Energy and the Poor ~ Black Carbon in Developing Nations

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**Energy and the Poor**

Number of people without electricity in their homes: 1.6 billion (80% rural)

Number of people relying on traditional biomass fuels for cooking and heating: 2.4 billion

Number of people killed annually from health problems associated with open-fire cooking: 2 million

Percent of total energy consumption used for domestic cooking in sub-Saharan Africa: 60%

Cost of an improved cook stove in China (not subsidized): $10-12

From: Spreading the Water Wealth: Making Water Infrastructure Work for the Poor,” IRN Dams, Rivers and People Report 2006, International Rivers Network, Berkeley, CA.

This activity can be used in classes related to energy, the environment, global health, or climate change, in either natural or social science courses. The goal is to increase awareness of global energy challenges, especially those of developing nations. Students will demonstrate a working knowledge of a variety of impacts linked to the use of black carbon producing fuels and will be able work in small groups to research the impacts of black carbon and synthesize their findings by developing a concept map and writing 2-page summary paper.

Instructor Notes:

**Class Day One ~ Assignments and introduction given**

1. A short video by *Earth Justice* introduces the term “black carbon” and its impacts on the global environment. <http://www.stopsoot.org/?source=homepage>

(Video from <http://www.earthjustice.org/index.html>)

A short article “Soot in the Greenhouse, and Kitchen,” by Andrew C. Revkin provides another good introduction.

<http://dotearth.blogs.nytimes.com/2008/03/26/soot-in-the-greenhouse-and-kitchen/?ref=environment>

2. To establish the context for the household energy discussion, students will discuss the sources of their own household energy (i.e. nuclear, coal, hydropower). State and national energy information is posted on the link below. Students should be aware that they might also produce black carbon by use of wood and charcoal in fireplaces, outdoor grills and wood burning stoves.

See link below: Net Generation by Energy Source by Type of Producer ~ Energy Information Administration

<http://www.eia.doe.gov/cneaf/electricity/epa/epat1p1.html>

3. The primary article, *“Third-World Soot is Target in Climate Fight*,” by Elizabeth Rosenthal (<http://www.nytimes.com/2009/04/16/science/earth/16degrees.html>), will be assigned as reading for Class Day Two. As students read the New York Times article, they will take notes on the many impacts of the use of wood, dung, and charcoal as household fuel in developing countries.

**Class Day Two ~ Discussion and Group Research Online**

1. Lead a discussion of the primary article, *“Third-World Soot is Target in Climate Fight*,” by Elizabeth Rosenthal. This article is well written and will easily encourage a wide-ranging discussion on the impacts of black carbon. The New York Times link (<http://www.nytimes.com/2009/04/16/science/earth/16degrees.html>) includes excellent visuals and additional links that can be used during the discussion.

**Additional Black Carbon overview links:**

Pew Center on Global Climate Change "What is Black Carbon?"

http://www.pewclimate.org/global-warming-basics/blackcarbon-factsheet

2. It is expected that the class will generate 4 to 6 broad topics. In 4 to 6 small groups, each dedicated to one of the generated topics, students will use online sources to find more detailed information on each of these topics. For example, one group may work on health effects, another group on environmental impacts.

Some possible topics that might come up during discussion, and links to good resources are listed below.

**Health Effects**

Chronic respiratory effects of early childhood exposure to respirable particulate matter. <http://ehs.sph.berkeley.edu/guat/page.asp?id=1>

World Health Organization ~ Fuel for life: household energy and health

<http://www.who.int/indoorair/publications/fuelforlife/en/index.html>

World Health Organization ~ Indoor Air Pollution and Household Energy

<http://www.who.int/heli/risks/indoorair/indoorairdirectory/en/index.html>

Disease Control Priorities Project

<http://www.dcp2.org/pubs/DCP/42/Section/6155>

**Political and Social impacts**

Students may want to explore the social impacts of wood gathering as well has how one might effect change through participatory approaches on a local scale

<http://www.who.int/indoorair/publications/fuelforlife/en/index.html>

See Section 2. Household energy and the Millennium Development Goals

See also proposed U.S. legislation on black carbon ~ H.R. 1760 Black Carbon Emissions Reduction Act of 2009 <http://www.govtrack.us/congress/bill.xpd?bill=h111-1760>

**Environmental impacts**

The references below focus on climate impacts. Students may also want to research changes in land use and soil fertility due to the use of dung, wood and charcoal as well as the effects of black carbon on air quality

“Study Proposes New Strategy to Stem Global Warming” By Andrew C. Revkin

August 19, 2000 Science, the New York Times

<http://www.nytimes.com/library/national/science/081900sci-environ-climate.html>

"A Perspective Paper on Black Carbon Mitigation as a Response to Climate Change" Kandlikar, Reynolds and Grieshop. Copenhagen Consensus on Climate

http://fixtheclimate.com/uploads/tx\_templavoila/PP\_Black\_Carbon\_Kandlikar\_Reynolds\_Grieshop\_v.1.0.pdf

NASA James Hanson Article on Soot and Snow

http://www.giss.nasa.gov/research/briefs/hansen\_10/

“Debate Rises over a Quick(er) Climate Fix” May 6, 2009 The New York Times

<http://www.nytimes.com/2000/10/03/science/03GREE.html>

"Black Carbon Research in NOAA/ESRL Chemical Sciences Division"

www.esrl.**noaa**.gov/csd/factsheets/**blackcarbonresearch**.pdf

“Global and regional climate changes due to black carbon”

By V. Ramanathan1 & G. Carmichael

<http://www.nature.com/ngeo/journal/v1/n4/abs/ngeo156.html>

Prof. V. (Ram) Ramanathan ~ Researcher on Black Carbon and climate change

<http://www-ramanathan.ucsd.edu/>

"How Does Black Carbon Change the Climate Debate?"

Climate Institute | www.climate.org

http://www.climate.org/publications/Climate%20Alerts/Autumn2009/ReassessingResponsibilities.html

"Soot Packs a Punch on Tibetan Plateau's Climate" Science Daily, March 3, 2011

http://www.sciencedaily.com/releases/2011/03/110303163320.htm

Black soot and the survival of Tibetan glaciers

Baiqing Xua,b, Junji Caob, James Hansenc,1, Tandong Yaoa, Daniel R. Joswiaa, Ninglian Wangd, Guangjian Wua, Mo Wanga, Huabiao Zhaoa, Wei Yanga, Xianqin Liue, and Jianqiao Hed. October 15, 2009.

www.pnas.org/content/early/2009/12/07/0910444106.full.pdf

"Short Lived Climate Forcers" Sasser, March 17, 2011, EPA

http://www.marama.org/presentations/2011\_climatechg/SLCF\_Sasser.pdf

**Solutions**

Students may want to research solutions to the problems caused by the use of black carbon producing fuels. Topics might include solar technology, the use of higher efficiency stoves, venting indoor stoves to reduce respiratory problems, or improving infrastructure in developing countries.

Excellent AGU press conference given by V. Ramanathan (Scripps San Diego)

and N. Ramanathan December 2010 on reducing black carbon emissions.

"Impact of California's Air Pollution Laws on Black Carbon: Implications for Mitigation of Global Warming"

http://www.youtube.com/watch?v=26hFtnpggSk

Project Surya: Reduction of Air Pollution and Global Warming by Cooking with Renewable Sources

A Controlled and Practical Experiment in Rural India. A White Paper. Ramanathan and Balakrishnan, March 5, 2007

www-ramanathan.ucsd.edu/files/**SuryaWhitePaper**.pdf

"Reducing Black Carbon," Clare, December 16, 2008, World Watch Institute, State of the World 2009.

www.worldwatch.org/files/pdf/SOW09\_CC\_**black**%20**carbon**.pdf

<http://www.who.int/indoorair/publications/fuelforlife/en/index.html>

See Section 3. The way forward

Solar Options <http://solarcooking.org/> <http://solarcooking.wikia.com/wiki/Heat-retention_cooking>

Clean Cook Stoves <http://www.envirofit.org/>

India Energy and Resources Institute <http://www.teriin.org/>

Biogas Digester ~ from Clean Energy Resource Teams

<http://www.cleanenergyresourceteams.org/technology/biogas-digesters>

Small Scale Biogas Digester ~ from Practical Action

<http://www.scribd.com/doc/8337831/Using-A-Biogas-Digester>

Sustainable Energy Resources

United Nations: Energy for Sustainable Development http://www.undp.org/energy/

**Class Day 3:**

Students will re-group into new multi-topic groups (for more on the *jigsaw method* used here*,* see <http://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/jigsaw.html>). Each of these new groups should contain at least one member from each of the first single-topic groups As a multi-topic group, students will generate a ***concept map*** (<http://serc.carleton.edu/NAGTWorkshops/assess/activities/dempsey.html>) illustrating the wide-ranging problems and solutions associated with the use of black carbon. Students will synthesize their findings in a ***group-written 2-page paper.***

This part of the assignment can be completed during a third class day or assigned to be completed outside of class once the new multi-topic groups have been formed.