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# INDIA'S ENVIRONMENTAL TRUMP CARD: HOW REDUCING BLACK CARBON THROUGH COMMON BUT DIFFERENTIATED RESPONSIBILITIES CAN CURB CLIMATE CHANGE

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## I. INTRODUCTION

Although black carbon, commonly known as soot, is a leading contributor to global warming, second only perhaps to carbon dioxide (CO<sub>2</sub>),<sup>1</sup> it has not received adequate attention on the international level. After the impasse at Copenhagen and very little progress at Cancun in reaching an agreement on the terms of a new treaty to address climate change, the international community is left wondering whether the Kyoto Protocol, which is set to expire at the end of 2012, will have a binding successor and, if so, what such an agreement will encompass.<sup>2</sup> No matter what form the Kyoto Protocol's eventual successor takes, it is essential that black carbon's role in mitigating climate change be taken into account primarily because, due to the nature of the sources from which it is emitted and its short lifespan in the atmosphere, reducing black carbon emissions could be the "fastest method of slowing global warming" in the immediate future,<sup>3</sup>

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1. V. Ramanathan & G. Carmichael, *Global and Regional Climate Changes Due to Black Carbon*, J. NAT. GEOSCIENCE, Mar. 23, 2008, at 221, available at [http://www.climate.org/PDF/Ram\\_Carmichael.pdf](http://www.climate.org/PDF/Ram_Carmichael.pdf) ("... emissions of black carbon are the second strongest contribution to current global warming, after carbon dioxide emissions") [hereinafter Ramanathan & Carmichael]; see Tami C. Bond & Haolin Sun, *Can Reducing Black Carbon Emissions Counteract Global Warming?*, 39 ENVIRON. SCI. TECH. 5921, 5921 (2005), available at <http://www.bioenergylists.org/tovesdoc/Bond/BondSun-BCPolicyAnalysis.pdf> ("Black carbon is the second or third largest individual warming agent, following carbon dioxide and perhaps methane."); Durwood Zaelke, *Missing the Point on Soot; Nuclear Hypocrisy*, N.Y. TIMES, Nov. 13, 2007, available at <http://www.nytimes.com/2007/12/13/opinion/13iht-edlet.1.8730762.html>.

2. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22 (the commitment period, first stated in Article 3, ¶1, is from 2008 until 2012) [hereinafter Kyoto Protocol].

3. According to Mark Z. Jacobson of Stanford University, in his Oct. 2007 testimony for a House Committee Hearing on Black Carbon and Global Warming, controlling black carbon emissions could be the "fastest method of slowing warming." Mark Z. Jacobson, *Testimony for the Hearing on Black Carbon and Global Warming*, H. Comm. on Oversight and Gov't Reform, U.S. H.R. (Oct. 18, 2007), available at <http://www.stanford.edu/group/efmh/jacobson/0710LetHouseBC%201.pdf> [hereinafter Jacobson Testimony].

This comment discusses black carbon's environmental impact, reviews global approaches to addressing the problems associated with black carbon, and suggests a course of action for the international community to effectively reduce black carbon emissions. Section II presents a brief overview of black carbon's scientific composition, identifies the geographical hotspots producing black carbon, and examines solutions to mitigating black carbon emissions. Next, Section III focuses on international law relating to black carbon and how a two-fold approach involving treaties and customary international law should be utilized to set goals for reducing black carbon through international cooperation. Section IV discusses how curbing black carbon emissions through the shipping industry could alleviate warming of the Arctic and the Himalayan regions and the controversy surrounding the warming of the Himalayan region is addressed. In Section V India's legal framework is examined and it is suggested that India's legal system could play an important role in reducing global black carbon pollution. Finally, the concluding section offers recommendations for the international community. Throughout the article, India's role in addressing the black carbon problem and its capacity to achieve environmental justice are highlighted.

## II. A SCIENTIFIC ACCOUNT OF BLACK CARBON AND EXPLANATION OF ITS WARMING CAPACITY

### *A. What is Black Carbon and Where Does it Come From?*

Black carbon is a form of particulate air pollution produced by incomplete combustion<sup>4</sup> of fossil fuels (e.g., coal, oil, gasoline), bio-fuel (e.g., wood or cow dung burned in stoves for cooking and heating); and open biomass burning (e.g., forest fires), as well as diesel exhaust.<sup>5</sup> It is both anthropogenic and natural in origin.<sup>6</sup> Unlike carbon dioxide, which is inert and can remain in the atmosphere for up to 100 years, black carbon is a short-lived particulate, remaining in the atmosphere for approximately only one week after it is emitted.<sup>7</sup>

Five hotspots of regional black carbon producers have been identified: 1) East Asia (eastern China, Thailand, Vietnam and Cambodia); 2) the Indo-Gangetic Plains in South Asia (extending from Pakistan across India to Bangladesh and Myanmar); 3) Indonesia; 4) Southern Africa; and 5) the Amazon basin in South

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4. Combustion is the act or instance of burning some type of fuel to produce energy. When any compound burns, the products are the oxides of the elements in the compound; combustion is a reaction with the oxygen in the air, accompanied by heat, light and often a flame. Incomplete combustion occurs when, due to a lack of oxygen or low temperatures, the complete chemical reaction does not take place and only partial burning of a fuel results, which may prevent the complete chemical reaction.

5. Charles Zender, Written Testimony for the Hearing on Black Carbon and Climate Change, U.S. H. Comm. on Oversight and Gov't Reform, *Arctic Climate Effects of Black Carbon 2* (Oct. 18, 2007), available at [http://dust.ess.uci.edu/ppr/ppr\\_hogrc\\_wrt.pdf](http://dust.ess.uci.edu/ppr/ppr_hogrc_wrt.pdf) [hereinafter Zender Testimony].

6. P.K. Quinn et al., *Short-lived Pollutants in the Arctic: Their Climate Impact and Possible Mitigation Strategies*, 8 *ATMOS. CHEM. PHYS.* 1723, 1724-25 (2008), available at <http://www.atmos-chem-phys.org/8/1723/2008/acp-8-1723-2008.pdf>.

7. *Id.*

America.<sup>8</sup> Emissions are especially high in India and China where cooking and heating utilize wood, field residue, cow dung, and coal burning at low temperatures, none of which allows for complete combustion.<sup>9</sup> China and India's heightened black carbon output can be explained by the use of solid/biomass fuels in cooking and heating in 80 percent of Chinese and Indian households.<sup>10</sup>

*B. The Warming Effects of Black Carbon and its Impact on Human Health and Weather Patterns*

Black carbon warms the earth's atmosphere in a number of different ways. First, when black carbon is released into the atmosphere it combines with other aerosols, forming atmospheric brown clouds.<sup>11</sup> It simultaneously warms the planet by intercepting direct sunlight and absorbing solar radiation.<sup>12</sup> Atmospheric brown clouds in turn affect weather patterns by reducing rainfall and increasing the occurrence of droughts.<sup>13</sup>

The brown clouds also intercept reflected sunlight by absorbing solar radiation reflected from the surface and clouds; this reduces solar radiation reflected to space by the earth-atmosphere system.<sup>14</sup> As a result, planetary albedo (earth's ability to reflect sunlight) decreases and solar radiation reaching the ground is reduced by five percent.<sup>15</sup>

8. Ramanathan & Carmichael, *supra* note 1, at 221.

9. Marcel de Armas & Maria Vanko, *Mitigating Black Carbon as a Mechanism to Protect the Arctic and Prevent Abrupt Climate Change*, 8 SUSTAINABLE DEV. L. & POL'Y 41, 42 (2008), available at [http://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1070&context=sdlp&sei-redir=1#search="Mitigating+Black+Carbon+as+a+Mechanism+to+Protect+the+Arctic+and+Prevent+Abrupt+Climate+Change"](http://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1070&context=sdlp&sei-redir=1#search=); Frederick R. Anderson, *Black Carbon Steps from the Shadows as a Major Climate Culprit Worldwide*, CLIMATE CHANGE INSIGHTS (Oct. 9, 2008), <http://www.climatechangeinsights.com/2008/10/articles/air-water/black-carbon-steps-from-the-shadows-as-a-major-climate-culprit-worldwide/>.

10. U.N. Dep't Econ. & Soc. Affairs, *Trends in Consumption Production: Household Energy Consumption*, U.N. DESA Discussion Paper No. 6, 5-9, U.N. Doc. ST/ESA/1999/DP.6 (Apr. 1999) (prepared by Oleg Dzioubinski & Ralph Chipman), available at <http://www.un.org/esa/sustdev/publications/esa99dp6.pdf>; Warwick J. McKibbin, *China and the Global Environment* 9 (2006), prepared for the conference on "China and Emerging Asia: Reorganizing the Global Economy," South Korea, May 11-12, 2006.

11. V. Ramanathan et al., *Atmospheric Brown Clouds: Impacts on South Asian Climate and Hydrological Cycle*, 102 PROC. NAT'L ACAD. SCI. USA 5326, 5326 (2005), available at <http://www.pnas.org/content/102/15/5326.full.pdf>; V. Ramanathan, *Role of Black Carbon on Global and Regional Climate Change*, Testimony to the H. Comm. on Oversight and Gov't Reform Comm. 2 (Oct. 18, 2007), available at [http://thedgw.org/definitionsOut/..%5Cdocs%5Cramanathan\\_testimony\\_on\\_black\\_carbon.pdf](http://thedgw.org/definitionsOut/..%5Cdocs%5Cramanathan_testimony_on_black_carbon.pdf).

12. Ramanathan & Carmichael, *supra* note 1.

13. UNEP & Science Team of Atmospheric Brown Cloud, *Black Carbon E-Bulletin*, vol.1, no. 1, p. 2, July 2009, [www.rrcap.unep.org/abc/bc/BC%20e-Bulletin%20July09.pdf](http://www.rrcap.unep.org/abc/bc/BC%20e-Bulletin%20July09.pdf) [hereinafter UNEP E-Bulletin].

14. Eleanor J. Highwood & Robert P. Kinnery, *When Smoke Gets in Our Eyes: The Multiple Impacts of Atmospheric Carbon on Climate Air Quality and Health*, 32 ENVIRON. INT'L. 560, 563 (2006).

15. *Id.*

Furthermore, black carbon causes warming when deposits fall on snow and sea ice; this increases the absorption of solar radiation by ice and snow which has the effect of melting the ice.<sup>16</sup> When black carbon falls on snow it also darkens it: white snow reflects 80 percent of the sun's rays,<sup>17</sup> but with the presence of black carbon, darker snow absorbs the sunlight instead, which melts the ice.<sup>18</sup> Reduction in surface glacial ice, especially in the Antarctic and the Himalayas, has been found to contribute to rising sea levels and overall global warming.<sup>19</sup>

Thus, black carbon in the atmosphere heats the air, altering atmospheric stability and vertical motions, and also affecting the large-scale circulation and hydrological cycle with significant regional climate effects, such as droughts in India and floods in China.<sup>20</sup> The NASA Goddard Institute for Space Studies' climate computer model and aerosol data specifically indicate that black carbon is responsible for localized climate problems in China resulting in increased droughts in the north and summer floods in the south.<sup>21</sup>

Indoor air pollution is caused primarily by soot and dust particles released during the burning of traditional biomass fuels such as wood or dung. Soot has alarming impacts on human health; the World Health Organization (WHO) estimates that indoor air pollution is the eighth most important health risk factor responsible for 2.7 percent of disease worldwide.<sup>22</sup> The effects are especially acute in developing countries as, for example, indoor air pollution causes 3.5 percent of all diseases in India,<sup>23</sup> and 1.6 million deaths in Asia were attributable to indoor air smoke from solid fuel use and urban air pollution in 2000.<sup>24</sup> Air pollution's share of global disease may also have a quantifiable economic impact, as studies show that the detrimental health effects of small particulate matter in India and China

16. See Mark Z. Jacobson & David G. Streets, *Influence of Future Anthropogenic Emissions on Climate, Natural Emissions, and Air Quality*, 114 J. OF GEOPHYSICAL RES. JOURNALS 15 (2009).

17. Leslie Alderman, *Let the Sunshine In, But Not the Harmful Rays*, N.Y. TIMES, Jan. 14, 2011.

18. Ramanathan & Carmichael, *supra* note 1.

19. Jane A. Leggett, *Climate Change: Science Highlights*, 14, Congressional Research Service, Feb. 23, 2009, available at [www.fas.org/sgp/crs/misc/RL34266.pdf](http://www.fas.org/sgp/crs/misc/RL34266.pdf).

20. Surabi Menon, et al., *Climate Effects of Black Carbon Aerosols in China and India*, 297 SCIENCE MAG. 2250, 2250 (2002), available at <http://shadow.eas.gatech.edu/~jean/monsoon/Menonmonsoon.pdf>.

21. David E. Steitz et al., *Black Carbon Contributes to Droughts and Floods in China*, NASA EARTH OBSERVATORY, Sept. 26, 2002, <http://earthobservatory.nasa.gov/Newsroom/view.php?old=2002092610820>.

22. World Health Organization [WHO], *Indoor Air Pollution and Health*, at 1, U.N. Doc. WHO/SDE/PHE/07.01rev (June 2005), available at <http://www.who.int/mediacentre/factsheets/fs292/en/index.html>.

23. Esther Duflo, Michael Greenstone, & Rema Hanna, *Cooking Stoves, Indoor Air Pollution and Respiratory Health in Rural Orissa, India*, 43 ECON. & POL. WEEKLY 71, 71 (2008), available at [http://www.povertyactionlab.org/sites/default/files/publications/69\\_Duflo\\_Cooking\\_Stoves\\_Indoor\\_Pollution.pdf](http://www.povertyactionlab.org/sites/default/files/publications/69_Duflo_Cooking_Stoves_Indoor_Pollution.pdf).

24. John C. Topping, Jr., *Reducing Soot: Common Ground for Climate Negotiations*, CLEANTECH ASIA ONLINE (Aug. 1, 2009), <http://www.cleantechasiaonline.com/reducing-soot-common-ground-climate-negotiations>.

could be as high as 3.6 and 2.2 percent of their gross domestic products, respectively.<sup>25</sup>

Although health concerns such as lung cancer and cardiovascular ailments have long been associated with black carbon,<sup>26</sup> its negative impact on the environment has garnered increasing attention only recently.<sup>27</sup> As explained by Örjan Gustafsson and colleagues at Stockholm University, biomass combustion in India produced about two-thirds of the total aerosol pollution, a much larger proportion than previously thought.<sup>28</sup> According to their study, “biomass combustion (such as residential cooking and agricultural burning) and fossil fuel combustion should be targeted to mitigate climate effects and improve air quality.”<sup>29</sup>

In its Fourth Assessment Report in 2007, the Intergovernmental Panel on Climate Change (IPCC) estimated that a 2.4°C warming above preindustrial surface temperatures is inevitable;<sup>30</sup> this is referred to as the zone of “dangerous anthropogenic interference” (DAI).<sup>31</sup> More than 100 countries have generally agreed that the threshold for DAI is at a 2°C increase above preindustrial temperatures.<sup>32</sup> To illustrate the impact of black carbon on global warming, it is responsible for almost 50 percent of the 1.9°C increase in warming of the Arctic

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25. U.N. Env't Programme [UNEP], *Atmospheric Brown Clouds: Regional Assessment Report with Focus on Asia: Summary*, at 8 (2008) (prepared by V. Ramanathan, et al.), available at <http://www.unep.org/pdf/ABCSummaryFinal.pdf>; see also Lindsay Beck, *Ship Emissions Seen Causing 60,000 Deaths a Year*, REUTERS, Nov. 7, 2007, <http://uk.reuters.com/article/2007/11/07/environment-shipping-dc-idUKPEK34163320071107> (discussing the shipping industry's impact on human health).

26. Karen L. Jansen, et al., *Associations Between Health Effects and Particulate Matter and Black Carbon in Subjects with Respiratory Disease*, 113 ENVIRON. HEALTH PERSPECTIVE 1741, 1741 (2005), available at <http://ehp03.niehs.nih.gov/article/fechArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.8153>.

27. UNEP E-Bulletin, *supra* note 13, at 1.

28. Örjan Gustafsson, et al., *Brown Clouds Over South Asia: Biomass or Fossil Fuel Combustion?*, 323 SCIENCE MAG. 495 (2009) <http://www.sciencemag.org/content/323/5913/495.full.pdf>.

29. *Id.*

30. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], WORKING GROUP I, FOURTH ASSESSMENT, SUMMARY FOR POLICY MAKERS 13 (2007), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf> [hereinafter IPCC, FOURTH ASSESSMENT]; V. Ramanathan & Y. Feng, *On Avoiding Dangerous Anthropogenic Interference with the Climate System: Formidable Challenges Ahead*, 105 PROC. NAT'L ACAD. SCI. USA 14245, 14245 (2008), available at <http://www.pnas.org/content/early/2008/09/16/0803838105.full.pdf>.

31. James E. Hansen, *Dangerous Anthropogenic Interference: A Discussion of Humanity's Faustian Climate Bargain and the Payments Coming Due*, Distinguished Public Lecture Series at the Department of Physics and Astronomy, Univ. of Iowa, Oct. 26, 2004, available at [www.columbia.edu/~jeh1/2004/dai\\_complete\\_20041026.pdf](http://www.columbia.edu/~jeh1/2004/dai_complete_20041026.pdf).

32. Malte Meinshausen et al., *Greenhouse-gas Emission Targets for Limiting Global Warming to 2° C*, 458 NATURE 1158, 1158 (2009), available at [http://www.ecoequity.org/wp-content/uploads/2009/07/meinshausen\\_nature.pdf](http://www.ecoequity.org/wp-content/uploads/2009/07/meinshausen_nature.pdf); Mario Molina et al., *Reducing Abrupt Climate Change Risk Using the Montreal Protocol and Other Regulatory Actions to Complement Cuts in CO<sub>2</sub> Emissions*, 106 PROC. NAT'L ACAD. SCI. USA 20616, 20616 (2009), available at <http://www.pnas.org/content/106/49/20616.full.pdf>.

since 1890.<sup>33</sup> Second only to CO<sub>2</sub>—which is responsible for 40 percent of the planet's warming—studies show that black carbon generates 18 percent of the planet's warming, a figure that is three to four times higher than estimated in the IPCC's 2007 report.<sup>34</sup>

Air pollution abatement policies aimed at protecting human health and the environment may inadvertently accelerate warming by decreasing sulphate and other aerosols.<sup>35</sup> The reason for this unexpected consequence is that these aerosols have a cooling impact on the climate, and thus, reduction of such pollutants in the interest of protecting human health can in fact negatively affect the environment.<sup>36</sup> However, after such aerosols are removed, reducing short-lived warming agents such as black carbon and methane can counteract the unintentional warming caused by efforts to improve human health, further highlighting the urgent need to decrease concentrations of black carbon.<sup>37</sup>

### C. *The Most Direct Methods to Curb Black Carbon Emissions*

Due to its short life span and anthropogenic nature of the sources from which black carbon is polluted, researchers say that decreasing black carbon emissions would be inexpensive, direct, and the most efficient and immediate way to reduce warming.<sup>38</sup> While efforts remain primarily focused on cutting global CO<sub>2</sub> emissions, even after significant emissions reductions have been made, CO<sub>2</sub> will still linger in the atmosphere because of its extended life-span.<sup>39</sup> Moreover, as found by Dr. Veerabhadran Ramanathan, a professor of climate science at the Scripps Institute of Oceanography, reducing black carbon emissions by 50 percent

33. Molina et al., *supra* note 32, at 20617; *Cutting Non-CO2 Pollutants Can Delay Abrupt Climate Change. Solve 'Fast Half' of Climate Problem*, INDOOR AIR QUALITY (IAQ) UPDATES, Oct. 13, 2009, <http://iapnews.wordpress.com/2009/10/13/cutting-non-co2-pollutants-can-delay-abrupt-climate-change/>; Int'l Maritime Org. [IMO], Marine Env't Prot. Comm., 60th Sess., Prevention of Air Pollutants from Ships, Submitted by Norway, Sweden and the United Nations, ¶ 2, IMO Doc. MEPC 60/4/24, Jan. 15, 2010, available at [http://www.catf.us/diesel/policy/international/20100115-MEPC60-4-24-Prevention\\_of\\_Air\\_Pollution\\_from\\_Ships.pdf](http://www.catf.us/diesel/policy/international/20100115-MEPC60-4-24-Prevention_of_Air_Pollution_from_Ships.pdf) [hereinafter, Joint Submission to MEPC].

34. Ramanathan & Carmichael, *supra* note 1. See also Elisabeth Rosenthal, *By Degrees: Third-World Stove Soot is Target in Climate Fight*, N.Y. TIMES, Apr. 15, 2009, available at <http://www.nytimes.com/2009/04/16/science/earth/16degrees.html>; ECOSURVIVOR, *Still in a Haze: What We Don't Know About Black Carbon & Climate*, Mar. 15, 2011.

35. U.N. Econ. & Soc. Council [ECOSOC], Executive Body for the Convention on Long-Range Transboundary Air Pollution, *Air Pollution and Climate Change: Developing a Framework for Integrated Co-Benefits Strategies*, ¶ 27, U.N. Doc. ECE/EB.AIR/2008/10, 6 (Oct. 28, 2008), available at <http://www.unece.org/env/documents/2008/EB/EB/ece.eb.air.2008.10.e.pdf>.

36. *Id.*

37. *Id.*

38. Convention on Long-Range Transboundary Air Pollution, Sept. 13-15, 2010, EMEP Steering Body, *Draft Report of the Ad-Hoc Expert Group on Black Carbon*, ¶ 19 (Sept. 7, 2010), available at [http://www.unece.org/env/documents/2010/eb/ge1/EMEP%2034th/Informal%20documents/Info.%20doc\\_2\\_Draft%20report%20of%20the%20Ad-Hoc%20Expert%20Group%20on%20Black%20Carbon.pdf](http://www.unece.org/env/documents/2010/eb/ge1/EMEP%2034th/Informal%20documents/Info.%20doc_2_Draft%20report%20of%20the%20Ad-Hoc%20Expert%20Group%20on%20Black%20Carbon.pdf).

39. NASA, Earth Observatory, *How Much More Will Earth Warm?*, <http://earthobservatory.nasa.gov/Features/GlobalWarming/page5.php> (last updated Apr. 4, 2011).

could also have the effects of delaying the warming effects of CO<sub>2</sub> by one to two decades.<sup>40</sup>

Because of the ease with which black carbon and ozone can be reduced compared with CO<sub>2</sub>, Dr. Ramanathan and Dr. Jessica Wallack, Director of the Centre for Development Finance at the Institute for Financial Management and Research, in Chennai, India, view reducing black carbon as a “low-hanging fruit.”<sup>41</sup> The Institute for Governance and Sustainable Development (IGSD) is demanding “fast-action mitigation strategies” to prevent passing the “tipping points”<sup>42</sup> (small increases in global warming which produce large and irreversible events) as a result of abrupt climate changes,<sup>43</sup> and is promoting non-CO<sub>2</sub> strategies such as reducing emissions of short-term climate forcers such as black carbon, for more immediate emissions reductions, to coincide with cuts in CO<sub>2</sub> that are necessary for significant long-term reductions.<sup>44</sup>

#### *D. Mitigating Efforts and Solutions to Curb Black Carbon Emissions*

The main sources of black carbon and their approximate contributions are: open biomass burning – forest and savanna (42 percent); diesel engines (40 percent); and residential burning of biofuels such as coal, wood, dung, and agricultural residues (18 percent).<sup>45</sup> It follows, therefore, that the most direct approach to reducing its emissions is mitigation of pollution from these sources.

Suggested methods for reducing black carbon in the atmosphere include upgrading diesel engines or completely phasing them out, replacing biomass burning stoves with gas or solar cookers and cutting down on deforestation, especially slash and burn techniques. In Russia, for example, the prominence of agricultural burning is known to significantly contribute to black carbon emissions.<sup>46</sup> Due to the proximity of the Arctic, which makes up one of the largest regions in Russia, domestic laws should be adopted to prohibit, restrict or monitor

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40. *Cutting Non-CO<sub>2</sub> Pollutants Can Delay Abrupt Climate Change, Solve 'Fast Half' of Climate Problem: Scripps Researchers Among Team Calling for Expansion of Montreal Protocol*, SCRIPPS INST. OF OCEANOGRAPHY, Oct. 12, 2009, <http://scrippsnews.ucsd.edu/Releases/?releaseID=1028>.

41. *Cleaning Up Black Carbon Provides Instant Benefits Against Global Warming*, SCRIPPS INST. OF OCEANOGRAPHY, Aug. 19, 2009, available at <http://scrippsnews.ucsd.edu/Releases/?releaseID=1013>; Jessica Seddon Wallack & Veerabhadran Ramanathan, *The Other Climate Changers: Why Black Carbon and Ozone Also Matter*, FOREIGN AFF. Sept./Oct. 2009.

42. *Tipping Points, Abrupt Climate Changes Approaching Faster than Previously Predicted Fast-Track Climate Mitigation Strategies Needed*, INST. FOR GOVERNANCE & SUSTAINABLE DEV. [IGSD], Dec. 1, 2008, <http://www.igsd.org/tipping/index.php>.

43. IGSD, *The Fast-Action Climate Mitigation Campaign*, <http://www.igsd.org/> (last visited Apr. 8, 2011).

44. *Id.*

45. Dennis Clare, *Reducing Black Carbon*, in STATE OF THE WORLD 56, 56 (Dec. 16, 2008), available at [http://www.worldwatch.org/files/pdf/SOW09\\_CC\\_black%20carbon.pdf](http://www.worldwatch.org/files/pdf/SOW09_CC_black%20carbon.pdf) (excerpt only available on this site); see also Tami Bond, *Summary: C. Aerosols*, Air Pollution as a Climate Forcing: A Workshop, Honolulu, Haw., Apr. 29-May 3, 2002, available at <http://www.giss.nasa.gov/meetings/pollution2002/summaryc.html>; Ramanathan & Carmichael, *supra* note 1, at 224.

46. *Black Carbon in Arctic Russia*, CLIMATE PROGRESS, Dec. 12, 2009, <http://climateprogress.org/2009/12/12/black-carbon-in-arctic-russia/>.



agricultural burning because at the present time no such law exists.<sup>47</sup> The international community should assist by applying pressure on Russia and elsewhere in the world where agricultural burning is common practice, in order to prevent it from being done without effective restrictions.

Reductions of diesel emissions can be achieved in a variety of ways and are especially effective in urban areas where cars and trucks are the main culprits. Highly effective diesel particulate filters are available for diesel vehicles and can eliminate over 90 percent of particulate emissions.<sup>48</sup> Additionally, diesel oxidation catalysts have been available for over 30 years, can be used on almost any diesel vehicle and contribute to a 25-50 percent reduction of overall particulate emissions.<sup>49</sup> Unfortunately for India and much of the developing world, these filters require ultra-low sulfur diesel fuel which is not yet widely available outside the US, EU or Japan.<sup>50</sup>

Growing awareness of pollution-related health problems has prompted India to take action. To illustrate, India's Environmental Protection Act of 1981 set national standards for emissions of various substances.<sup>51</sup> The Supreme Court of India has also been significantly involved in mitigating black carbon emissions in India's densely populated cities; in its 1998 ruling<sup>52</sup> the Court directed Delhi's Government to address the problem of air pollution caused by public transport vehicles, including high amounts of black carbon emissions from buses, cars, and autorickshaws.<sup>53</sup> This decision led to a massive shift from diesel fuel to

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47. *Id.*

48. Clare, *supra* note 45, at 57.

49. MANUFACTURERS OF EMISSION CONTROLS ASSOCIATION [MECA], EMISSION CONTROL TECHNOLOGIES FOR DIESEL-POWERED VEHICLES 9 (2007), available at <http://www.meca.org/galleries/default-file/MECA%20Diesel%20White%20Paper%202012-07-07%20final.pdf>; IGSD, *Reducing Black Carbon May be the Fastest Strategy for Slowing Climate Change*, IGSD/INECE Climate Briefing Note, at 6, Aug. 29, 2008, available at [www.igsd.org/docs/BC%20Summary%206July08.pdf](http://www.igsd.org/docs/BC%20Summary%206July08.pdf) [hereinafter IGSD/INECE Climate Briefing].

50. Clare, *supra* note 45, at 57.

51. *The Legal and Regulatory Framework for Environmental Protection in India*, in AGENDA 21: AN ASSESSMENT 23, 25, available at <http://moef.nic.in/divisions/ic/wssd/doc2/main.html>; The Environment (Protection) Rules 1986, ¶ 3, GAZETTE OF INDIA, Nov. 19, 1986.

52. *M.C. Mehta v. Union of India (Vehicular Pollution case)*, (1991) A.I.R. SC 813. The Supreme Court directed the Union Government to provide lead free petrol to four metropolitan cities by April 1995 and petrol with a lead content of 0.15g/l in the entire country by December 1996. Automobile manufacturers were ordered to equip new vehicles to ply on lead free petrol and all new cars registered from April 1995 onwards have been fitted with catalytic converters. The Union Government was also asked to convert all government vehicles and public transport to lead free petrol. Delhi has become the only city in the world to have all public transport operating on Compressed Natural Gas (CNG); For a comprehensive examination of the Indian Supreme Court's role in abatement of air pollution in India, see Urvashi Narain & Ruth Greenspan Bell, *Who Changed Delhi's Air? The Roles of the Court and the Executive in Environmental Policymaking*, Resources for the Future (Dec. 2005), available at <http://www.rff.org/documents/RFF-DP-05-48.pdf>.

53. Conor C. O. Reynolds & Milind Kandlikar, *Climate Impacts of Air Quality Policy: Switching to a Natural Gas-Fueled Public Transportation System in New Delhi*, 42 ENV'T SCI. TECH. 5860, 5860 (2008), available at <http://pubs.acs.org/doi/pdfplus/10.1021/es702863p>.

Compressed Natural Gas (CNG), a much cleaner fuel which emits negligible particulate matter, in over 84,000 public vehicles and resulted in a 10 to 30 percent reduction of climate emissions.<sup>54</sup> Delhi thus became the first city in the world to have its entire public transport run on CNG<sup>55</sup> and now boasts the largest fleet of CNG-powered buses in the world.<sup>56</sup>

Another approach to reduce diesel emissions and thus further reduce black carbon emissions involves replacing vehicles equipped with very inefficient two-stroke engines. At a cost of about \$350 per unit, motorized tricycles or rickshaws in Asia could be retrofitted which would reduce their CO<sub>2</sub> and black carbon emissions by about 70 percent, while increasing fuel efficiency by about 50 percent.<sup>57</sup> Microcredit institutions could play a key role in furthering this initiative.<sup>58</sup>

Reducing black carbon from rural sources will not be as easy. The main polluters of black carbon are deeply imbedded in culturally rooted facets of daily life that have been practiced in the same way for centuries by millions of people. The problem must be approached strategically and carefully. In March 2009, Dr. Ramanathan started Project Surya, which has provided 20,000 rural Indian households with smoke-free cookers equipped to transmit data through which a team of researchers observe air pollution levels in the region to measure the effect of the cookers.<sup>59</sup> This, along with other efforts to reduce the dependency on indoor cooking and heating, such as Solar Cookers International,<sup>60</sup> which seeks to replace indoor cookers with solar powered stoves throughout the developing world, shows how scientists and non-governmental organizations (NGOs) are addressing international environmental concerns in non-traditional and innovative ways.

Providing environmentally sound technology in the form of solar cookers to the developing world could have a positive effect on climate change and also curb the detrimental effects of indoor air pollution on health.<sup>61</sup> Notably, although

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54. *Id.*

55. See M C Mehta Environmental Foundation, [http://mcmef.org/landmark\\_cases.html](http://mcmef.org/landmark_cases.html) (last visited, Mar. 28, 2011).

56. Atul Mathur, *Diesel Demand Drops Sharply, Thanks to CNG*, HINDUSTAN TIMES, Oct. 21, 2010, available at <http://www.hindustantimes.com/Diesel-demand-drops-sharply-thanks-to-CNG/Article1-615655.aspx>.

57. Topping, *supra* note 24.

58. *Id.*

59. *Black Carbon Pollution Emerges as Major Player in Global Warming*, SCRIPPS INST. OF OCEANOGRAPHY, Mar. 23, 2008, <http://scrippsnews.ucsd.edu/Releases/?releaseID=891>.

60. About SCI, SOLAR COOKERS INTERNATIONAL, <http://www.solarcookers.org/about/about.html> (last visited Mar. 15, 2011). For information on recent US support for cookstove initiative programs, see Matthew McDermott, *US \$50 Million Pledge for Cleaner Cookstoves is Big Win for Women, Forests & Climate*, TREEHUGGER, Sept. 21, 2010, <http://www.treehugger.com/files/2010/09/u-s-50-million-pledge-cleaner-cookstoves-win-for-women-forests-climate.php> (discussing Secretary of State Hillary Clinton's \$50 million pledge of seed money, distributed over five years, to help the Global Alliance for Clean Cookstoves provide 100 million clean-burning biomass cookstoves by 2020 to people in Africa, Asia and South America).

61. Elizabeth Burleson, *Energy Policy, Intellectual Property, and Technology Transfer to Address*

downplaying any connection between open bio-fuel fires from chullahs (stoves) and climate change and instead focusing on health concerns,<sup>62</sup> Farooq Abdullah, India's Minister of New and Renewable Energy, along with Prime Minister Manmohan Singh's special envoy, Shyam Saran, announced the "National Biomass Cook-stoves Initiative" on December 2, 2009.<sup>63</sup> Seventy to 80 percent of rural villagers—an estimated 826 million Indians<sup>64</sup>—living in more than 160 million households depend on biomass cook stoves, burning solid fuel, mainly wood or coal, for cooking and heat.<sup>65</sup> More efficient stoves that combust cleanly are available for around US \$15-\$20.<sup>66</sup> Improved cook stoves could also significantly reduce non-CO<sub>2</sub> gas emissions and 0.5-1 billion tons of methane, black carbon, and carbon monoxide could be avoided.<sup>67</sup> India's Biomass Cook-stoves Initiative is only in its initial experimental phase but it is hoped that by providing cook stoves of various grades and combustion capacities throughout rural India, the program will be able to determine the best and most suitable options for the long-term.

The practice of burning cow-dung for warmth and cooking cannot change overnight. Abdullah and Saran both emphasized the degree of care that would be taken to ensure the chullahs as well as biomass fuels supplied "meet the diverse needs of people across the country."<sup>68</sup> While the government of India has implemented similar programs in the past, they failed largely in part due to the way in which the state attempted to impose uniform solutions across the country and failed to properly train households on how to use the new technologies.<sup>69</sup> This resulted in unfavorable responses from villagers because, *inter alia*, they did not

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*Climate Change*, 18 TRANSNAT'L L. & CONTEMP. PROBS. 69, 90 (2009); see also FRED PEARCE, STOKING UP A COOKSTOVE REVOLUTION; THE SECRET WEAPON AGAINST POVERTY AND CLIMATE CHANGE, ASHDEN AWARDS REPORT 7, available at [http://www.ashdenawards.org/files/pdfs/reports/Cookstove\\_report\\_final.pdf](http://www.ashdenawards.org/files/pdfs/reports/Cookstove_report_final.pdf) (quoting Sarah Butler Sloss, Founder Director of the Ashden Awards for Sustainable Energy: "There is now a compelling case for getting improved stoves to millions more people. Better Stoves improve health, save lives, help mitigate the effects of climate change while also saving money. . .").

62. See *Green Stoves to Replace Chullahs*, TIMES OF INDIA, Dec. 3, 2009, <http://timesofindia.indiatimes.com/india/Green-stoves-to-replace-chullahs/articleshow/5293563.cms> ("The black carbon or soot from the chullahs causes local health problems. It [is] also a greenhouse gas though of a far lesser concern internationally than carbon dioxide emissions.").

63. Ben Block, *India Announces Improved Cook Stove Program*, WORLDWATCH INSTITUTE, Dec. 2, 2009, <http://www.worldwatch.org/node/6328> (last visited Apr. 8, 2011); see also, *No Differences in Gov't on Climate Change Issue: PM's Envoy*, INDIA TODAY, Dec. 2, 2009, <http://indiatoday.intoday.in/site/Story/73300/world/No+differences+in+govt+on+climate+change+issue:+PM%27s+envoy.html>.

64. Block, *supra* note 63.

65. Dzioubinski & Chipman, *supra* note 10; Carl Pope, *And How Good is India's Offer?*, HUFFINGTON POST, Dec. 7, 2009, [http://www.huffingtonpost.com/carl-pope/and-how-good-is-indias-of\\_b\\_383163.html](http://www.huffingtonpost.com/carl-pope/and-how-good-is-indias-of_b_383163.html); TIMES OF INDIA, *supra* note 62.

66. Topping, *supra* note 24.

67. Block, *supra* note 63.

68. TIMES OF INDIA, *supra* note 62.

69. *Id.*

care for the stoves or did not like the taste of food prepared on the stoves.<sup>70</sup> Moreover, adapting to the new stoves requires users to change their traditional cooking methods. “You can’t drop a stove into a household and walk away,” explains Rita Colwell, an infectious disease researcher at the University of Maryland at College Park and former director of the U.S. National Science Foundation.<sup>71</sup> “[Y]ou need to do follow-up . . . [and] implementation.”<sup>72</sup>

But if black carbon is ever to be addressed on a large scale, acceptance of the new stoves is crucial. “I’m not going to go to the villagers and say CO<sub>2</sub> is rising, and in 50 years you might have floods,” said Dr. Ibrahim Rehman, Dr. Ramanathan’s collaborator at the Energy and Resources Institute. “I’ll tell her about the lungs and her kids and I know it will help with climate change as well,”<sup>73</sup> he added. If the Surya stoves program and the Indian Government’s initiatives are successful they can ideally serve as a model to be implemented in other developing countries in Asia, Africa and Latin America.<sup>74</sup>

Most recently, the UN general Assembly kicked off the Global Alliance for Clean Cookstoves, as part of the Clinton Global Initiative and promoted by the UN Foundation and the UN Environment Programme.<sup>75</sup> The Alliance, launched in September 2010, in conjunction with the General Assembly’s summit on the Millennium Development Goals, plans to put clean, new cook stoves in 100 million homes.<sup>76</sup> Because cook stoves employ a wide range of varied technology – from natural draft rocket stoves, fan stoves, semi-gasifier stoves, to natural draft top lighting stoves, institutional stoves, and of course, solar-powered stoves – replacing 3 billion old, inefficient cook stoves and traditional biomass burning practices across Africa, Asia and Latin America “holds the promise of saving lives, uplifting health, improving regional environments, reducing deforestation, empowering local entrepreneurs, speeding development and helping to stem global climate change.”<sup>77</sup>

### III. THE ROLE OF INTERNATIONAL LAW IN REDUCING BLACK CARBON AND MITIGATING ITS WARMING EFFECTS

No international instrument currently regulates or monitors black carbon. The United Nations Framework Convention on Climate Change (UNFCCC) contains

70. Block, *supra* note 63.

71. *Id.*

72. *Id.*

73. Rosenthal, *supra* note 34.

74. Press Release, *India - Launching of the New Biomass Cookstove Initiative – 2 December 2009 at New Delhi*, INDOOR AIR QUALITY (IAQ) UPDATES, Dec. 3, 2009, <http://iapnews.wordpress.com/2009/12/03/india-launching-of-the-national-biomass-cookstove-initiative/>.

75. *UN-backed ‘Clean Stove’ Initiative to Save Lives and Heal Environment*, U.N. NEWS CENTRE (Sept. 21, 2010), <http://www.un.org/apps/news/story.asp?NewsID=36040&Cr=mdgs&Cr1> [hereinafter *UN Clean Stove Initiative*].

76. See John Greenya, *Clean Stoves for the Third World*, MILLER-MCCUNE, Apr. 4, 2011, available at <http://www.miller-mccune.com/environment/clean-stoves-for-the-third-world-29745/>.

77. *UN Clean Stove Initiative*, *supra* note 75.

no provision to limit black carbon emissions and does not list black carbon as a defined greenhouse gas (GHG).<sup>78</sup> The world's two foremost documents on climate change, the Montreal Protocol and the Kyoto Protocol, are also silent on black carbon. Nevertheless, the international community is becoming increasingly aware of the need to include black carbon in climate discussions. As Romina Picolotti, Secretary of Environment and Sustainable Development in Argentina, aptly stated in a speech delivered at the international celebration of World Environment Day in Tromsø, Norway, on June 5, 2007:

We must also strictly regulate emissions of “black carbon.” Black carbon contributes more to climate change than any other substance or gas, with the exception of carbon dioxide, yet its impact on climate is not strictly regulated at the international level . . . . Regulating black carbon will provide significant climate benefits, as well as other strong co-benefits, including improvements in public health, as it is a leading cause of asthma and respiratory diseases.<sup>79</sup>

Future regulation is necessary by means of amending existing treaties, combined with incorporation and integration of black carbon in future conventions and protocols, and continued affirmation of the customary international law norm of Common but Differentiated Responsibilities. The basis for this norm is that all parties are obligated to act (common) but developed nations assume greater responsibility (differentiated),<sup>80</sup> and its applicability to black carbon regulation is particularly notable.

A January 2011 Report, *Beyond a Global Deal: A UN+ Approach to Climate Governance*, postulated that three scenarios are possible in forthcoming climate talks: 1) the establishment of a successor to the Kyoto Protocol through negotiations under the UNFCCC; 2) a complete stalemate in climate negotiations; and 3) a “patchwork” scenario in which the UNFCCC continues to play a role but substantive actions to reduce climate change are agreed upon in smaller, bilateral or multilateral negotiations.<sup>81</sup> As part of the Global Governance 2020 program, the Report, produced by Princeton University and the Brookings Institution in the United States, Fudan University and the Shanghai Academy of Social Sciences in China, and the Hertie School of Governance in Germany, explained that a patchwork scenario was most likely because of the failures of Copenhagen and Cancun to yield a binding global agreement on greenhouse gas emission reductions

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78. United Nations Framework Convention on Climate Change, art. 2, May 9, 1992, 31 I.L.M. 849 [hereinafter UNFCCC].

79. Romina Picolotti, *Rethinking Climate Strategies*, in *THE MONTREAL PROTOCOL: CELEBRATING 20 YEARS OF ENVIRONMENTAL PROGRESS* 155, 161 (Donald Kaniaru ed., 2007).

80. See Christopher D. Stone, *Common But Differentiated Responsibilities in International Law*, 98 AM. J. INT'L L. 276 (2004).

81. BRUCE AU ET AL., *BEYOND A GLOBAL DEAL: A UN+ APPROACH TO CLIMATE GOVERNANCE*, GLOBAL GOVERNANCE 2020, at 4 (2011), available at [http://www.gg2020.net/products/climate\\_change\\_report/](http://www.gg2020.net/products/climate_change_report/) [hereinafter BEYOND A GLOBAL DEAL].

to replace the Kyoto Protocol.<sup>82</sup> Whatever scenario eventually unfolds, regulating black carbon should be a priority.

*A. Existing Treaties*

**1. Montreal Protocol**

Former Secretary General of the United Nations, Kofi Annan, has referred to the Montreal Protocol as “perhaps the single most successful international agreement to date . . . .”<sup>83</sup> Opened for signature on September 16, 1987, the Montreal Protocol is aimed at repairing the ozone hole by 2050 and has reduced emissions of CO<sub>2</sub> by 135 billion tons, effectively delaying climate change by up to 12 years.<sup>84</sup> The treaty is structured around several groups of chlorofluorocarbons that have been proven to contribute to ozone depletion.<sup>85</sup> Although the Montreal Protocol fails to mention black carbon in its text, parties at the negotiating table overcame encumbering economic and environmental interests ingrained in the division between countries in the Northern hemisphere (primarily developed nations) and those in the Southern (the majority of which are developing nations), by including the principle of Common but Differentiated Responsibilities.<sup>86</sup> With its continued success in regulating ozone-depleting substances for both ozone and climate benefits, the Montreal Protocol can serve as an important model for climate regulation by either being updated to include black carbon or can be referenced as a template from which future agreements may be drawn.

**2. UNFCCC**

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 and entered into force in 1994 as an instrument for international cooperation on the issue of climate change for the purpose of stabilizing “GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”<sup>87</sup> The Convention establishes the necessary principles and mechanisms to enable it to address black carbon emissions, yet it has thus far made little to no progress in this area. For example, the 2007 UNFCCC Bali Meeting produced the Bali Road Map, which consists of forward-looking plans necessary to reach a secure climate future, and, at least in principle encourages the development and transfer of technology to developing countries in order to promote access to affordable environmentally

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82. *Id.*

83. KOFI ANNAN, WE THE PEOPLES, THE ROLE OF THE UNITED NATIONS IN THE 21ST CENTURY, 56, U.N. Sales No. E.00.I.16 (2000), available at <http://www.un.org/millennium/sg/report/full.htm>.

84. Piccolotti, *supra* note 79, at 158.

85. Montreal Protocol on Substances that Deplete the Ozone Layer, Annex A, Sept. 16, 1987, 26 I.L.M. 1541 [hereinafter Montreal Protocol].

86. Montreal Protocol, *supra* note 85, pmbl.; Lisa Schenck, *Climate Change “Crisis” – Struggling for Worldwide Collective Action*, 19 COLO. J. INT’L ENVTL. L. & POL’Y 319, 361 (2008); see *infra* Section III(B).

87. UNFCCC, *supra* note 78, art. 2.

sound technologies.<sup>88</sup> However, it does not specifically mention or address black carbon.

### 3. Kyoto Protocol

The Kyoto Protocol, a product of the UNFCCC, was the first major agreement demonstrating unprecedented cooperation between developing and developed countries. It is based on a cap-and-trade regulatory system and sets binding limits of CO<sub>2</sub> and other greenhouse gases for developed country parties for the period of 2008-2012.<sup>89</sup> The Protocol reaffirms the UNFCCC's goal of preventing dangerous interference with the climate by regulating greenhouse gas emissions into the atmosphere and is set to expire in 2012.<sup>90</sup> The Kyoto Protocol places restrictions on industrialized nations (with the sole exception of the US as it is not a party to the Treaty), while developing nations are not obligated to reduce their emissions, apart from reduction efforts through the Clean Development Mechanism which enables developed member countries to invest in emission reductions in developing countries, resulting in credits that can count toward their emission goals.<sup>91</sup> With its limited time frame and participation, the Kyoto Protocol was only intended to be a first step in solving the climate problem.<sup>92</sup>

As a consequence of black carbon's classification as an aerosol, it has been left out of both the Montreal Protocol, which specifically regulates several different types of hydrocarbons, and the Kyoto Protocol, which is aimed at greenhouse gases. Although the impacts of aerosols are different from those of greenhouse gases, it is clear that the adverse effects on the climate are comparable and the principles outlined in the UNFCCC suggest that both should be addressed.<sup>93</sup> The US is currently not a signatory, partially due to President George Bush's dissatisfaction with the Treaty's exclusion of black carbon.<sup>94</sup> Hence,

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88. Rachmat Witoelar, President, U.N. Climate Change Conference, *Address to Closing Plenary at Closing of the Joint High-Level Segment: The Bali Road Map* (Dec. 15, 2007), available at [http://unfccc.int/files/meetings/cop\\_13/application/pdf/close\\_stat\\_cop13\\_president.pdf](http://unfccc.int/files/meetings/cop_13/application/pdf/close_stat_cop13_president.pdf).

89. Kyoto Protocol, *supra* note 2.

90. Kyoto Protocol, *supra* note 2.

91. See Kyoto Protocol, *supra* note 2, art. 12.

92. Tom M.L. Wigley, *The Kyoto Protocol: CO<sub>2</sub>, CH<sub>4</sub> and Climate Implications*, 25 *GEOPHYS. RES. LETT.* 13, 2285 (1998).

93. Tami C. Bond & Haolin Sun, *Can Reducing Black Carbon Emissions Counteract Global Warming?*, 39 *ENV'T SCI. TECH.* 5921, 5921 (2005), available at <http://pubs.acs.org/doi/pdfplus/10.1021/es0480421>.

94. In his public address explaining why the U.S. was withdrawing from the Kyoto Protocol, President George W. Bush explained that "Kyoto also failed to address two major pollutants that have an impact on warming: black soot and tropospheric ozone. Both are proven health hazards. Reducing both would not only address climate change, but also dramatically improve people's health." Remarks by the President on Global Climate Change, White House, June 11, 2001, available at <http://usinfo.org/wf-archive/2001/010611/epf103.htm>. According to Stanford University, President Bush used the findings presented by Mark Jacobson that "[r]eductions in [black carbon and organic matter] emissions from fossil-fuel sources will not only slow global warming, but also improve health," to justify the U.S. withdrawal from the Kyoto Protocol. Quote by U.S. President George W. Bush on Black Carbon, STAN. UNIV., <http://www.stanford.edu/group/efmh/bush/> (citing Mark Z. Jacobson,

President Obama will have a second chance to review the Kyoto Protocol at the end the Protocol's first commitment period, in 2012,<sup>95</sup> at which time black carbon should be considered in relation to the Treaty's successor.

The primary strength of the Kyoto Protocol is its attempt to transform the principle of Common but Differentiated Responsibilities from customary international law into a policy instrument.<sup>96</sup> Realization of such a principle should enable countries such as the US, China and India to work together as a collective group with common interests to preserve global environmental integrity and tackle the problems posed by black carbon primarily in developing countries.

#### 4. Copenhagen and Cancun Meetings

The Copenhagen meeting of the UNFCCC has been called the “emptiest deal one could imagine” by the Financial Times<sup>97</sup> and headlines read, “How China and India Sabotaged the UN Climate Summit.”<sup>98</sup> On the other hand, Frank Loy, former US undersecretary of state for global affairs and the lead U.S. climate negotiator from 1998 to 2001, and Michael Levi, a senior fellow for energy and the environment at the Council on Foreign Relations recognized the Copenhagen Accord “a serious step forward,” albeit a severely limited one.<sup>99</sup> By establishing a concrete goal of limiting the rise in global temperature to two degrees Centigrade,<sup>100</sup> Copenhagen could claim some success, but it failed to live up to lofty expectations that it would provide a binding document to replace the Kyoto protocol.

In August 2009, the Copenhagen Consensus Center commissioned 21 papers to examine the costs and benefits of various proposed solutions to global warming in response to the question: “If the global community wants to spend up to, say \$250 billion per year over the next 10 years to diminish the adverse effects of

*Control of Fossil-Fuel Particulate Black Carbon and Organic Material, Possibly the Most Effective Method of Slowing Global Warming*, 107(D19) J. GEOPHYSICAL RES. VOL. 16-1 (2002), available at <http://www.stanford.edu/group/efmh/fossil/>.

95. UNFCCC, *Kyoto Protocol*, [http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php) (last visited Mar. 15, 2011).

96. Christopher C. Joyner, *Common but Differentiated Responsibility*, 96 AM. SOC'Y INT'L L. PROC. 358, 358 (2002).

97. *Dismal Outcome at Copenhagen Fiasco*, FINANCIAL TIMES, Dec. 20, 2009, available at [http://www.ft.com/cms/s/0/5b49f97a-ed96-11de-ba12-00144feab49a.html?nclick\\_check=1#axzz1EFtPIKQb](http://www.ft.com/cms/s/0/5b49f97a-ed96-11de-ba12-00144feab49a.html?nclick_check=1#axzz1EFtPIKQb).

98. Tobias Rapp, Christian Schwägerl & Gerald Traufetter, *How China and India Sabotaged the UN Climate Summit*, SPIEGEL INT'L, Mar. 5, 2010, <http://www.spiegel.de/international/world/0,1518,692861,00.html>.

99. Frank E. Loy & Michael A. Levi, *The Road From Copenhagen*, N.Y. TIMES, Dec. 23, 2009, available at <http://www.nytimes.com/2009/12/24/opinion/24iht-edloy.html>; see also Ved Nanda, *Not All Lost at Copenhagen Climate Talks*, DENVER POST, Dec. 24, 2009, available at [http://www.denverpost.com/ci\\_14059461](http://www.denverpost.com/ci_14059461).

100. UNFCCC, Report of the Conference of the Parties on its fifteenth session, Copenhagen, Dec. 7–19, 2009, Addendum, Decision 2/CP.15, Copenhagen Accord, 5 ¶ 2, U.N. Doc. FCCC/CP/2009/11/Add.1, Dec. 18, 2009, available at <http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf>.



climate changes, and to do most good for the world, which solutions would yield the greatest net benefits?"<sup>101</sup> One of the papers, *An Analysis of Black Carbon Mitigation as a Response to Climate Change*, argues that an overall program should be implemented to encourage developing countries to reduce emissions by: 1) improving black carbon emissions inventory; 2) making use of better technology for current combustion practice; and 3) providing financing for these commercially available technologies on a sustainable basis.<sup>102</sup> As the international community moves into future negotiations, such strategies should be evaluated and prioritized.

At a high-level forum on energy in Washington D.C. leading up to the Copenhagen meeting, India's environment minister, Jairam Ramesh, rejected attempts to link black carbon to the efforts to reach an international agreement to cut greenhouse gas emissions. According to Mr. Ramesh, black carbon had no place in the Copenhagen negotiations towards a universal pact on global warming. As he explained, "Black carbon is another issue. I know there is now a desire to bring the black carbon issue into the mainstream. I am simply not in favour of it."<sup>103</sup>

The IPCC's Fourth Report acknowledged anthropogenic contributions to aerosols from black carbon and stated that the resulting impacts on climate are now better understood, while claiming that there is still a great deal of uncertainty.<sup>104</sup> It additionally stated that changes in surface albedo, due to land cover changes and deposition of black carbon aerosols on snow, cause further climate changes.<sup>105</sup> However, it failed to send a clear signal to policy makers that regulation is immediately necessary. United Nations Environment Programme (UNEP) has similarly acknowledged black carbon's role in climate change,<sup>106</sup> but has made no significant effort to include it in its spectrum of action. Moreover, in spite of the fact that scientists now estimate that nearly 50 percent of the emissions causing global warming in the 21st century are from non-CO<sub>2</sub> pollutants ranging from

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101. *Cut Black Carbon Emissions, Reducing the Soot Created When We Burn Biomass Like Firewood*, COPENHAGEN CONSENSUS CENTER, <http://fixtheclimate.com/component-1/the-solutions-new-research/black-carbon/#c500> (last visited Mar. 30, 2011).

102. ROBERT E. BARON, W. DAVID MONTGOMERY & SUGANDHA D. TULADHA, COPENHAGEN CONSENSUS CENTER, *AN ANALYSIS OF BLACK CARBON MITIGATION AS A RESPONSE TO CLIMATE CHANGE* 18, Aug. 14, 2009, available at <http://fixtheclimate.com/component-1/the-solutions-new-research/black-carbon/#c500>.

103. Randeep Ramesh & Suzanne Goldenberg, *Soot Clouds Pose Threat to Himalayan Glaciers*, GUARDIAN, Oct. 4, 2009, available at <http://www.guardian.co.uk/environment/2009/oct/04/climate-change-melting-himalayan-glaciers>.

104. IPCC, *FOURTH ASSESSMENT*, *supra* note 30, at 2.

105. *Id.* at 4-5.

106. *UN Agency Urges Measure to Slash Non-Carbon Dioxide Greenhouse Gas Pollutants*, U.N. NEWS CENTRE (Sept. 4, 2009), <http://www.un.org/apps/news/story.asp?NewsID=31952&Cr=unep&Cr1>.

black carbon to methane and nitrogen compounds,<sup>107</sup> the international community remains focused, almost exclusively and detrimentally, on CO<sub>2</sub> cuts.

India achieved marked success at the Cancun meeting in December 2009 by securing an agreement from the EU and G-77 to transfer climate change mitigation technology.<sup>108</sup> This was a significant outcome, despite the notable absence of the US in the deal,<sup>109</sup> as developing countries lack the financial or technical wherewithal to develop technologies that can deal with the adverse impacts of climate change. Additionally, at Cancun, India was applauded for its willingness to commit to legally binding commitments associated with an international climate deal.<sup>110</sup>

### *B. Customary International Law: Common but Differentiated Responsibilities*

The most immediate approach for the international community to combat the effects of black carbon should be through the principle of Common but Differentiated Responsibilities, which has already been embodied in several international environmental treaties.<sup>111</sup> Article 3 of the UNFCCC first articulated the principle, acknowledging the “Common but Differentiated Responsibilities and respective capabilities” of the Parties, pursuant to which “the developed country Parties should take the lead in combating climate change and the adverse effects thereof.”<sup>112</sup> The Kyoto Protocol further developed the idea, which was also articulated at the 1992 Rio Conference,<sup>113</sup> that all states have a common obligation to protect the environment but have differentiated levels of duty, depending upon their wealth and technology, and their share of causing global environmental degradation.<sup>114</sup> This is primarily due to the fact that the developed industrialized nations have contributed more to been the major source of today’s environmental problems and also because of their greater technological and financial resources to contribute to the solution.<sup>115</sup> The principle relies upon cooperation in the spirit of

107. *Climate Change – UNEP Points to Accelerated Opportunities for Action*, UNEP NEWS CENTRE (Sept. 4, 2009), <http://new.unep.org/Documents.Multilingual/Default.asp?DocumentID=596&ArticleID=6299&l=en&t=long>.

108. *India Scores Major Success at Cancun Climate Talks*, ECONOMIC TIMES, Dec. 4, 2010, available at <http://economictimes.indiatimes.com/news/politics/nation/india-scores-major-success-at-cancun-climate-talks/articleshow/7038791.cms>.

109. *Id.*

110. Nitin Sethi, *India Willing to Accept Legally Binding Pact at Cancun*, TIMES OF INDIA, Dec. 9, 2010, available at <http://timesofindia.indiatimes.com/india/India-willing-to-accept-legally-binding-pact-at-Cancun/articleshow/7070583.cms>.

111. See, e.g., VED P. NANDA & GEORGE PRING, *INTERNATIONAL ENVIRONMENTAL LAW & POLICY FOR THE 21ST CENTURY* 39 (2003).

112. UNFCCC, *supra* note 78, art. 3(1).

113. United Nations Conference on Environment and Development, *Rio Declaration on Environment and Development*, Princ. 7, June 14, 1992, UN Doc. A/CONF.151/5/Rev.1, 31 I.L.M. 874.

114. NANDA & PRING, *supra* note 111.

115. Ileana Porras, *The Rio Declaration: A New Basis for International Cooperation*, in PHILIPPE SANDS, *GREENING INTERNATIONAL LAW* 20, 28-29 (1993).

global partnership to conserve, protect and restore the health and integrity of the earth's ecosystem.<sup>116</sup>

Implicit in this concept is the international legal principle that states have a right to development. To illustrate, India's position is, and has been for some time, that because current concentrations of greenhouse gases in the atmosphere are primarily the result of developed countries' activities during periods of industrialization, that it should be permitted to similarly develop.<sup>117</sup> Institutionalizing the principle of Common but Differentiated Responsibilities in the successor convention to Kyoto will further advance cooperation with respect to black carbon, even without mentioning it specifically, and developing countries will be able to request help from developed nations to address the problems of black carbon.

### *C. India's Role as a Leader of Developing Countries*

The Government of India's official position is that the earth is a common resource of humanity and every person is entitled to equal enjoyment of that space.<sup>118</sup> Therefore, it is India's posture that all countries' per capita emissions should not only be uniform, but should be reduced to the low level of India's per capita emissions because each citizen of the world has an equal right to enjoyment of the natural environment.<sup>119</sup> While India ranks seventh in the world in annual GHG emissions, with 3.6 percent,<sup>120</sup> it is one of the lowest per capita emitters with only 1.5 tons of CO<sub>2</sub> emitted per person,<sup>121</sup> as compared for example, with the US per capita emissions of nearly 20 tons.<sup>122</sup>

On March 18, 2010, India announced its National Action Plan on Climate Change which incorporates a vision of sustainable development and the steps it must take to achieve it.<sup>123</sup> India is not likely to back down from its desires to develop, as articulated by the Indian Government's position paper in preparation for Copenhagen:

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116. *Id.*

117. See Warwick McKibbin, *Climate Change Policy for India 2* (Lowy Inst. for Int'l Peace, Working Papers in Int'l Econ. No. 2.04, Apr. 30, 2004), available at <http://www.lowyinstitute.org/Publication.asp?pid=128>.

118. PUBLIC DIPLOMACY DIVISION, MINISTRY OF EXTERNAL AFFAIRS, GOVERNMENT OF INDIA, THE ROAD TO COPENHAGEN: INDIA'S POSITION ON CLIMATE CHANGE ISSUES 2 (2009), available at [http://pmindia.nic.in/Climate%20Change\\_16.03.09.pdf](http://pmindia.nic.in/Climate%20Change_16.03.09.pdf) [hereinafter THE ROAD TO COPENHAGEN].

119. *Id.*

120. Neelam Singh, *Indian Industry Launches National GHG Inventory Program*, WORLD RES. INST. (May 30, 2008), <http://www.wri.org/stories/2008/05/indian-industry-launches-national-ghg-inventory-program>.

121. *Id.*

122. *Per Capita CO<sub>2</sub> Emissions for Select Major Emitters, 2007 and 2030 (Projected)*, WORLD RES. INST. (Nov. 4, 2009), <http://www.wri.org/chart/capita-co2-emissions-select-major-emitters-2007-and-2030-projected>.

123. NATIONAL ACTION PLAN ON CLIMATE CHANGE (NAPCC) (Mar. 18, 2010), <http://www.energymanagertraining.com/NAPCC/main.htm>.

India is a country which is and will continue to be severely impacted by Climate Change precisely at a time when it is confronted with huge development imperatives. We therefore, expect that the Copenhagen outcome not only provides us with the space we require for accelerated social and economic development, in order to eradicate widespread poverty, but also create a global regime which is supportive of our national endeavors for ecologically sustainable development.<sup>124</sup>

India's stated priorities include: 1) defining per capita emission obligations; 2) continued acceptance of the principle of Common but Differentiated Responsibilities; 3) China's acceptance of voluntary actions to make energy-intensity reductions as the Indian government has done; 4) international sharing of technology and finance; and 5) the need for flexible dynamics during international negotiations.<sup>125</sup> In furtherance of its priorities, India must find a way to commit to long-term reduction of pollutants while at the same time not having to cut short-term costs of development.

Along with India's significant efforts to curb black carbon emissions, namely reductions in diesel emissions and solar cooker initiatives, the country plays a very important leadership role for other developing countries. Hence, it should also play a significant role in climate change negotiations and make a commitment to mitigating its own contributions. It seems that a breakthrough may be possible with India moderating its seemingly inflexible approach and moving toward a willingness to be bound.<sup>126</sup> This is significant, particularly as Prime Minister Manmohan Singh expressed the need for India's non-alignment movement to evolve forward in order to "meet the challenges of today."<sup>127</sup> Yet, in the same speech, he reiterated that industrial activity and unsustainable lifestyles in the developed world caused the current climate problems and emphasized the importance of reaching an equitable solution to the problem of climate change that acknowledges "this historical responsibility" and ensures that climate change action not perpetuate poverty of the developing countries.<sup>128</sup>

Thus, the Indian Government continues to demand that the US and other developed nations responsible for most of the greenhouse gas emissions worldwide cut their emissions before asking developing countries to take any action.<sup>129</sup> This has led to a "global standoff" as articulated by a Time Magazine article entitled

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124. THE ROAD TO COPENHAGEN, *supra* note 118, at 2.

125. *Id.* at 3-4.

126. Varad Pande, *India at Cancun: The Dawn of a New Era*, CENTER FOR THE ADVANCED STUDY OF INDIA, U. PENN (Jan. 3, 2011), <http://casi.ssc.upenn.edu/iit/pande>.

127. Press Release, Press Information Bureau, Government of India, Prime Minister's Office, *PM's Address at the 15th Non Aligned Movement Summit in Egypt* (July 15, 2009), available at <http://pib.nic.in/newsite/erelease.aspx?relid=50449>.

128. *Id.*

129. Bryan Walsh, *Why is India Playing Hard to Get on Climate Change?*, TIME, Nov. 6, 2009, available at [http://www.time.com/time/specials/packages/article/0,28804,1929071\\_1929070\\_1936360,00.html](http://www.time.com/time/specials/packages/article/0,28804,1929071_1929070_1936360,00.html).

“Why is India Playing Hard to get on Climate Change?”<sup>130</sup> As long as developing countries wait for the West to firmly commit to reductions, and the West points the finger back at developing countries to share in the responsibility, significant and timely progress is doubtful.

The key to achieving cooperation will be striking a balance between the negotiating positions of developing and developed countries, and recognizing that developing countries should not be expected to contribute equally to the cost of abatement of global greenhouse gas emissions as developed countries are doing. The issue is complicated by developing countries' claimed right to development<sup>131</sup> and, at least for the present time, the CO<sub>2</sub> discussion has not been able to address these issues to these countries' satisfaction. However, black carbon may offer a more direct and immediate solution that countries should be able to agree on. After all, involving the Indian government in promoting healthy lifestyle changes for its people - which is half of what the solar cookers are intended to do (the other half of course is to curb climate change) is easier than asking it to commit to reducing its CO<sub>2</sub> emissions and having to simultaneously slow development and growth. Moving forward, the US should pay special attention to India's prioritization of social and economic development and poverty eradication. As these are common concerns for most developing nations, India represents the interests of nearly two thirds of the world's population<sup>132</sup> and hence these concerns should not be ignored in future negotiations on the international level.

*D. Future Developments in the International Regime Should Address Black Carbon*

The Global Governance Report, finding that a so-called “patchwork scenario” was the most likely result of decades of efforts to bind the world community in committing to curb climate change, relied partially on the lessons learned from the failures of Copenhagen and Cancun to yield a successor to the Kyoto Protocol.<sup>133</sup> A “patchwork” scenario, involving the UNFCCC but shifting attention and resources toward smaller, bilateral or multilateral negotiations, entails an international framework in the future with multi-dimensional characteristics.<sup>134</sup>

Thus, based on the inability of Copenhagen and Cancun to produce a binding document, the post-Copenhagen approach should involve participation from a broad coalition of non-traditional groups of media, NGOs and companies working in cooperation with “ambitious and pragmatic countries, regions, cities . . . and leaders” to contribute to the “emergence of a complex, multilayered governance landscape.”<sup>135</sup> This multi-dimensional framework demands that participants

130. *Id.*

131. Srikanta K. Panigrahi, Paper presented at Climate Change Kiosk, UNFCCC Facilitation Centre at COP-8, Vigyan Bhawan, New Delhi, Oct. 23-Nov. 1 2002, *Climate Change and Development in Indian Context 7*, available at <http://unfccc.int/cop8/se/kiosk/cd4.pdf> (last visited Mar. 30, 2011).

132. Two-thirds of the world's population lives in developing countries.

133. BEYOND A GLOBAL DEAL, *supra* note 81, at 4.

134. *Id.*

135. *Id.*

undertake innovative approaches to achieve the goals of the Kyoto Protocol. Implementing solar cookers in rural India can serve as an example of such outside the box thinking and can have immediate effects on slowing global warming.

With the recent emergence of scientific evidence explaining black carbon's contribution to arctic ice melt and its ability to mitigate harm caused by CO<sub>2</sub>, it should first and foremost be classified as a greenhouse gas within the international environmental framework. This would require its inclusion in the UNFCCC regime and its regulation by upcoming agreements. A notable development was the 2009 creation of an *Ad Hoc* Expert Group on Black Carbon under the Convention on Long-range Transboundary Air Pollution of the UN Economic Commission for Europe (UNECE) and its subsequent first meeting in June 2010.<sup>136</sup> The group was tasked with identifying options for potential revisions to the Convention's 1999 Gothenburg Protocol,<sup>137</sup> which would enable parties to mitigate black carbon as a component of particulate matter for health purposes as well as climate benefits.<sup>138</sup> Such capacity shifting would have formidable results in the international legal framework through which black carbon should be regulated.

UNFCCC's precautionary principle additionally supports inclusion of black carbon within its purview because it urges parties to take precautionary measures to "anticipate, prevent, or minimize the causes of climate change and prevent its adverse effects" and scientific uncertainty should not be used as a reason for postponing such measures.<sup>139</sup> Accordingly, any claims, especially those from India, that there is still too much scientific uncertainty around black carbon for it to be regulated, should be considered in light of the factual data that has been presented.

The US failure to ratify the Kyoto Protocol poses a second major obstacle for further cooperation because of India's refusal to take action until the US does. Notwithstanding the US share of only six percent of black carbon emissions<sup>140</sup> combined with the Environmental Protection Agency's (EPA) regulation of black carbon as particulate matter under the Clean Air Act<sup>141</sup> to protect human health,<sup>142</sup> this country has a central role in the implementation of the Common but Differentiated Responsibilities principle and reaffirmation of the Kyoto Protocol's black carbon emissions provisions. In the 1960s, the US first started to regulate

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136. News, *UNECE Black Carbon Group Holds First Meeting*, INT'L INST. FOR SUSTAINABLE DEV. (June 28, 2010), <http://climate-l.iisd.org/news/unece-black-carbon-group-holds-first-meeting/?referrer=climate-l.org-daily-feed>.

137. Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone, Nov. 30, 1999, U.N. Doc. EB.AIR/1999/1, available at <http://www.unece.org/env/lrtap/full%20text/1999%20Multi.E.Amended.2005.pdf>.

138. *Id.* arts. 2-3.

139. UNFCCC, *supra* note 78, art. 3.

140. Anderson, *supra* note 9.

141. *Atmosphere Changes*, US ENV'T PROT. AGENCY [EPA], <http://www.epa.gov/climatechange/science/recentac.html> (last updated Aug. 19, 2010).

142. See Clean Air Research, *Particulate Matter (PM) Research*, EPA, <http://www.epa.gov/airsceince/quick-finder/particulate-matter.htm> (last updated Mar. 3, 2011).

black carbon indirectly as particulate matter primarily to protect human health and now its contribution of black carbon is negligible. Therefore, in a Common but Differentiated Responsibilities framework, the fact that developing countries contribute more to the problem of black carbon does not alleviate the responsibility of developed countries to contribute to the solution.

*E. Other Approaches to Mitigating Black Carbon in International Law*

As a promising development, the international community has finally started to study black carbon, focusing on its causes and effects. The most prominent voices originate from local and regional groups. As Andreas Stohl explained, "Finally, this topic has been put on the international political agenda," speaking as the project manager for the International Polar Year (IPY) project POLARCAT (Polar Study using Aircraft, Remote Sensing, Surface Measurements and Models, of Climate Chemistry, Aerosols, and Transport), which studies the transport of pollutants and climate forcing agents into the Arctic.<sup>143</sup> This project encompasses "spring agricultural burning, identification of other sources or black carbon impacting Arctic climate, and expansion of methane reduction efforts, worldwide."<sup>144</sup>

Thus, in May 2009, Arctic Council ministers agreed to jointly undertake efforts to reduce emissions of black carbon and other non-CO<sub>2</sub> pollutants in order to slow climate change and ice melt in the Arctic.<sup>145</sup> However, these voices have yet to reach the international scene on a large enough scale to effectuate meaningful change.

Additional efforts include a plea from the Indigenous People's Global Summit on Climate Change to the UNEP "to conduct a fast track assessment of short-term drivers of climate change, specifically black carbon, with a view to initiating negotiation of an international agreement to reduce emission of black carbon."<sup>146</sup> The Summit Declaration also calls for the US and Europe to take the lead by transferring appropriate technology, among other actions to reduce black carbon.<sup>147</sup>

#### IV. HOW REGULATING THE SHIPPING INDUSTRY CAN HELP CURB BLACK CARBON'S WARMING EFFECTS IN THE ARCTIC AND HIMALAYAN REGIONS

*A. Arctic Region*

Although the vast majority of black carbon emissions originate elsewhere, when such emissions reach the Arctic, the resulting ice-melt has widespread ecological implications; it has been postulated that reducing black carbon

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143. Anita Thorolvson Munch, *Arctic Council Targets Black Carbon*, POLARCAT (May 28, 2009), <http://www.ipy-osc.no/artikler/2009/1243517028.28>.

144. *Id.*

145. *Id.*

146. Indigenous People's Global Summit on Climate Change, Apr. 20-24, 2009, Anchorage, Alaska, *Report of the Indigenous Peoples' Global Summit on Climate Change*, 7 (2009), available at <http://www.indigenoussummit.com/servlet/content/home.html> [hereinafter Anchorage Declaration].

147. *Id.* at 96.

emissions is the fastest way to mitigate Arctic warming.<sup>148</sup> As a result of increased Arctic ice melting, shipping activity, which currently accounts for only 1.7 percent of the global black carbon inventory,<sup>149</sup> will also increase due to opening of Arctic channels, such as the Northwest Passage and the Northeast Passage,<sup>150</sup> thereby increasing emissions of black carbon from shipping vessels within the region.<sup>151</sup> As emissions from diesel engines and marine vessels contain higher levels of black carbon compared to other sources,<sup>152</sup> regulating black carbon emissions from these sources presents a significant opportunity to reduce black carbon's global warming impact.<sup>153</sup>

Given the expected increase in shipping throughout regions that are especially sensitive to black carbon, like the Arctic, regulation of the shipping industry can contribute to reductions in black carbon.<sup>154</sup> Otherwise, retreating Arctic sea ice will allow the Northern Sea Route and the Northwest Passage to remain open for longer periods of time each year, thus increasing shipping traffic through the Arctic.<sup>155</sup> The increased presence of the shipping industry in Polar Regions will in turn add a significant source of locally produced black carbon intensifying and exacerbating the pollution levels the Arctic already receives from lower latitudes.<sup>156</sup>

As the Kyoto Protocol does not regulate the shipping industry, a large emitter of black carbon<sup>157</sup> is allowed to continue emitting an estimated 70,000 to 160,000 tons per year.<sup>158</sup> Thus, implementation of a stricter set of environmental rules would have a powerful positive impact. In a joint submission preceding the March 2010 meeting of the Marine Environment Protection Committee (MEPC), Norway, Sweden and the US urged the International Maritime Organization (IMO) to take

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148. Zender Testimony, *supra* note 5, at 6.

149. Daniel Lack et al., *Light Absorbing Carbon Emissions from Commercial Shipping*, 35 GEOPHYSICAL RES. LETTERS L13815 (2008), available at [http://origin.pmcdn.net/p/ss/library/ocs/public/Lack\\_GRL\\_LAC\\_Shipping.pdf](http://origin.pmcdn.net/p/ss/library/ocs/public/Lack_GRL_LAC_Shipping.pdf).

150. Armas & Vanko, *supra* note 9.

151. IGSD/INECE Climate Briefing, *supra* note 49, at 3.

152. *Id.* at 4-5; Jacobson Testimony, *supra* note 3, at 3.

153. Lack, *supra* note 149.

154. *Id.*

155. For an overview of the problem posed by black carbon related to the shipping industry see Armas & Vanko, *supra* note 9, at 44.

156. Joseph Cheek, *Black Carbon: Playing a Major Role in Arctic Climate Change*, INT'L POLAR FOUNDATION (June 12, 2008), [http://www.sciencepoles.org/articles/article\\_detail/black\\_carbon\\_playing\\_a\\_major\\_role\\_in\\_arctic\\_climate\\_change/](http://www.sciencepoles.org/articles/article_detail/black_carbon_playing_a_major_role_in_arctic_climate_change/).

157. David Marshall, *No Progress to Reduce Shipping Climate Impact*, ACID NEWS, No. 3, at 19-20, Oct. 2008, available at <http://www.airclim.org/acidnews/2008/documents/AN3-08.pdf>.

158. *Id.*; see also IMO, Marine Env't Prot. Comm., *Prevention of Air Pollution from Ships. Second IMO GHG Study 2009*, at 1, IMO Doc. No. MEPC 59/4/7, Apr. 9, 2009, available at [http://www5.imo.org/SharePoint/blastDataHelper.asp/data\\_id%3D27795/GHGStudyFINAL.pdf](http://www5.imo.org/SharePoint/blastDataHelper.asp/data_id%3D27795/GHGStudyFINAL.pdf) (concluding that international shipping emitted 870 million tones of CO<sub>2</sub> in 2007, amounting to 2.7 percent of the global total that year). According to the IMO, the Second IMO GHG Study comprises the "most comprehensive and authoritative assessment of greenhouse gas emissions from ships engaged in international trade." *Greenhouse Gas Study 2009*, IMO, <http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Greenhouse-Gas-Study-2009.aspx> (last visited Mar. 11, 2011).



action on black carbon.<sup>159</sup> However, black carbon was not discussed, nor was it addressed at the February 2011 meeting of the MEPC.<sup>160</sup>

On a related subject, the US and Canada are nearing a Joint Marine Pollution Contingency Plan to clean up air pollution and emissions by regulating ships passing within 200 nautical miles of their shores,<sup>161</sup> but the plan does not address black carbon and new rules about black carbon emissions recently announced by Canada and the United States specifically exclude ships operating in the Arctic.<sup>162</sup> However, in February 2011, Rep. Jerrold Nadler, along with 50 other co-sponsors, introduced the Clean Ports Act in the U.S. House of Representatives.<sup>163</sup> The bill provides support for policies, such as the Los Angeles Clean Truck Program, that curb diesel pollution in port regions, thus reducing black carbon and improving the air quality affecting 87 million Americans who live and work in port regions.<sup>164</sup> Similar action should be taken in India since it lacks nationwide port legislation and has 12 major ports and 181 minor ports along its 6,000 km coastline, similar action should be taken.<sup>165</sup>

It is worth noting that estimating global greenhouse gas emissions from shipping is challenging due to the lack of data and scientific uncertainty on its overall impact. Research on quantification of shipping's emissions had previously focused on emissions of CO<sub>2</sub>, but now attention is appropriately focusing on emissions of black carbon and NO<sub>2</sub> from ships.<sup>166</sup> Other potential solutions to such emissions from the shipping industry include installation of scrubbers on ships or reducing sulfur emission by switching to an ultra-low sulfur fuel and requiring shipping companies to reduce their ships' speed as ships that slow down by ten percent use twenty-five percent less fuel. Ports authorities could also encourage or require ships to reduce their engine use as they approach the shore and the port.

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159. Joint Submission to MEPC, *supra* note 33, at 1.

160. *IMO Meeting Makes no Progress on Controlling Black Carbon Emissions*, SUSTAINABLE SHIPPING, Feb. 11, 2011, [http://www.sustainableshipping.com/news/i100607/IMO\\_meeting\\_makes\\_no\\_progress\\_on\\_controlling\\_black\\_carbon\\_emissions#](http://www.sustainableshipping.com/news/i100607/IMO_meeting_makes_no_progress_on_controlling_black_carbon_emissions#).

161. Renee Schoof, *U.S., Canada Near Agreement to Control Pollutants from Ships*, MCCLATCHY (Sept. 2, 2009), <http://www.mcclatchydc.com/2009/09/02/74811/us-canada-near-agreement-to-control.html#>; see also *Canada-United States Joint Marine Pollution Contingency Plan*, Letter of Promulgation (May 22, 2003), available at [http://www.nrt.org/production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/A-403CANUSJCPEnglish/\\$File/CANUS%20JCP%20English.pdf?OpenElement](http://www.nrt.org/production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/A-403CANUSJCPEnglish/$File/CANUS%20JCP%20English.pdf?OpenElement).

162. Scott Highleyman & Marilyn Heiman, *Arctic Shipping: Stormy Seas or Smooth Sailing*, SACRAMENTO BEE, July 23, 2009, available at [http://www.pewtrusts.org/news\\_room\\_detail.aspx?id=54327](http://www.pewtrusts.org/news_room_detail.aspx?id=54327).

163. Coalition for Clean & Safe Ports, *Clean Ports Act of 2011*, <http://www.cleanandsafeports.org/clean-ports-act-of-2011/> (last visited Mar. 26, 2011).

164. *Id.*

165. Maritime Connector, *Indian Ports and Port Authorities*, <http://www.maritime-connector.com/ContentDetails/3192/gcgid/219/lang/English/INDIAN-PORTS---PORT-AUTHORITIES.wstml> (last visited Mar. 26, 2011).

166. ELLYCIA HARROULD-KOLIEB, OCEANA, *SHIPPING IMPACTS ON CLIMATE: A SOURCE WITH SOLUTIONS* 4 (2008), available at <http://na.oceana.org/en/news-media/publications/reports/shipping-impacts-on-climate-a-source-with-solutions>.

Additionally, once ships are docked at a port, the port should require reliance on shore power instead of the ship's engines or generators,<sup>167</sup> because relying on shore power will reduce particulate emissions in accordance with regulations in many industrialized countries. Moreover, relying on shore power eliminates carbon and particulate emissions if shore power is generated by renewable sources, such as wind or solar.<sup>168</sup>

### *B. Himalayan Glaciers*

Most scientists view the Himalayan glaciers as melting alarmingly rapidly, leading to severe flooding in the Southern Hemisphere.<sup>169</sup> Soot emitted from sources in India and China and the industrialized Northern Hemisphere is considered as further exacerbating such melting.<sup>170</sup> However, controversy surrounds the rate at which the glaciers are melting and the accuracy of the scientific data measuring their rate of retreat.<sup>171</sup> In the weeks leading up to the Copenhagen meeting, critics challenged the IPCC's projected timeframe for the Himalayan glaciers' expected disappearance.<sup>172</sup>

Notwithstanding the mistakes in the IPCC's reported findings, however, scientific research exists showing that in the Himalayan region, solar heating from black carbon at high elevations may contribute to glacial melting almost equivalent to CO<sub>2</sub>.<sup>173</sup> According to some studies, warmer air resulting from black carbon in South and East Asia over the Himalayas contributes to a warming of approximately 0.6°C and studies on the Tibetan plateau show a warming in excess of 1°C since the 1950s.<sup>174</sup>

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167. John-Michael Cross, *Shore-Based Power: Reducing Idle Ships' Emissions*, CLIMATE INSTITUTE, Spring 2010. See also John Gillie, *Puget Sound First: Shore Power Instead of Generators for Docked Cargo Ship*, THE NEWS TRIBUNE, Mar. 26, 2011, available at <http://www.thenews-tribune.com/2010/10/28/1399238/ship-powers-up-from-shore.html>.

168. HARROULD-KOLIEB, *supra* note 166, at 11. See also Join Submission to MEPC, *supra* note 33, ¶ 8.

169. Pope, *supra* note 65.

170. *Id.*

171. IPCC, *IPCC Statement on the Melting of Himalayan Glaciers*, Jan. 20, 2010, available at <http://www.ipcc.ch/pdf/presentations/himalaya-statement-20january2010.pdf> [hereinafter *IPCC Statement*].

172. The Synthesis Report of the Fourth Assessment Report of the IPCC stated: "Climate change is expected to exacerbate current stresses on water resources from population growth and economic and land-use change, including urbanisation. On a regional scale, mountain snow pack, glaciers and small ice caps play a crucial role in freshwater availability. Widespread mass losses from glaciers and reductions in snow cover over recent decades are projected to accelerate throughout the 21st century, reducing water availability, hydropower potential, and changing seasonality of flows in regions supplied by meltwater from major mountain ranges (e.g. Hindu-Kush, Himalaya, Andes), where more than one-sixth of the world population currently lives." IPCC, *FOURTH ASSESSMENT*, *supra* note 30. The IPCC released a statement supporting the accuracy of the paragraph but pointed out that a paragraph in 938-page Working Group II contributed to the underlying assessment referred to "poorly substantiated estimates of rate of recession and date for the disappearance of Himalayan glaciers." *IPCC Statement*, *supra* note 171, referring to, IPCC, Working Group II, *Technical Report*, 37 (2009).

173. Burleson, *supra* note 61, at 92.

174. Ramanathan & Carmichael, *supra* note 1, at 221-24; see also IGSD/INECE Climate Briefing,

The Energy and Resources Institute (TERI) in Delhi has two sensors in the Himalayas, one on the Kholai glacier that sits on the mountain range's western flank in Kashmir and the other flowing through the eastern reaches in Sikkim.<sup>175</sup> Professor Syed Hasnain of TERI described findings from the sensors as indicating "concentrations of black carbon in the Himalayas in what are supposed to be pristine, untouched environments."<sup>176</sup> Glaciers in the Himalayan region feed a majority of the major rivers in Asia and the substantial melting results in severe flooding downstream.<sup>177</sup> Hasnain is critical of India's response, pointing out that although India and China both contribute to about a third of the world's black carbon, "at least in China the state has moved to measure the problem. In Delhi no government agency has put any sensors on the ground. [TERI] is doing it by ourselves."<sup>178</sup>

#### V. WHY INDIA'S LEGAL FRAMEWORK IS WELL SUITED TO ADDRESS BLACK CARBON

Indian Prime Minister, Manmohan Singh's goal of a common per capita global warming emissions level<sup>179</sup> is unrealistic given India's low per capita emission compared with the West. However, as the following discussion shows, India is capable of achieving success in curbing climate change through its legal system. To illustrate, India's National Green Tribunal Act, which passed in June 2010, established a new court, the National Green Tribunal, designed to exclusively hear cases concerning environmental law.<sup>180</sup> While the Court's parameters and functionality have yet to come to fruition, the existence of the Court elevates India to a position among leading countries in the world, including Australia and New Zealand, with such an extensive system of specialized environmental courts.<sup>181</sup>

India's Supreme Court has an already impressive jurisprudence with respect to individual rights to a healthy environment.<sup>182</sup> Notable decisions include *M.C. Mehta v. Union of India* (1987),<sup>183</sup> *M.C. Mehta v. Union of India* (1988),<sup>184</sup> *M.C.*

*supra* note 49, at 4.

175. Ramesh & Goldenberg, *supra* note 103.

176. *Id.*

177. *Id.*

178. *Id.*

179. Dr. Manmohan Singh, *PM's Speech on Release of Climate Change Action Plan*, New Delhi, PRIME MINISTER OF INDIA (June 30, 2008), <http://pmindia.nic.in/lispeech.asp?id=690>.

180. Wendy Zeldin, *India: New Green Tribunal Established*, GLOBAL LEGAL MONITOR, Jan. 6, 2011, available at [http://www.loc.gov/lawweb/servlet/lloc\\_news?disp3\\_1205402462\\_text](http://www.loc.gov/lawweb/servlet/lloc_news?disp3_1205402462_text).

181. *Id.*; *India First Country in the World to have Specialized Environment Courts*, GITS4U.COM, <http://www.gits4u.com/envo/envo16.htm> (last visited Mar. 30, 2011); GEORGE (ROCK) PRING & CATHERINE (KITTY) PRING, GREENING JUSTICE: CREATING AND IMPROVING ENVIRONMENTAL COURTS AND TRIBUNALS, v (2009) ("The Land and Environment Court of New South Wales, Australia, is a leading example of a specialized court.").

182. PRING & PRING, *supra* note 181, at v, 24; for an overview see also S.P. Sathe, *Judicial Activism: The Indian Experience*, 6 WASH. U. J.L. & POL'Y 29 (2001).

183. *M.C. Mehta v. Union of India (Oleum Gas Leakage case)*, 1987 A.I.R. 1086. This case involved the award of and compensation to the victims of the Oleum gas leakage from a factory of

*Mehta v. Union of India* (1998),<sup>185</sup> *M.C. Mehta v. Union of India* (1999),<sup>186</sup> *M.C. Mehta v. Kamal Nath*,<sup>187</sup> and *M.C. Mehta v. Union of India* (2004),<sup>188</sup> which upheld various environmental rights, generally finding that disturbing the basic environment, such as air and water, constitutes a violation of the right to life, as it encompasses the preservation of ecological balance. In a 2010 decision, the Court invoked the wisdom of Mahatma Gandhi by emphatically reiterating the importance of protecting the environment:

Mahatma Gandhi once said that earth provides enough to satisfy every man's need but not every man's greed. It is the greed of the mankind which has brought environment degradation and pollution. Preservation of the eco-system is an immutable duty under the Constitution - a fine balance must be struck between environmental protection and development.<sup>189</sup>

In light of India's stance that climate mitigation must not impede economic development,<sup>190</sup> the Indian judiciary's interpretation of the Indian Constitution

Sriram Foods manufacturing and hazardous chemical storage plants and Fertilizers in New Delhi on the night of December 3, 1985, which caused serious human health problems, including deaths. The Indian Supreme Court ordered compensation to the victims based on Article 21 of the Indian Constitution, which provides for the right to a pollution-free living environment.

184. *M.C. Mehta v. Union of India (Ganga Pollution case)*, 1988 A.I.R. 1037, 1041. The Indian Supreme Court held that there was no dispute that the discharge of trade effluents from tanneries in Jajmau in Kanpur was polluting the river Ganga and thus causing considerable problems for human health and thus ordered the closing of 157 tanneries and 191 other industries in U.P., Bengal and Bihar. It also ordered more than 5,000 industries located in the Ganga basin to set up effluent treatment plants and pollution control devices; "We are conscious that closure of tanneries may bring unemployment, loss of revenue, but life, health and ecology have greater importance to the people." Justice Singh, concurring opinion.

185. *M.C. Mehta v. Union of India*, 1998 A.I.R. 2340, modification of the Indian Supreme Court's 1992 order in the *Vehicular Pollution case*, *supra* note 52.

186. *M.C. Mehta v. Union of India (Badkhal & Surajkund Lakes case)*, 1996 (8) S.C.C. 462. India's Supreme Court held "in order to preserve environment and control pollution within the vicinity of the two tourist resorts it is necessary to stop mining in the area." The Court ordered cessation of mining activity within 2 kms radius of the tourist resorts, and no construction would be permitted within 5 km radius.

187. *M.C. Mehta v. Kamal Nath*, 1997 (1) S.C.C. 388. The Supreme Court of India established the principle of exemplary damages for the first time in India, invoking the Polluter Pays Principle and Public Trust Doctrine in a case involving a family-owned motel's beautification plans that would have resulted in encroachment upon forest areas. The Court ordered the Span Motel owners to hand over forest land to the Government and remove any encroachments, thus holding that disturbing the basic environment, such as air and water, constituted a violation of the right to life which encompasses preservation of ecological balance.

188. *M.C. Mehta v. Union of India*, 2004 (3) S.C.R. 128. In reviewing the *Badkhal & Surajkund Lakes case*, *supra* note 186, the Indian Supreme Court held that the mine leases would not be renewed.

189. *Maharashtra Land Development Corp. v. State of Maharashtra*, Civ. App. 2147-2148, at 21 (2010), also stating that "[t]his Court has for long been an outspoken critic of attempts to degrade the environment, and a vocal supporter of sustainable development."

190. THE ROAD TO COPENHAGEN, *supra* note 118, at 4-5. Secretary of India's Environment Ministry, Pradipto Ghosh, made clear before the 2007 G8 summit that India would not accept CO<sub>2</sub> limits that would retard economic growth and damage India's attempts to eradicate poverty. See NIGEL

stands to facilitate the prioritization of favorable environmental conditions over development concerns. Article 21 of the Indian Constitution provides that “no person shall be deprived of his life or personal liberty except according to procedure established by law.”<sup>191</sup> In *Bandhua Mukti Morcha v. India*, Justice Bhagwati articulated that whenever a fundamental right is violated, any person could have standing to bring an action in the Supreme Court for the enforcement of such fundamental right.<sup>192</sup> The basis for India’s public interest litigation is the belief on the part of judges and the Court that justice is not a privilege only for the rich, as stated in *PUDR v. India*, in 1982:

Public interest litigation is brought before the Court not for the purpose of enforcing the rights of one individual against another as happens in the case of ordinary litigation, but is intended to promote and vindicate public interest which demands that violations of constitutional or legal rights of large number of people who are poor, ignorant or in a socially or economically disadvantaged position should not go unnoticed and unredressed.<sup>193</sup>

In line with the precedent of the Indian Supreme Court, the National Green Tribunal, when it becomes institutionalized,<sup>194</sup> will have the opportunity to seek redress for harm caused by black carbon. The Court’s liberal rule of *locus standi* allows for individuals and groups, such as Peoples Union For Civil Liberties, and activists such as M.C. Mehta, to represent underprivileged sections of society.<sup>195</sup> A cause of action could accordingly be brought on behalf of the millions of poor who suffer from inhalation of soot and who breathe the smoke-filled air. A possible remedy to such action would be similar to that of the remedy in *M.C.*

LAWSON, AN APPEAL TO REASON: A COOL LOOK AT GLOBAL WARMING (2008).

191. INDIA CONST. art. 21.

192. *Bandhua Mukti Morcha v. Union of India*, 1984 A.I.R. 802.

193. *People’s Union for Democratic Rights (PUDR) v. India*, 1982 A.I.R. 1473, 1476 (1982).

194. On Dec. 15, 2010 the Indian Supreme Court ordered the National Green Tribunal (NGT) to be set up within four weeks. Although the Tribunal was set to start hearing cases on Jan. 15, 2011, the launching of the Tribunal was delayed according to an environment ministry official who said it was still in the process of selecting candidates for the tribunal. Padmaparna Ghosh, *Gov’t Misses Deadline to Set up Eco-Court*, LIVEMINT.COM, Jan. 17, 2011, available at <http://www.livemint.com/2011/01/16210159/Govt-misses-deadline-to-set-up.html?type=tp>. “Two months have passed but the tribunal is still not functional.” At the time of publication, the Court’s chairperson position has been filled by Lokeshwar Singh Pant, a former Supreme Court judge. The tribunal’s additional 10 judicial members and 10 expert members have not yet been appointed. According to the NGT Act, the chairperson alone cannot exercise the jurisdiction, powers and authority of the tribunal while the appointment of other members may take up to three months, according to a source in the environment ministry. The rules for the Tribunal’s functioning have also not yet been finalized and no regional branch has been opened. Kumar Sambhav Shrivastava, *National Green Tribunal Fails to Start, Project Clearances Continue*, CLIMATE HIMALAYA INITIATIVE – NEWS, Dec. 25, 2010, available at <http://chimalaya.org/2010/12/25/non-existent-check-post-india/>. See also Kanchi Kohli, *A Crevasse in the Regulatory Environment*, INDIA TOGETHER, Nov. 28, 2010, available at <http://www.indiatogether.org/2010/nov/env-ngt.htm>.

195. Sathe, *supra* note 182, at 79.

*Mehta v. Union of India & ORS*,<sup>196</sup> in which the Delhi Supreme Court ordered an overhaul of Delhi's public transportation system in the interest of public health. A Court-ordered shift from traditional methods of burning biomass to cooking and heating through the use of cook stoves could have life-saving results.

Such a decision would also be in line with the U.N.'s Millennium Development Goals, which strive toward eradicating global poverty and ensuring environmental sustainability, because reduction of black carbon's harmful effects on human health and warming will facilitate achievement of the other goals.<sup>197</sup> A legal order to such effect would have global benefits. The combined power of India's activist Supreme Court having taken on a de facto legislative and regulatory role,<sup>198</sup> and existing legislation<sup>199</sup> places India in a position to be a leader in environmental justice.

## VI. CONCLUSION

As developing countries focus their energies on efforts aimed at development, they must also prioritize safeguarding and improving the environment.<sup>200</sup> Although willing to accept certain measures to protect health concerns related to black carbon emissions, India must accept its role as a leader of developing countries to take steps to mitigate the harmful effect of such emissions on the environment.

Developing and developed nations must collaboratively address the problem of climate change resulting from non-CO<sub>2</sub> sources. While the international community's primary focus will likely remain on reducing CO<sub>2</sub> emissions in the near future, it is imperative that the successor to the Kyoto Protocol regulates black carbon emissions as well. Such inclusion in an international treaty, in conjunction with national efforts, particularly in India, and active NGO and community engagement, could have a positive impact on reducing black carbon. This would simultaneously benefit human health and slow warming in the Arctic and Himalayan regions.

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196. *Vehicular Pollution Case*, *supra* note 52.

197. Lakshman Guruswamy, *Energy Justice and Sustainable Development*, 21 *COLO. J. INT'L L. & POL'Y* 231, 237-38 (2010).

198. United States Agency for International Development (USAID), *India Air Quality Reforms*, 3, Apr. 2002 – Dec. 2003, finding that "the Court taking on a de-facto legislative and regulatory role, was aligned with technical and legal precedents and resulted in positive impacts on air quality."

199. The Air (Prevention and Control of Pollution) Act, No. 14, 1981, enacted in accordance "decisions made at the United Nations Conference on the Human Environment, held in Stockholm in June, 1972, in which India participated, to take appropriate steps for the preservation of the natural resources of the earth, which, among other things, include the preservation of the quality of air and control of air pollution."

200. United Nations Conference on the Human Environment, Stockholm, Swed., June 5-16, 1972, *Declaration of the United Nations Conference on the Human Environment*, ¶¶ 3-5, U.N. Doc. A/CONF.48/14/Rev.1, 11 *I.L.M.* 1416 (June 16, 1972).

Scientific evidence indicates the enormous benefit of reducing black carbon emissions, as found by a recent US EPA study.<sup>201</sup> As mentioned above, the Indian government, aware of the detrimental effects of black carbon on human health, especially on women and children who inhale soot regularly,<sup>202</sup> has taken preliminary steps to regulate it.<sup>203</sup> While these efforts are primarily motivated by public health concerns rather than to curb climate change, the resulting effects on the climate will directly promote environmental stability and sustainability.

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201. See the EPA study of March 2011, Ari Natter, *Reducing Black Carbon Can Slow Warming, EPA Finds*, WORLD CLIMATE CHANGE, Mar. 25, 2011, which determined that although black carbon reductions should not be considered a substitute for reductions in greenhouse gas emissions, “[m]ounting scientific evidence suggests that reducing current emissions of [black carbon] can provide near term climate benefits, particularly for sensitive regions such as the Arctic.” See also UNEP, *Integrated Assessment of Black Carbon and Tropospheric Ozone; Summary for Policy Makers*, 2 (2011); Ronald Bailey, *Cutting Black Carbon and Methane Emissions Would Reduce Projected Global Warming by Half*, Feb. 24, 2011, available at <http://reason.com/blog/2011/02/24/cutting-black-carbon-and-metha>; Matthew McDermott, *Reducing Black Carbon Soot Would Slash Arctic Warming Two-Thirds by 2030, Cut Temp Rise by 0.5C*, Feb. 23, 2011, available at <http://www.treehugger.com/files/2011/02/reducing-black-carbon-soot-slash-arctic-warming-two-thirds-2030.php>.

202. Anderson, *supra* note 9.

203. Chetan Chauhan, *India to Launch Black Carbon Plan on Dec. 15*, HINDUSTAN TIMES, Dec. 9, 2010, available at <http://www.hindustantimes.com/India-to-launch-black-carbon-plan-on-Dec-15/Article1-636111.aspx> (quoting India’s Environment minister Jairam Ramesh from the UNFCCC’s COP 16 meeting in Cancun, Mex., Dec. 2010: “Our position on the issue is clear. We are starting the programme on black carbon as it is a health issue more than [an] environment issue for us.”). India’s black carbon program, launched on Dec. 15, 2010, covers measurement, monitoring and modeling for black carbon, but India still officially objects to the inclusion of black carbon within the framework of UN climate talks. *Id.*