenarios are most likely to meet climate and energy goals.	http://www.sciencedirect.com/science/article/pii/S2214629614001364	Bridges, A.; Felder, F.A.; McKelvey, K.; Niyogi, I. (2015). Uncertainty in energy planning: Estimating the health impacts of air pollution from fossil fuel electricity generation. Energy Research & Social Science 6, 74-77.
Report	February 2015	California, United States	Uses COBRA model for the Energy Commission's first "Standardized Regulator Impact Assessment" for appliance efficiency standards division. Estimates proposed standards would avoid $1.0-$2.3 million in health impacts in the first year. By 2025, the range increases to $5.8 -$14.8 million.	https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=15-AAER-01	REVISED STANDARDIZED REGULATORY IMPACT ASSESSMENT OF 2014 PROPOSED APPLIANCE EFFICIENCY REGULATIONS: Regulations for Toilets, Urinals, Faucets, Dimming Ballasts, Air Filters, and Heat-Pump Water-Chilling Packages
Book	January 2015	N/A	COBRA is used to value the avoided health impacts from the reduction in air quality pollutants from electric drive vehicles.	http://www.routledge.com/books/details/9781138811102/	Link, A.N., O'Connor, A.C., & Scott, T.J. (2015). Battery Technology for Electric Vehicles: Public Science and Private Innovation. Abingdon, UK: Routledge.
Article	January 2015	N/A	Results from InMAP, a comprehensive air quality model for estimating the air pollution health impacts of emission reductions and other potential interventions, are compared against COBRA because it is an existing reduced-form model.	http://www.geosci-model-dev-discuss.net/8/9281/2015/gmdd-8-9281-2015.pdf	C. W. Tessum, J. D. Hill, and J. D. Marshall. (2015). InMAP: a new model for air pollution interventions. Geosci. Model Dev. Discuss., 8, 9281–9321. Doi: 10.5194/gmdd-8-9281-2015.
Working Paper	November 2014	N/A	Explains COBRA's use in calculating morbidity endpoints including mortality, chronic bronchitis, non-fatal heart attaches, respiratory hospital admissions, and acute bronchitis, among others.	http://www.theicct.org/sites/default/files/publications/ICCT_morbidities_20141112.pdf	Chambliss, S. et al. (2014). Morbidities Calculation: Guidelines and Walkthrough. The International Council on Clean Transportation. Working Paper 2014-10.

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Working Paper	November 2014	United States	Uses COBRA to measure the health impacts from current electricity generation infrastructure. SO_2 and NO_x pollutants are expected to add $125 billion to health care costs in 2013, leading to 18,000 premature deaths, 27,000 cases of acute bronchitis, 240,000 episodes of respiratory distress, and 2.3 million lost work days.	https://www.edf.org/sites/default/files/edf_laitner-mcdonnell-energy-efficiency-as-a-pollution-control-technology.pdf	Laitner, J.A.; McDonnell, M.T. (2014). Energy Efficiency as a Pollution Control Technology and a Net Job Creator under Section 111(d) Carbon Pollution Standards for Existing Power Plants. Working paper prepared for the Environmental Defense Fund.
Report	August 2014	United States	Uses COBRA to evaluate the health impacts of energy efficiency and renewable energy research and development programs. Finds avoided incidences and monetary benefits of adult and infant mortality, heart attacks, hospital admissions, respiratory symptoms, and work loss days, resulting in $17.7-$45.2 million in benefits.	https://energy.gov/sites/prod/files/2015/05/f22/evaluating_realized_rd_mpacts_9-22-14.pdf	O'Connor, Alan C., and Ross J. Loomis. "Evaluating Realized Impacts of DOE/EERE R&D Programs." (2014).
Report	April 2014	United States	Uses COBRA to measure the health impacts of four state policies to improve energy efficiency. Finds ACEEE scenario would avoid over 147,000 asthma attacks, 5000 premature deaths, and $100 million due to lost work days.	http://climateandenergy.org/resources/ACEEE111droleofefficiency.pdf	American Council for an Energy-Efficient Economy. (2014). Change Is in the Air: How States Can Harness Energy Efficiency to Strengthen the Economy and Reduce Pollution.
Master's Thesis	January 2014	Utah, United States	COBRA is used to estimate Cache County's potential public health savings from a seasonal gas tax. Finds benefits to be $479,403-$1,086,075.	http://digitalcommons.usu.edu/etd/3870	Moscardini, Leo A., "Estimating the Effectiveness of a Seasonal Gas Tax for Controlling Episodic PM2.5 Concentrations in Cache County, Utah" (2014). All Graduate Theses and Dissertations. Paper 3870.
Report	December 2013	United States	Uses COBRA to quantify and monetize the value of changes in the incidence of avoided adverse health events associated with emissions reductions. Finds avoided incidences and economic value for mortality, respiratory and cardiovascular measures, and work loss days, totalling $1.76-$45.2 million.	https://www1.eere.energy.gov/analysis/pdfs/2013_bca_vto_edvs.pdf	Link, Albert N., et al. "Benefit-Cost Evaluation of US DOE Investment in Energy Storage Technologies for Hybrid and Electric Cars and Trucks." (2013).

Publication type	Date Published	Location	Summary	URL	Citation
Article	February 2013	California and Idaho, United States	Uses COBRA to calculate the benefits of wind energy derived from two locations: a 580 MW wind farm at Altamont Pass, CA, and a 22 MW wind farm in Sawtooth, ID. The turbines in CA will likely avoid $560 million-$4.38 billion in health costs and the ID turbines will likely avoid $18-104 million.	https://www.sciencedirect.com/science/article/pii/S0301421512009696X	McCubbin, D. and Sovacool, B.K. (2013). Quantifying the health and environmental benefits of wind power to natural gas. Energy Policy 53, 429–441.
Book	January 2013	N/A	Analyzes COBRA as a tool for program evaluation to discuss the many factors that affect the utility of each technique and how that impacts the technological, economic and societal forecasts of the programs in question.	https://www.e-elgar.com/shop/handbook-on-the-theory-and-practice-of-program-evaluation	O'Connor, A. et al. "Estimating avoided environmental emissions and environmental health benefits" Chapter 9, *Handbook on the Theory and Practice of Program Evaluation* (2013): 247.
Article	November 2012	United States	"In this example, the original air quality modeling entailed a significant investment of time and resources, but the resulting benefit per ton estimates enable analysts to quickly estimate benefits. In other approaches, a simplified air quality model is developed based on the responsiveness of ambient pollutant levels to changing emissions. These source–receptor relationships are then used to calculate health impacts and benefits. Though the development of the air quality model is resource intensive, its subsequent application to various policy scenarios is not." Finds the value of reducing directly emitted $PM_{2.5}$ and NOx ranges between approximately $1,300 for reducing a ton of NO_x from Ocean-Going Vessels to about $450,000 for reducing a ton of directly emitted $PM_{2.5}$ from Iron and Steel facilities.	http://www.sciencedirect.com/science/article/pii/S0160412012001985	Fann, N., Baker, K. R., & Fulcher, C. M. (2012). Characterizing the PM 2.5-related health benefits of emission reductions for 17 industrial, area and mobile emission sectors across the US. *Environment international*, *49*, 141-151.
Working Paper	July 2012	North Carolina, United States	Uses COBRA to determine the portion of Clean Smokestacks emissions reduction benefits realized in North Carolina under the Clean Smokestacks Act. Finds mortality benefits from reduced SO_2 emissions to equal $6.365-$16.032 million.	http://nicholasinstitute.duke.edu/climate/policydesign/benefits-of-early-state-action-in-environmental-regulation-of-electric-utilities/	Hoppock, David, et al. "Benefits of early state action in environmental regulation of electric utilities: North Carolina's clean smokestacks act." *Nicholas Institute for Environmental Policy Solutions, Duke University: Durham, NC* (2012).

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Publication type	Date Published	Location	Summary	URL	Citation
Article	January 2012	California, United States	Uses COBRA to estimate the health impacts of plug-in electric vehicles in California. Estimates the value of benefits at $750 to $1,500 per vehicle in an expected PEV penetration scenario and $1,000 to $2,500 per vehicle in an aggressive penetration scenario.	https://journals.sagepub.com/doi/10.3141/2287-19	Witt, M. et al. (2012). Plug-in Vehicles in California: Review of Current Policies, PEV-Related Emissions Reductions for 2020, and Policy Outlook.
Book	January 2012	N/A	Uses COBRA to measure the health impacts from decreases $PM_{2.5}$, SO_2, and NO_x from public investments in energy technologies. Finds adverse health incidences to be $90,500 (on-grid centralized systems), $11.8 million (grid-connected distributed systems), and $28.7 million (off-grid systems).	https://www.e-elgar.com/shop/public-investments-in-energy-technology	Gallaher, Michael P., Albert N. Link, and Alan O'Connor. *Public Investments in Energy Technology*. Edward Elgar Publishing, 2012.
Article	November 2011	United States	Uses COBRA to estimate the health benefits of wind power. The turbines in CA will likely avoid $560 million-$4.38 billion in health costs and the ID turbines will likely avoid $18-104 million.	http://www.sciencedirect.com/science/article/pii/S1040619011002351	McCubbin, Donald, and Benjamin K. Sovacool. "The hidden factors that make wind energy cheaper than natural gas in the United States." *The Electricity Journal* 24.9 (2011): 84-95.
Book	January 2011	United States	Uses COBRA to estimate the health costs of air pollution by mode of transportation including road, rail, air, and water. Estimates air-pollution costs by road (LDVG: 0.91¢/pmt; HDVD: ¢1.55/tm), rail (¢0.35/tm), air (¢0.39/pmt; ¢1.88/tm) and water (¢1.74/tm).	https://escholarship.org/uc/item/13n8v8gq	Delucchi, Mark, and Don McCubbin. "External costs of transport in the United States." Chapter 15 in *A Handbook of Transport Economics* (2011): 341.
Report	August 2010	United States	Uses COBRA to calculate the health benefits of reductions in air pollutants resulting from using PV systems rather than the next best technology alternative for electricity production. Estimates environmental health benefits to be to be $237 million.	https://energy.gov/sites/prod/files/2015/05/f22/solar_pv.pdf	O'Connor, Alan C., Ross J. Loomis, and Fern M. Braun. "Retrospective Benefit-Cost Evaluation of DOE Investment in Photovoltaic Energy Systems." *RTI International* (2010).

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Report	August 2010	United States	RTI International (2010): RTI, for the U.S. Department of Energy (DOE), estimates health benefits associated with two types of geothermal technologies in which DOE has invested using COBRA. The study calculates a net reduction in PM, NO_x, and SO_2 associated with geothermal energy produced by geothermal plants that otherwise would have been produced by fossil fuel plants. Total environmental health benefits are estimated to be $155.7 million.	https://www.energy.gov/sites/prod/files/2014/02/f7/gtp_benefit-cost_eval_aug2010.pdf	Retrospective Benefit-Cost Evaluation of U.S. DOE Geothermal Technologies R&D Program Investments: Impacts of a Cluster of Energy Technologies
Report	June 2010	United States	Uses COBRA to quantify and monetize the value of changes in the incidence of avoided adverse health events associated with emissions reductions from electric vehicle investments. Finds $1,107,053 in avoided mortality and health care incidents.	https://www1.eere.energy.gov/analysis/pdfs/wind_bc_report10-14-10.pdf	Retrospective Benefit–Cost Evaluation of U.S. DOE Wind Energy Program: Impact of Selected Energy Technology Investments
Report	May 2010	United States	"Health benefits associated with reduced diesel fuel consumption and reduced NOx, PM, and Sox emissions are quantified in monetary terms using the COBRA." Finds $53.7 million in health benefits from reduce environmental emissions.	https://www1.eere.energy.gov/analysis/pdfs/advanced_combustion_report.pdf	May 2010 - USDOE EERE Prepared by Albert Link, UNC at Greensboro Dept of Economics, Retrospective Benefit-Cost Evaluation of US DOE Vehicle Combustion Engine R&D Investments: Impacts of a Cluster of Energy Technologies
Report	May 2010	Utah, United States	Mentions COBRA as an option for estimating the co-benefits of emissions reductions from energy efficiency and renewable energy. Finds mortality benefits to be $7.39-7.79/MWh and mobility benefits to be $0.48/MWh.	http://www.synapse-energy.com/sites/default/files/SynapseReport.2010-05.UT-EO.Utah-Co-Benefits.08-064.pdf	Fisher, Jeremy, et al. "Co-Benefits of energy efficiency and renewable energy in Utah." *Synapse Energy Economics* (2010).
Report	January 2010	Iowa, United States	Physicians for Social Responsibility, a non-profit organization, uses COBRA to estimate the health benefits of a scenario in which the percentage of Iowa's electricity generation derived from coal is reduced from its current level of 72% to the national average of 47%. Health benefits total $71.8 million, of which 92.1% were derived from reduced mortality.	https://iowaenvironmentalfocus.org/tag/iowa-coal-health-a-preliminary-mapping-study/	Iowa Coal & Health: A Preliminary Mapping Study

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Article	January 2010	United States	"To estimate health effects from changes in air pollution emissions attributed to the program cluster evaluated, the US Environmental Protection Agency's (EPA) COBRA model (Co-Benefits Risk Assessment Model, described in US EPA [6]) is used. To apply COBRA, it is necessary to enter the estimated changes in air emissions of particulate matter (PM), sulphur dioxide (SO2), nitrogen oxide (NOx), and volatile organic compounds (VOCs) into the model. Because not all air pollutants are taken into account by the model, the results obtained from using COBRA for the analysis is taken as a lower bound estimate of impact of health effects and their economic value. Table 2 shows the health effects included in COBRA, by type of effect. The model provides estimates of the incidence of each type of effect and related healthcare costs."	https://www.witpress.com/Secure/elibrary/papers/EEIA10/EEIA10009FU1.pdf	Ruegg, R. T., and G. B. Jordan. "New benefit-cost methodology for evaluating renewable and energy efficiency programs of the US Department of Energy." *WIT Transactions on Ecology and the Environment* 131 (2010): 95-106.
Article	July 2009	United States	"For each power plant, we estimated the relationship between emissions and incremental contribution to ambient concentrations using an S-R matrix. S-R matrix is a reduced-form model based on the Climatological Regional Dispersion Model, a sector-averaged Gaussian dispersion model that includes wet and dry deposition and first-order chemical conversion of SO2 and NOx to sulfate and nitrate particles. More detail about the model is available elsewhere" Finds the economic valuation premature mortality to be $5.5 million.	http://onlinelibrary.wiley.com/doi/10.1111/j.1539-6924.2009.01227.x/full	Levy, J. I., Baxter, L. K., & Schwartz, J. (2009). Uncertainty and variability in health-related damages from coal-fired power plants in the United States. *Risk Analysis*, *29*(7), 1000-1014.

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Report	July 2009	California, United States	COBRA is analyzed as part of an effort to identify methodological alternatives for quantifying the benefits of renewable energy, including the pros and cons of the tool.	http://www.nrel.gov/docs/fy09osti/45639.pdf	Mosey, Gail, and Laura Vimmerstedt. *Renewable electricity benefits quantification methodology: a request for technical assistance from the California Public Utilities Commission*. National Renewable Energy Laboratory, 2009.
Report	January 2009	Virginia, United States	Abt Associates performs an analysis of the health effects impacts of a proposed coal-fired power plant in Wise County, Virginia. The study estimates that the plant would contribute to two to five premature mortality events annually in Virginia, and five to fourteen premature mortality events nationwide. Total annual economic impacts of health effects in Virginia range from $16 to $52 million, and $44 to $135 million nationwide.	https://www.abtassociates.com/insights/publications/report/assessing-the-economic-impact-of-dominion-virginia-powers-coal-fired	Assessing the Economic Impact of Dominion Virginia Power's Coal-Fired Power Plant in Wise County, Virginia (2009), Abt Associates, Prepared for: Wise Energy for Virginia Coalition c/o Appalachian Voices
Working Paper	November 2007	United States	"For a tool for calculating co-benefits, see Mulholland (2007). For estimates of damages from releases of particulates, sulfur dioxide, and nitrogen oxides in the U.S., see Muller and Mendelsohn (2007)."	http://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1121&context=peri_workingpapers	Boyce, James K., and Matthew Riddle. "Cap and dividend: how to curb global warming while protecting the incomes of American families." (2007).
Article	May 2007	United States	Uses COBRA to model the public health benefits and the change in the spatial inequality of health risk for a number of hypothetical control scenarios for power plants in the United States to determine optimal control strategies. Benefits range from 17,000–21,000 fewer premature deaths per year.	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1867973/	Levy, Jonathan I., Andrew M. Wilson, and Leonard M. Zwack. "Quantifying the efficiency and equity implications of power plant air pollution control strategies in the United States." Environmental health perspectives (2007): 743-750.
Memorandum	April 2007	Wisconsin, United States	Uses COBRA to determine the public health benefits of implementing the NO_x RACT rule. The benefits amount is compared to compliance costs. Finds the NO_x RACT rule would provide $80,000,000/year in public health benefits.	http://dnr.wi.gov/about/nrb/2007/April/04-07-3A1.pdf	DATE: April 9, 2007; TO: Members of the WI Natural Resources Board ; FROM: Scott Hassett, Secretary; SUBJECT: Reasonably Available Control Technology (RACT) program for major sources of nitrogen oxides (NOx) in the moderate ozone nonattainment; http://dnr.wi.gov/air/pdf/AM1705.pdf

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Article	February 2007	United States	"The S–R matrix is a regression-based derivation of output from the Climatological Regional Dispersion Model (CRDM) which uses assumptions similar to the Industrial Source Complex Short Term model (ISCST3). It was developed by Pechan and Associates for Abt Associates and used in past regulatory impact analyses (US Environmental Protection Agency, 1999d). S–R matrix provides a database of transfer factors that summarize the impact that mobile source PM2.5 and precursor emissions from any one county have on ambient PM2.5 concentrations in that county as well as all other counties (Abt Associates, 2003)"	http://www.sciencedirect.com/science/article/pii/S1352231006009654	Greco, S. L., Wilson, A. M., Spengler, J. D., & Levy, J. I. (2007). Spatial patterns of mobile source particulate matter emissions-to-exposure relationships across the United States. *Atmospheric Environment*, *41*(5), 1011-1025.
Article	April 2006	N/A	Other options include the Co-Benefits Risk Assessment (COBRA) model, 34 which features built-in source-receptor atmospheric sensitivity matrices in place of atmospheric modeling by the user to allow quick estimates of the health impacts from various emission sources; the Ozone Risk Assessment Model,35 which operates in a similar fashion to BenMAP; and the Air Strategy Assessment Program, currently under development by EPA to link BenMAP with AirControlNET costing software36 for full-stream assessment of both costs and benefits of attainment options (B. Hubbell, EPA, personal communication, March 8, 2005). These and other tools, along with an improved understanding of the potential role of benefit analysis in integrated air quality management, could provide the necessary impetus for its greater incorporation in upcoming SIP development. Estimates net benefits of alternative control strategies to be between $1.5-1.6 million.	http://www.tandfonline.com/doi/abs/10.1080/10473289.2006.10464524	Chestnut, Lauraine G., David M. Mills, and Daniel S. Cohan. "Cost-benefit analysis in the selection of efficient multipollutant strategies." *Journal of the Air & Waste Management Association* 56.4 (2006): 530-536.

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Report	November 2004	Connecticut, United States	REMI, for EPA and the State of Connecticut, analyze the impacts of oil and natural gas conservation policies in Connecticut. The study integrates estimates of reduced mortality and the value of health improvements from COBRA into a simulation of the impacts of these policies on the state's economy.		Economic Impact of Oil and Natural Gas Conservation Policies, Regional Economic Models, Inc. (2004). Prepared for U.S. EPA and the State of Connecticut.