



SCHOOL OF PUBLIC HEALTH

EARL WARREN HALL
BERKELEY, CALIFORNIA 94720-7360

April 25, 2008

Richard Bode
Kevin Kennedy
Margret Kim
California Air Resources Board

Re: Out-of-state carbon offsets

Greetings,

Knowing that California is grappling to find the most effective means to mitigate climate change and knowing CARB's long cooperation with China and other parts of the Pacific Rim, I wanted to call to your attention a set of issues surrounding what has been called "co-benefits", i.e. achieving mitigation and other important societal goals in the same activities. When health protection is among the co-benefits, such actions can achieve both climate change mitigation and adaptation at once, the latter by helping reduce vulnerability of human populations to environmental stress.¹

As you well know, there are a number of issues surrounding co-benefits, but here I discuss those associated with offsets, i.e., to what extent can/should co-benefits calculations be weighed in choosing which carbon reduction activities to undertake outside the state.

I can appreciate that it is difficult to determine which projects should contribute to meeting the state's GHG reduction goals even within California let alone incorporating offsets projects in other states or outside the country. Here are some of the issues:

1. What set of rules would be used to calculate the potential carbon offsets: those of the UNFCCC, those of other major international actors such as the World Bank, those of the "Gold Standard" or other schemes in the voluntary market, or those developed specifically for California?
2. How would M&E be done to verify that the promised offsets were actually achieved, particularly for distributed projects, such as those directed to vehicles and households that do not involve a small number of easily verified large emitters such as power plants.

¹ My group has been working on climate/health co-benefits issues, both by field measurement and policy analysis, since the early 1990s. See the attached publication list.

3. Would the offsets be limited solely to the "Kyoto" gases that are incorporated into the official UNFCCC mechanisms even though it is clear from IPCC and other sources that other pollutants (NMHC, BC, CO, etc) are also critical for warming. Indeed, most warming to date and for the next 20 years comes from shorter-lived GHGs (including methane) and not CO₂.
4. Given that some projects will achieve substantially more co-benefits than others, how would one both calculate and incorporate these benefits to set priorities among potential projects?
5. Given that California will eventually use up inexpensive in-state carbon-reduction opportunities, should less expensive out-of-state projects be undertaken so as to be more efficient with state funds or should they be avoided in order to keep the investments, even if expensive, within the state? Where is the proper balance?

I realize that out-of-country projects raise even more issues, but let me outline arguments why a set of them in selected developing countries may be appropriate in a portfolio of offsets projects.

- A. The cost-effectiveness for both carbon reduction and co-benefits, even with conservative calculations, can be quite high because of the poor efficiency with which energy is currently used in developing countries and the high emissions of health-damaging pollution per unit useful energy.
- B. California arguably has important stakes in health and efficiency co-benefits in Mexico and Central America because of our close familial, economic, and other ties to the region. A healthy population and better economic efficiency in those regions are clear advantages to the state.
- C. As the air passing into the state from the Pacific Ocean may well exceed California air quality standards before many years due to emissions in China, the state has a clear stake in reducing those emissions in addition to promoting the local benefits that might accrue in China.

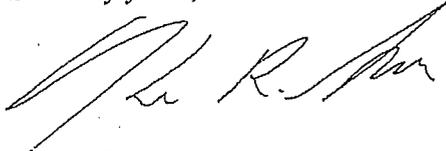
My group and its partners are now embarked on carbon offsets projects marketed on the international voluntary carbon market in both Mexico and China combined with health and economic co-benefits work and will soon have even better data and experience on which to evaluate the potential of further activities. In China, we are also cooperating with the UNDP/MOST MDG Carbon Facility. We find that household energy projects can be highly cost-effective both in health and carbon terms. See the attached figure from a paper published this month.

I realize there are too many issues to discuss in a short letter, but hope that the potential for win-win efforts with clear direct benefits to California as well as contributing to its growing leadership role in the Pacific Basin would be sufficiently intriguing to **CARB to plan a workshop or seminar to discuss international carbon offsets**. Besides us, there are other groups here at Berkeley and around the state with interests and experience and who could be engaged.

In addition, such a workshop might want to explore issues related to the co-benefits of reducing **ground-level ozone**, a powerful greenhouse gas as well as health-damaging air pollutant of critical importance in the state and also increasingly trans-national in scope.

We are happy to provide more information about these activities and look forward to your thoughts. With thanks, I am

Sincerely yours,



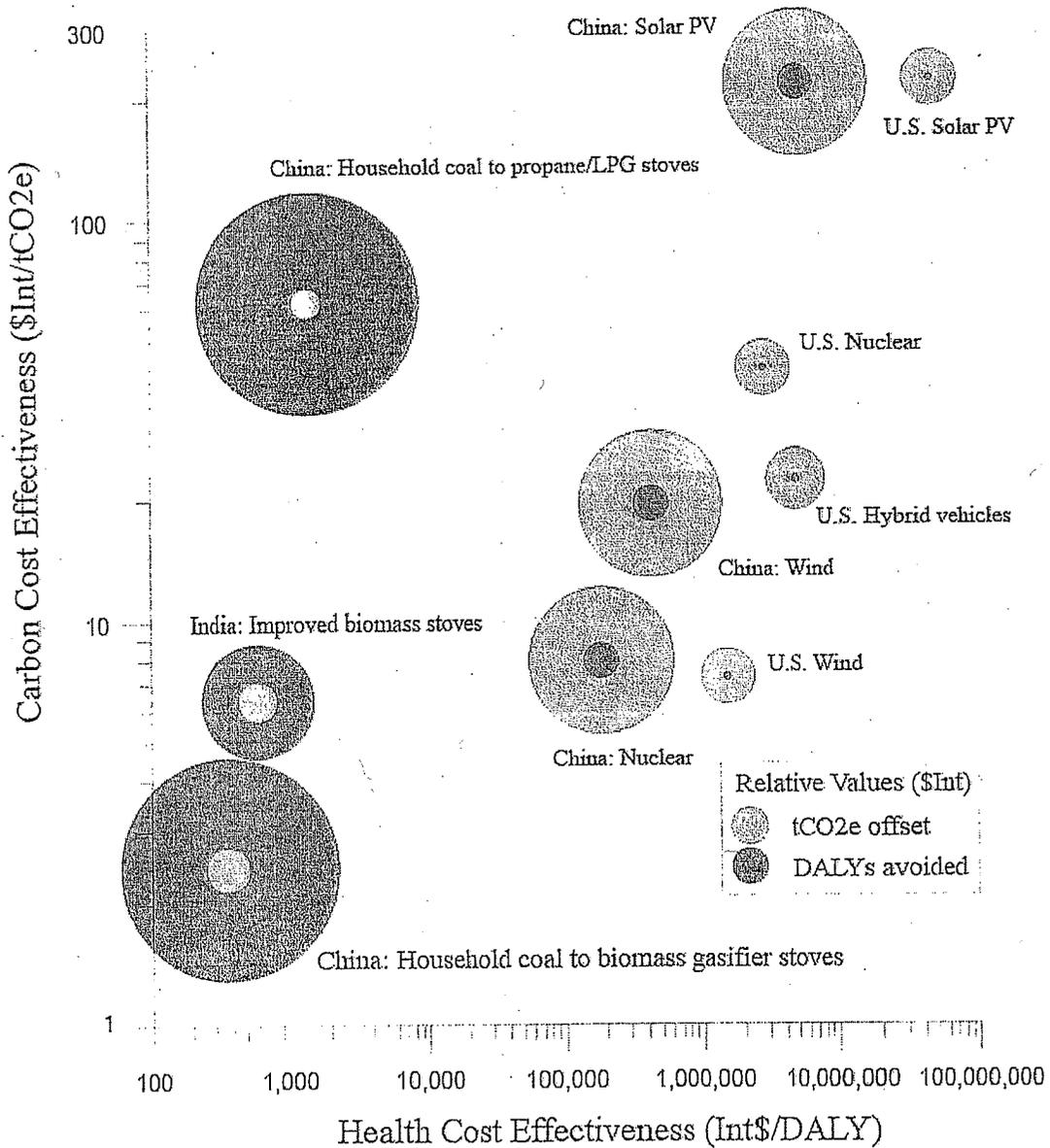
Kirk R. Smith,
Professor of Global Environmental Health
Director: Health, Environment, and Development Program
Chair, Graduate Group in Environmental Health Sciences
510-643-0793
krksmith@berkeley.edu
Publications: <http://ehs.sph.berkeley.edu/krsmith/>

cc. John Balmes, CARB
Art Rosenfeld, CEC

Encl. List of co-benefits publications

Attach: Cost-effectiveness for health and carbon protection of energy projects

Figure showing cost-effectiveness for carbon reduction and health improvement of a range of projects. Note high efficiency of household energy interventions in China for both outcomes. From Smith KR, Haigler E, Co-benefits of climate mitigation and health protection in energy systems: Scoping methods, *Annual Review of Public Health*, 29: 11-25, April 2008 {In a special Symposium edited by KR Smith, *Climate Change and Health*}



April 2008
Selected Publications related to the

Co-Benefits Projects: Climate, Energy, and Health

Prof. Kirk R. Smith, University of California at Berkeley: krksmith@berkeley.edu

Current Major Off-UCB-Campus Collaborators ^a

School of Medicine, University of California, Irvine CA
Woods Hole Research Center, Falmouth MA
Indian Institute of Technology, Mumbai India
Center for Entrepreneurship in International Health and Development Berkeley CA
Chinese Association of Rural Energy Industries, Beijing China
Grupo Interdisciplinario de Tecnologia Rural Apropiada, Patzcuaro Mexico
School of Public Health, Rutgers University, Piscataway NJ

Those marked * can currently be downloaded from <http://ehs.sph.berkeley.edu/krsmith/>
Those marked B contain portions of the database of primary measurements of household GHG emissions

Smith K.R., Comparative Environmental Health Assessments: A brief introduction and application in China, Annals of the NY Academy of Sciences (in press 2008)

*Smith KR, ed, (2008), Symposium on Climate Change and Health, Annual Review of Public Health, 29. Introduction: Mitigating, Adapting, and Suffering: How Much of Each?, p. xxiii.

* Smith KR Haigler E (2008), Co-benefits of climate mitigation and health protection in energy systems: Scoping methods, *ibid.*, pp. 11-25.

* Catalano R, Bruckner T, Smith KR (2008), Ambient temperature predicts sex ratios and male longevity, Proceedings of the National Academy of Sciences, 105 (6): 2244-2247.

* Patz JA, Gibbs HK, Foley JA, Rogers JV, Smith KR, Climate change and global health: Quantifying a growing ethical crisis, EcoHealth 4(4): 397-405, 2007.

*Banerjee R, Sagar A, Smith KR (eds), 2007, Development and Climate Change Benefits of Clean Energy in India, (part of the Woods Hole Research Center Project, "Linking Climate Policy with Development Strategy in Brazil, China, and India" Indian Institute of Technology Bombay, Mumbai.

*Wilkinson P, Smith KR, Joffe M, Haines A, A global perspective on energy Health effects and injustices, Series on Energy and Health #1, Lancet 370: 5-18, 2007.

*Wilkinson P, Smith KR, Beevers, Tonne C, Oreszczayn T, Energy, energy efficiency, and the built environment, Series of Energy and Health #4, Lancet 370: 42-54, 2007.

^a Funding from US Environmental Protection Agency through the East-West Center, Honolulu; World Health Organization, Geneva; Shell Foundation, London; Hewlett Foundation through the Woods Hole Research Center, Falmouth; Maxwell Endowed Chair in Public Health, UC Berkeley

*Haines A, Smith KR, Anderson D, Epstein P, McMichael A, Roberts I, Wilkinson P, Woodcock J, Woods J, Policies for accelerating access to clean energy, improving health, advancing development, and mitigating climate change, Series on Energy and Health #6, Lancet 370:66-83, 2007.

*Masera O, Edwards R, Arnez CA, Berrueta V, Johnson M, Bracho VM, Riojas-Rodriguez H, Smith KR, Impact of Patsari improved cookstoves on indoor air quality in Michoacan, Mexico, Energy for Sustainable Development, 15 (2): 45-56, 2007

*Smith KR, Rogers J, Cowlin SC, Household Fuels and Ill-Health in Developing Countries: What improvements can be brought by LP Gas?, Paris: World LP Gas Association & Intermediate Technology Development Group, 2005,

*Sinton JE, Smith KR, Peabody JW, Liu Y, Zhang X, Edwards R, Gan Q, An Assessment of Programs to Promote Improved Household Stoves in China, Energy for Sustainable Development 8(3):33-52, 2004.

*Edwards, RD, Smith KR, Zhang J, Ma, Y., (Climate and Health) Implications Of Changes In Household Stoves And Fuel Use In China, Energy Policy, 32:395-411, 2004.

*Smith, KR, Wealth, Poverty, and Climate Change, Medical Journal of Australia, 179: 571-572, 2003.

*B-Tsai SM, Zhang J, Smith KR, Ma Y, Rasmussen RA, Khalil MAK. Characterization of non-methane hydrocarbons emitted from various cookstoves used in China. Environmental Science & Technology, 37: 2869-2877, 2003.

*Edwards, RD, Smith KR, Zhang J, Ma, Y., (2003). Models To Predict Emissions Of Health-Damaging Pollutants And Global Warming Contributions Of Residential Fuel/Stove Combinations In China, Chemosphere, 50(2) 201-215.

*Smith KR, "In Praise of Petroleum?" Science 298: 1847, 2002.

Smith KR, Desai M, The Contribution of Global Environmental Factors Ill-health, Ch 3 in Martens P and McMichael AT, eds, Environmental Change, Climate, and Health: Issues and Research Methods, pp.52-95, Cambridge Univ. Press, 2002.

*Green D, Smith KR, Implications of graduation: Why developing countries will never produce more greenhouse gases than developed countries, J of Energy and Develop 28(1): 15-40, 2002.

*B-Pennise DM, Smith KR, Kithinji JP, Rezende ME, Raad TJ, Zhang J, Fan C, (2001). Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil. J. Geophysical Research-Atmosphere 106:24143-24155

Fan Z, Fan C, Pennise DM, Zhang J, (2001) The MMT bag for emission source sampling: Design and evaluation, J Air and Waste Management Assoc. 51:60-68.

*Smith KR, Zhang J, Uma R, Kishore VVN, Joshi V, Khalil MAK (2000), Greenhouse implications of household fuels: An analysis for India, Annual Review of Energy and Environment, 25:741-763.

*B-Smith KR, Uma R, Kishore VVN, Lata K, Joshi V, Zhang J, Rasmussen RA, and Khalil MAK, (2000) Greenhouse Gases from Small-scale Combustion Devices in Developing Countries, Phase IIa: Household Stoves in India. EPA-600/R-00-052, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C., June. Also available at <http://www.epa.gov/crb/apb/publications.htm>.

*B-Zhang J, Smith KR, Ma Y, Ye S, Weng X, Jiang F, Qi W, Khalil MAK, Rasmussen RA, and Thorneloe SA, (2000) Greenhouse gases and other pollutants from household stoves in China: A database for emission factors. Atmospheric Environment. 34(26): 4537-4549.

*Holdren JP, KR Smith (CLAs), *Energy, Environment, and Health*, Chapt 3 of J. Goldemberg et al., World Energy Assessment, UNDP/CSD/WEC, United Nations Development Programme, New York, 2000.

*B-Smith KR, Pennise DM, Khummongkol P, Chaiwong V, Ritgeen K, Zhang J, Panyathanya W, Rasmussen RA, Khalil MAK, and Thorneloe SA (1999) *Greenhouse Gases from Small-scale Combustion Devices in Developing Countries. Phase III: Charcoal-Making Kilns in Thailand*. EPA-600/R-99-109, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C., December.
Available at: <http://www.epa.gov/crb/apb/publications.htm>

*Zhang J, Smith KR, Uma R, Ma Y, Kishore VVN, Lata K, Khalil MAK, Rasmussen RA, and Thorneloe SA (1999) Carbon monoxide from cookstoves in developing countries: 2. Potential chronic exposures. *Chemosphere: Global Change Science* 1(1-3): 367-375.

*Zhang J, Smith KR, Uma R, Ma Y, Kishore VVN, Lata K, Khalil MAK, Rasmussen RA, and Thorneloe SA (1999) Carbon monoxide from cookstoves in developing countries: 1. Emission factors. *Chemosphere: Global Change Science* 1(1-3): 353-366.

*Wang X and Smith KR (1999) Near-term benefits of greenhouse gas reductions: Health impacts in China. *Environmental Science and Technology*, 33 (18): 3056-3061 (web publication 8/4/99; Also available at http://pubs.acs.org/subscribe/journals/esthag/browse_asap.html).

*Wang X and Smith KR (1999) *Near-term Health Benefits of Greenhouse Gas Reductions: A Proposed Assessment Method and Application to Two Energy Sectors of China*, WHO/SDE/PHE/99-01, World Health Organization, Geneva. Also available at: http://www.who.int/environmental_information/Information_resources/documents/Greenhousegas.pdf

*Zhang J and Smith KR (1999) Emissions of carbonyl compounds from various cookstoves in China, *Environmental Science and Technology* 33(14): 2311-2320.

*Zhang, J, KR Smith, Y Ma, R Uma, VVN Kishore, MAK Khalil, RA Rasmussen, ST Thorneloe, "CO from Various cookstoves in Developing Countries: 1. Determination of Emission Factors," Chemosphere: Global Change Science, 1(1-3): 453-466, 1999.

*Zhang, J, KR Smith, Y Ma, R Uma, VVN Kishore, MAK Khalil, RA Rasmussen, ST Thorneloe, "CO from Various Cookstoves in Developing Countries: 2. Assessment of Potential Chronic Exposures," Chemosphere: Global Change Science, 1(1-3): 467-475; 1999.

*Zhang J, Smith KR, Kishore VVN, Ma Y, Rasmussen RA, Uma R, Khalil MAK, Kusam J, and Thorneloe SA (1997) Greenhouse gases from cookstoves in developing countries: Preliminary emission factors. *In Emission Inventory: Planning for the Future, Proceedings of the 1997 AWMA/EPA Emission Inventory Conference*, October 28-30, Research Triangle Park, NC. Vol 1, pp. 368-378.

Uma R, Lata K, Kishore VVN and Smith KR (1997) Use of producer gas as a superior cooking fuel: Results of emission and efficiency tests, in Venkataramana P and Srinivas SN, eds. *Proceedings of Biomass Energy Systems Conference*, Tata Energy Research Institute, Delhi.

Zhang J and Smith KR (1996) Hydrocarbon emissions and health risks from cookstoves in developing countries. *Journal of Exposure Analysis and Environmental Epidemiology*, 6: 1-15.

Zhang J and Smith KR (1996) Indoor air pollution: Formaldehyde and other carbonyls emitted from various cookstoves. *Proceedings of Indoor Air '96, the 7th International Conference on Indoor Air Quality and Climate*, 2: 85-90. Nagoya, Japan.

Smith KR, Zhang J, and Thorneloe SA (1995) Greenhouse gases from widely used small-scale combustion devices in developing countries: Phase I-II: stoves in India and China and Phase III: charcoal kilns in Thailand. *Proceedings of the EPA's Symposium on Greenhouse Gas Emissions and Mitigation Research*. June 27-29, Washington, D.C.

Kishore VVN and Joshi V (1995) Greenhouse-gas emissions from cookstoves. *Energy Environment Monitor* 11(2): 161-165.

*Smith KR (1995) Health, energy, and greenhouse-gas impacts of biomass combustion. *Energy for Sustainable Development*, 1(4): 23-29.

*Smith KR, Khalil MAK, Rasmussen RA, Thorneloe SA, Manegdeg M, and Apte M (1993) Greenhouse gases from biomass and fossil fuel stoves in developing countries: A Manila pilot study. *Chemosphere* 26(1-4): 479-505.

Smith KR, Rasmussen RA, Manegdeg F, and Apte M (1992) *Greenhouse Gases from Small-Scale Combustion in Developing Countries: A Pilot Study in Manila*, EPA-600/R-92-005, Global Emissions and Control Division, USEPA, Research Triangle Park, NC.