David W. Keith.

Current Position

Founding Faculty Director
Climate Systems Engineering Initiative

Professor
Department of Geophysical Sciences

The University of Chicago
Henry Hinds Laboratory
5734 South Ellis Avenue
Chicago, IL 60637 USA

(857) 294-2050
davidkeith@uchicago.edu

Education

Ph.D. Massachusetts Institute of Technology, 1991: Experimental Physics, "An Interferometer for Atoms", supervised by David Prichard.

B.Sc. University of Toronto, 1986: Physics.

Citizenship

Canada, United States, and United Kingdom.

Employment

2023–Current: Founding Faculty Director of Climate Systems Engineering Initiative, University of Chicago; Professor, Department of Geophysical Sciences.

2011–2023: Gordon McKay Professor of Applied Physics in the School of Engineering and Applied Sciences (SEAS) and Professor of Public Policy at the Harvard Kennedy School (HKS), Harvard University.

2018–2023: Board Member, Carbon Engineering; President from 2009-2013; Founder in 2009.

2004–2011: University of Calgary, Canada Research Chair in Energy and the Environment; Director and Professor, ISEEE Energy and Environmental Systems Group; Professor, Department of Chemical and Petroleum Engineering; Adjunct Professor, Faculty of Environmental Design, 2007-11, Faculty of Physics and Astronomy, 2010-11, and Department of Economics, 2004-2008.

1999– 2011: Carnegie Mellon University, Department of Engineering and Public Policy, Adjunct Professor, 2004-2011; Assistant Professor, 1999-2003; Adjunct Assistant Professor, 1992-1999; Post-Doctoral Fellow, 1991-1992.

1993–1999: Research Scientist, Harvard University, Department of Earth and Planetary Science.

1992–1993: National NOAA Global Change Fellowship, National Center for Atmospheric Research, Climate Modeling Section.

Awards

Concordia University, Honorary Doctorate, 2022.

Queen Elizabeth II's Diamond Jubilee Medal, 2013.

Time Magazine, Hero of the Environment, 2009.

The City of Calgary Award for Environmental Achievement by an Individual, 2008.

Canadian Geographical Society, Environmental Scientist of the Year, 2006.

MIT Martin Deutsch Prize, MIT's biennial prize for excellence in experimental physics, 1989.

Canadian Association of Physicists, National University Prize Exam, First prize, 1986.

Summary of research contributions

Solar Geoengineering. For better or worse, my work has accelerated research on geoengineering and—far more important—it has helped knit together science and quantitative policy analysis in an arena prone to extremism. Since my 1992 paper which introduced a structured comparison of cost and risk and later review paper that first described the moral hazard and set geoengineering in the post-war history of weather control, I have attempted pragmatic answers to the big questions.

- How unequal? – First quantitative analysis of regional inequality of solar geoengineering.
- How to reduce risks? – First method that could limit the sulfur needed for a given radiative forcing; and, a novel class of self-levitated particles that might limit ozone loss.
- How expensive? – First systematic engineering analysis of deployment technologies.
- How to control? – First quantitative demonstration that feedback can enable partial control of climate in the face of uncertainty.
- What does the public think? – First large-scale survey of public perception.
- How to regulate? – Proposed two-threshold system that combines a deployment moratoria with a pathway for regulating small-scale research.
- How to evaluate trade-offs? – First economic analysis of optimal decisions under uncertainty while supervising the first economics PhD to focus on geoengineering.
- How to do process experiments – Early and detailed experiment design and summary of possible experiments and their rationale.
- Finally, I am the first researcher to write a book on geoengineering for non-specialists: *A Case for Climate Engineering,* MIT Press: 2013.

Climatic Impacts of Wind Power. I led the first quantitative study of the climatic impacts of large-scale wind power. At least thirty studies have subsequently used models and or observations to explore the topic. I led development of a 2015 meeting that brought together a broad range of researchers and environmental policymakers to discuss implications of this work for energy and environmental policy.

Carbon Capture and Storage. Starting with a 1998 policy form in *Science,* I pioneered studies of risk, regulatory policy and public perception of CCS and developed new scientific tools to limit risks.

- Biomass: In 2001, I was among the first to realize that biomass energy with CCS (BECCS) enabled negative emissions, supervised the first PhD on the topic, and was first to address land-use impacts.
- Risk reduction: I developed a novel method for engineering reservoirs to minimize leakage risk by accelerating dissolution and new analytical tools to predict onset of convection.
- The IPPC's the framing and specific language of the "likely more than 99% for 1000 years" leakage estimate in the IPCC special report on CCS came directly from my work—as crosscutting lead author—and my use of a formal expert judgment exercise within the IPCC process.
- Direct capture of CO_2 from air (DAC). I was the first to analyze the role of negative emissions in an optimal climate policy framework with uncertainty. After starting analytic work to critique over-optimistic cost analyses of DAC, I developed a new technology to reduce costs, work that led to the formation of Carbon Engineering which has filed >62 patents, has >150 employees, has a 0.5 kt-CO_2/year pilot plant Squamish, BC, and has a 500 kt-CO_2/year commercial plant under construction in Texas.

Climate Observation. Working for Jim Anderson at Harvard, I lead the development of a new high-accuracy infrared spectrometer that flew on the NASA ER-2 high-altitude aircraft and Arrhenius, a proposed small satellite mission that was a precursor to CLARREO.

Physics. As Dave Prichard's student, I built the first interferometer for atoms. The topic was among the ten "hottest" areas of science that year as measured by the Institute for Scientific Information (ISI), and my publications on this work have been cited over 1000 times.

Current and Selected Past Service

Senior advisor to Secretariat of the Climate Overshoot Commission, 2022 – present.
Highest level political panel to examine carbon removal and solar geoengineering.

Founding member of Geoengineering Modeling Consortium steering committee, 2019 – present.

Member, Carnegie Climate Geoengineering Governance Initiative (C2G2) Advisory Group, 2017-present.

Member, Scientific Steering Group, IPCC Inter-Working Group Expert Meeting on Geoengineering, 2011.

Member, Research Advisory Board, Electric Power Research Institute, 2010-2013.

Member, Task Force on Geoengineering and Climate Change, National Commission on Energy Policy, 2010.

Member, Geoengineering Study Panel, UK Royal Society, 2009.

Member, Canada ecoENERGY Carbon Capture and Storage Task Force, 2007.
Served as the only academic on this seven member panel that included three CEO's and two deputy ministers.

Member, Research Panel on Transitions to Sustainable Energy, InterAcademy Council, 2007.
The IAC is the union of the world's major science academies. I served as one of 15 worldwide experts for their first energy study chaired by Steve Chu and Jose Goldemberg.

Member, Canada National Advisory Panel on Sustainable Energy Science and Technology, 2006.
Served as the only Canadian academic on this ten-member panel.

Lead Author and Chair, Group on Regulation, Legal Issues and Public Perception, IPCC Special Report on Carbon Storage, 2005.
As Chair of one of the three crosscutting groups, my responsibility was roughly equivalent to a "Convening Lead Author". I became the *de facto* crosscutting lead for issues related to timescales and the risk of leakage, one of the most crucial issues for policymakers.

Member, Research Panel on Benefits of Sequestration R&D, U.S. National Academy of Sciences, 2004.

Publications

Books, Edited Volumes, and Thesis

Keith, D. (2013). *A Case for Climate Engineering*, A Boston Review Book, MIT Press.

Rubin E. S., Keith D., and C. F. Gilboy, eds (2005). Volume I: Peer Reviewed Papers and Overviews. *Proceedings of 7th International Conference on Greenhouse Gas Control Technologies*. Vancouver, Canada.

Keith D. W. (1991). An Interferometer for atoms. Thesis, Department of Physics, Massachusetts Institute of Technology, Cambridge, MA.

Journal Articles

This list includes peer-reviewed articles, and a few commentaries archival journals. See davidkeith.earth for a more complete list with PDFs.

***Indicates advised graduate student or post-doctoral researcher under my direct supervision.*

Sharipov, F., Schafer, B., & Keith, D. W. (2024) Modelling the photophoretic force on a perforated membrane. *Physics of Fluids*, **36**.

Parson, E. A. & Keith, D. W. (2024) Solar Geoengineering: History, Methods, Governance, Prospects. *Annual Review of Environment and Resources*, **49**.

*Sun, H., Bourguet, S., Luan, L., Keith, D. (2024) Stratospheric transport and tropospheric sink of solar geoengineering aerosol: a Lagrangian analysis. *npj Climate and Atmospheric Science*, **7**: 115.

Smith, W. & Keith D. W. (2024) Solar geoengineering could start soon if it starts small. *MIT Technology Review*.

*Sun, H., Bourguet, S., Eastham, S., Keith, D. (2023) Optimizing injection locations relaxes altitude-lifetime trade-off for stratospheric aerosol injection. *Geophysical Research Letters, **10**: 1029–2023.*

*Harding, A. R., Keith, D., Yang, W., Vecchi, G. (2023) Impact of solar geoengineering on temperature-attributable mortality. *RFF Working Paper 23-23.*

Kim, J., Jin, L., Schafer, B. C., Jiao, Q., Bertoldi, K., Keith, D. W., Vlassak, J. J. (2023) Ultralight and ultra-stiff nano-cardboard panels: mechanical analysis, characterization, and design principles. *Acta Materialia, **248**: 118782*

*Harding, A.R., Belaia, M., & Keith, D. W. (2023). The value of information about solar geoengineering and the two-sided cost of bias. *Climate Policy*, **23**: 355-365

*Sun, H., Eastham, S., & Keith, D. (2022). Developing a plume-in-grid model for plume evolution in the stratosphere. *Journal of Advances in Modeling Earth Systems*, **14**: e2021MS002816.

Weisenstein, D. K., Visioni, D., Franke, H., Niemeier, U., Vattioni, S., Chiodo, G., Peter, T., & Keith, D. W. (2022). An interactive stratospheric aerosol model intercomparison of solar geoengineering by stratospheric injection of SO_2 or accumulation-mode sulfuric acid aerosols. *Atmospheric Chemistry and Physics*, **22**: 2955–2973.

Keith D. W. (2021). Toward constructive disagreement about geoengineering: A shared taxonomy of concerns may help. *Science*, **374**: 812-815.

Aldy J. E., Felgenhauer T., Pizer W. A ., Tavoni M., Belaia M., Borsuk, M. E., Ghosh A., Heutel G., Heyen D., Horton J., Keith D., Merk C., Moreno-Cruz J., Reynolds J. L., Ricke K., Rickels W., Shayegh S., Smith W., Tilmes S., Wagner G., Wiener J. B. (2021). Social science research to inform solar geoengineering: What are the benefits and drawbacks, and for whom? *Science*, **374**: 815-818.

Behrer, A. P., Park, R. J., Wagner, G., *Golja, C. M., & Keith, D. W. (2021). Heat has larger impacts on labor in poorer areas. *Environmental Research Communications*, **3**: 095001.

Felgenhauer T., Horton J., and D. Keith. (2021). Solar geoengineering research on the U.S. policy agenda: when might its time come? *Environmental Politics,* **31:** 495-518.

*Belaia M., Moreno-Cruz J.B., and D. Keith. (2021). Optimal climate policy in 3D: mitigation, carbon removal, and solar geoengineering. *Climate Change Economics*, **12**: 2150008.

*Golja, C. M., Chew, L. W., Dykema, J. A., & Keith, D. W. (2021). Aerosol Dynamics in the Near Field of the SCoPEx Stratospheric Balloon Experiment. *Journal of Geophysical Research: Atmospheres*, **126:** e2020JD033438.

*Dai, Z., Burns, E. T., Irvine, P. J., Tingley, D. H., Xu, J., and D. W. Keith. (2021). Elicitation of US and Chinese expert judgments show consistent views on solar geoengineering. *Humanities and Social Sciences Communications*, **8**: 1-9.

Eastham, S., Doherty, S., Keith, D., Richter, J., Xia, L. (2021). Improving Models for Solar Climate Intervention Research. Eos. **102**: doi.org/10.1029/2021EO156087.

*Golja, C. M., Chew, L. W., Dykema, J. A., and D. W. Keith. (2021). Aerosol Dynamics in the Near Field of the SCoPEx Stratospheric Balloon Experiment. *Journal of Geophysical Research*, **126**: e2020JD033438.

Yunchao F., Tjiputra J., Muri H., Lombardozzi D., Park C-E., Wu S., and D. Keith. (2021). Solar geoengineering can alleviate climate change pressures on crop yields. *Nature Food*, **2**: 373-381.

Keith, D. and P. Irvine. (2021). The U.S. Can't Go It Alone on Solar Geoengineering. *Environmental Affairs*, **1:** 38-44.

Seeley, J. T., Lutsko, N. J., and D. W. Keith. (2020). Designing a radiative antidote to CO2. *Geophysical Research Letters,* **48**: e2020GL090876.

*Dai, Z., Weisenstein, D. K., Keutsch, F. N., and D. W. Keith. (2020). Experimental reaction rates constrain estimates of ozone response to calcium carbonate geoengineering. *Communications Earth & Environment*, **1**.

Horton, J., Lefale, P., and D. Keith. (2020). Parametric Insurance for Solar Geoengineering: Insights from the Pacific Catastrophe Risk Assessment and Financing Initiative. *Global Policy*, **12:** 97-107.

Mallapragada, D., Gençer, E., Insinger, P., Keith, D., and F. M. O'Sullivan. (2020). Can Industrial-Scale Solar Hydrogen Supplied from Commodity Technologies Be Cost Competitive by 2030? *Cell Reports Physical Science*, **1:** 100174.

Lutsko, N., Seeley, J., and D. Keith (2020). Estimating Impacts and Trade-offs in Solar Geoengineering Scenarios With a Moist Energy Balance Model. *Geophysical Research Letters*, **47**: e2020GL087290.

Keith, D. and P. Irvine (2020). Halving warming with stratospheric aerosol geoengineering moderates policy-relevant climate hazards. Environmental Research Letters, **15**: 044001.

Keith D. and J. Horton (2019). Multilateral parametric climate risk insurance: a tool to facilitate agreement about deployment of solar geoengineering? *Climate Policy,* **7**: 820-826.

Vattioni S., Weisenstein D., Keith D., Feinberg A., Peter T., and A. Stenke (2019). Exploring accumulation-mode H2SO4 versus SO2 stratospheric sulfate geoengineering in a sectional aerosol–chemistry–climate model. *Atmospheric Chemistry and Physics*, **19**: 4877-4897.

Irvine P., Emanuel K., He J., Horowitz L. W., Vecchi G., and D. Keith (2019). Halving warming with idealized solar geoengineering moderates key climate hazards. *Nature Climate Change,* **5:** 295-299.

Miller L. M. and D. W. Keith (2018). Observation-based solar and wind power capacity factors and power densities. *Environmental Research Letters*, **13**: 079501.

Miller L. M. and D. W. Keith (2018). Climatic Impacts of Wind Power. *Joule*, **2:** 2618-2632.

Irvine P. J., Keith D. W., and J. Moore (2018). Brief communication: Understanding solar geoengineering's potential to limit sea level rise requires attention from cryosphere experts. *The Cryosphere*, **12**.

Horton J. B., Reynolds J. L., Buck H. J., Callies D., Schäfer S., Keith D. W., and S. Rayner (2018). Solar Geoengineering and Democracy. *Global Environmental Politics*, **18**: 5-23.

Keith D. W., Holmes G., St. Angelo D., and K. Heidel (2018). A Process for Capturing CO2 from the Atmosphere. *Joule*, **2:** 1573-1594.

Eastham S. D., Weisenstein D. K., Keith D. W., and S. R. H. Barrett (2018). Quantifying the impact of sulfate geoengineering on mortality from air quality and UV-B exposure. *Atmospheric Environment,* **187**: 424-434.

Parker A., Horton J. B., and D. Keith (2018). Stopping Solar Geoengineering Through Technical Means: A Preliminary Assessment of Counter-Geoengineering. *Earth's Future*, **6:** 2058-1065.

MacMartin D. G., Ricke K. L., and D. Keith (2018). Solar geoengineering as part of an overall strategy for meeting the 1.5°C Paris target. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **376**: 20160454.

Smith J. P., Dykema J. A., and D. Keith (2018). Production of Sulfates Onboard an Aircraft: Implications for the Cost and Feasibility of Stratospheric Solar Geoengineering. *Earth and Space Science,* **5**: 150-162.

Eastham S. D., Keith D. W., and S. R. H. Barrett (2018). Mortality tradeoff between air quality and skin cancer from changes in stratospheric ozone. *Environmental Research Letters*, **13**: 034035.

*Dai Z., Weisenstein D. K., and D. W. Keith (2018). Tailoring Meridional and Seasonal Radiative Forcing by Sulfate Aerosol Solar Geoengineering. *Geophysical Research Letters*, **45**: 1030–1039.

Ocko I. B., Hamburg S. P., Jacob D. J., Keith D. W., Keohane N. O., Oppenheimer M., Roy-Mayhew J. D., Schrag D. P., and S. W. Pacala (2017). Unmask temporal trade-offs in climate policy debates. *Science*, **356**: 492–493.

Keith D. W., Wagner G., and C. L. Zabel (2017). Solar geoengineering reduces atmospheric carbon burden. *Nature Climate Change*, **7**: 617–619.

Keith D. (2017). Toward a Responsible Solar Geoengineering Research Program. *Issues in Science and Technology*, **8**: 71-77.

Dykema J. A., Keith D. W., and F. N. Keutsch (2016). Improved aerosol radiative properties as a foundation for solar geoengineering risk assessment. *Geophysical Research Letters*, **43**: 7758–7766.

Keith D., Weisenstein D., Dykema J., and F. Keutsch (2016). Stratospheric Solar Geoengineering without Ozone Loss. *Proceedings of the National Academy of Sciences*, **113**: 14910-14914.

Miller L., Smil V., Wagner G., and D. Keith (2016). Establishing practical estimates for city-integrated solar and PV wind and Stated estimates for city-integrated wind and solar PV are too high. *Science* eLetter.

*****Keith D., Wagner G., and J. Moreno-Cruz (2016). Modeling the effects of climate engineering. *Science*, **352**: 1526–1527.

*Keith D. W., and P. J. Irvine (2016). Solar geoengineering could substantially reduce climate risks — A research hypothesis for the next decade. *Earth's Future*, **4**: 549–559.

Burns E. T., Flegal J. A., Keith D. W., Mahajan A., Tingley D., and G. Wagner (2016). What do people think when they think about solar geoengineering? A review of empirical social science literature, and prospects for future research. *Earth's Future*, **4**: 538-542.

Barrett S. R. H., Speth R. L., Eastham S. D., Dedoussi I. C., Ashok A., Malina R. and D. W. Keith (2015). Impact of the Volkswagen emissions control defeat device on U.S. public health. *Environmental Research Letters*, **10**: 114005.

*Safaei H. and D. W. Keith (2015). How much bulk energy storage is needed to decarbonize electricity? *Energy and Environmental Science*, **8**: 3409-3417.

*Miller L. M., Brunsell N. A., Mechem D. B., Gans F., Monaghan A. J., Vautard R., Keith D. W., and A. Kleidon (2015). Two methods for estimating limits to large-scale wind power generation. *Proceedings of the National Academy of Sciences*, **112**:11169–11174.

Weisenstein D. K., and D. W. Keith (2015). Solar geoengineering using solid aerosol in the stratosphere. *Atmospheric Chemistry and Physics*, **15**: 11799-1185.

Horton J. B., Parker A., and D. Keith (2015). Liability for Solar Geoengineering: Historical Precedents, Contemporary Innovations, and Governance Possibilities. *NYU Environmental Law Journal,* **22**: 225-273.

Keith, D. W., and D. G. MacMartin (2015). A temporary, moderate and responsive scenario for solar geoengineering. *Nature Climate Change,* **5**: 201-206.

Dykema J. A., Keith D. W., Anderson J. G., and D. Weisenstein (2014). Stratospheric controlled perturbation experiment (SCoPEx): a small-scale experiment to improve understanding of the risks of solar geoengineering. *Philosophical Transactions of the Royal Society A*, **372**(2031).

MacMartin, D. G., Caldeira K., and D. W. Keith (2014). Solar geoengineering to limit the rate of temperature change. *Philosophical Transactions of the Royal Society A*, **372**(2031).

Keith, D. W., Duren R., and D. G. MacMartin (2014). Field experiments on solar geoengineering: report of a workshop exploring a representative research portfolio. *Philosophical Transactions of the Royal Society A*, **372**: 20140175.

Kravitz B., MacMartin D. G., Robock A., Rasch P. J., Ricke K. L., Cole J. N. S., Curry C. L., Irvine P. J., Ji D., Keith D. W., Kristjánsson J. E., Moore J. C., Muri H., Singh B., Tilmes S., Watanabe S., Yang S., and J.-H. Yoon (2014). A multi-model assessment of regional climate disparities caused by solar geoengineering. *Environmental Research Letters*, **9**.

MacMartin D. G., Kravitz B., Keith D. W., and A. Jarvis (2013). Dynamics of the coupled human-climate system resulting from closed-loop control of solar geoengineering. *Climate Dynamics*, **43**: 243-258.

*Safaei H. and D. W. Keith (2013). Compressed air energy storage with waste heat export: An Alberta case study. *Energy Conversion and Management*, 78: 114–124.

*Carr W., Preston C., Yung L., Keith D. W., Szerszynski B., and A. Mercer (2013). Public Engagement on Solar Radiation Management and Why it Needs to Happen Now. *Climatic Change,* **121**: 567-577.

David W. Keith and Andy Parker (2013). The fate of an engineered planet. *Scientific American*, **308**:34-36.

Parson E. A., and D. W. Keith (2013). End the Deadlock on Governance of Geoengineering Research. *Science,* **339**: 1278-1279.

Adams A. S., and D. W. Keith (2013). Are global wind power resource estimates overstated? *Environmental Research Letters*, **8**: 015021.

McClellan J., Keith D. W. and J. Apt (2012). Cost analysis of stratospheric albedo modification delivery systems. *Environmental Research Letters*, **7**: 034019.

MacMartin D. G., Keith D. W., Kravitz B. and K. Caldeira. Management of tradeoffs in geoengineering through optimal choice of non-uniform radiative forcing. *Nature Climate Change*, **3**: 365-368.

*Safaei H., Keith D.W. and R. J. Hugo (2012). Compressed Air Energy Storage (CAES) with compressors distributed at heat loads to enable waste heat utilization. *Journal of Applied Energy*, **103**: 165-179.

*Holmes G. and D. W. Keith. An Air-Liquid Contactor for Large-Scale Capture of CO_2 from Air. *Philosophical Transactions of the Royal Society A – Mathematical, Physical & Engineering Sciences*, **370**: 4380-4403.

*Moreno-Cruz J. B. and D. W. Keith (2012). Climate Policy under Uncertainty: A Case for Geoengineering. *Climatic Change*, **121**: 431-444.

*Ricke R. L., Rowlands D., Ingram W. J., Keith D. W. and M. G. Morgan (2011). Effectiveness of stratospheric solar radiation management as a function of climate sensitivity. *Nature Climate Change*, **2**: 92-96.

*Mercer A. M., Keith D. W. and J. D. Sharp (2011). Public understanding of Solar Radiation Management. *Environmental Research Letters*, **6**: 044006.

*Doluweera G., Jordaan S., Bergerson J., Moore M. and D. Keith (2011). Evaluating the Role of Cogeneration for Carbon Management in Alberta. *Energy Policy*, **39**: 7963-7974.

*Cubi E. and D. W. Keith (2011). LEED, Energy Savings, and Carbon Abatement: Related but Not Synonymous. *Environmental Science and Technology*, **45**: 1757-1758.

*Moreno-Cruz J., Ricke K. and D. W. Keith (2011). A simple model to account for regional inequalities in the effectiveness of solar radiation management. *Climatic Change*, **110**: 649-668.

MacMynowski D. G., Shin H., Caldeira K. and D. W. Keith (2011). Can we test geoengineering? *Energy and Environmental Science*, **4**: 5044-5052.

*Keith D. and J. Moreno-Cruz (2010). Pitfalls of coal peak production. *Nature*, **469**: 472.

Ghaderi, S., Keith D., Lavoie R. and Y. Leonenko (2010). Evolution of Hydrogen Sulfide in Sour Saline Aquifers During Carbon Dioxide Sequestration. *International Journal of Greenhouse Gas Control*, **5**: 347-355.

*Yeh S., Jordaan S. M., Brandt A. R., Turetsky M., Spatari S. and D. Keith (2010). Land Use Greenhouse Gas Emissions from Conventional and Unconventional Oil Production. *Environmental Science & Technology*, **44**: 8766–8772.

Caldeira K. and D. W. Keith (2010). The Need for Climate Engineering Research. *Issues in Science and Technology*, **27**: 57-62.

Pierce J. R., Weisenstein D. K., Heckendorn P., Peter T. and D. W. Keith (2010). Efficient formation of stratospheric aerosol for climate engineering by emission of condensable vapor from aircraft. *Geophysical Research Letters*, **37**: L18805.

Keith, D. W. (2010). Photophoretic levitation of aerosols for geoengineering. *Proceedings of the National Academy of Sciences*, **107**: 16428-16431.

Zickfeld Z., Morgan M. G., Frame D. J. and D. W. Keith (2010). Expert judgments about transient climate response to alternative future trajectories of radiative forcing. *Proceedings of National Academy of Sciences*, **107**: 12451-12456.

Bergerson J. and D. Keith (2010). The truth about dirty oil: Is CCS the answer? *Environmental Science & Technology*, **44**: 6010-6015.

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*Zeidouni, M., Pooladi-Darvish M. and D. W. Keith (2009). Analytical Solution to Evaluate Salt Precipitation during CO_2 Injection in Saline Aquifers. *International Journal of Greenhouse Gas Control Technologies*, **3**: 600-611.

Sharp J. D., Jaccard M. K. and D. W. Keith (2009). Anticipating Public Attitudes toward Underground CO_2 Storage. *International Journal of Greenhouse Gas Control*, **3**: 641-651.

Mahmoudkhani M. and D. W. Keith (2009). Low-energy sodium hydroxide recovery for CO_2 capture from air. *International Journal of Greenhouse Gas Control Technologies*, **3**: 376-384.

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*Jordaan S. M., Keith D. W. and B. Stelfox (2009). Quantifying land use of oil sands production: a life cycle perspective. *Environmental Research Letters*, **4**.

*Cubi E., Keith D. and J. Love (2009). Integrated design & UFAD. *American Society of Heating, Refrigerating and Air-Conditioning Engineers*, **51**: 30-40.

*Hassanzadeh, H., Pooladi-Darvish M. and D. W. Keith (2009). Accelerating CO_2 Dissolution in Saline Aquifers for Geological Storage--Mechanistic and Sensitivity Studies. *Energy & Fuels*, **23**: 3328-3336.

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Zeman F. S. and D. W. Keith (2008). Carbon Neutral Hydrocarbons. *Philosophical Transactions of the Royal Society A*, **366**: 3901-3918.

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*Stolaroff J. K., Keith D. W. and G. V. Lowry (2008). Carbon dioxide capture from atmospheric air using sodium hydroxide spray. *Environmental Science & Technology*, **42**: 2728-2735.

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*Rhodes J. S. and D. W. Keith (2008). Biomass with Capture: Negative Emissions Within Social and Environmental Constraints. *Climatic Change*, **87**: 321-328.

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