

## Earth: The Sequel: The Race to Reinvent Energy and Stop Global Warming

By: Fred Krupp & Miriam Horn

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It is no secret that the success of industrial nations, such as the United States, is in part a product of their dependence on fossil fuels as their primary energy source.<sup>1</sup> However, this success did not come without consequence. Two hundred years worth of fossil fuel emissions have resulted in significant increases in “greenhouse gas”<sup>2</sup> concentrations in the atmosphere leading to noticeable climate change.<sup>3</sup> According to climate change theory, the aggregation of these gases prevents excess heat from escaping the Earth’s atmosphere, gradually raising the Earth’s temperature.<sup>4</sup> Subsequently, “[s]tabilizing the climate will require cutting greenhouse gas emissions around the globe....”<sup>5</sup> Today, more than ever, it is apparent that alternative energy sources must be implemented to begin the process of reversing the effects of these greenhouse gases on the environment. In *Earth: The Sequel: The Race to Reinvent Energy and*

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<sup>1</sup> The term “fossil fuels” generally refers to coal, oil, and natural gas, all non-renewable sources of energy. Fossil fuels provide more than 85% of all the energy consumed in the United States. Fossil Fuels, US Department of Energy, available at <http://www.energy.gov/energysources/fossilfuels.htm> (last visited Mar. 11, 2009).

<sup>2</sup> Greenhouse gases occur both through natural processes and as the result of human activity. Principal greenhouse gases entering the atmosphere include: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and fluorinated gases (e.g. hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>)). Greenhouse Gas Emissions, US Environmental Protection Agency, available at <http://www.epa.gov/climatechange/emissions/> (last visited Mar. 11, 2009).

<sup>3</sup> Fossil Fuels, Energy Matters, available at <http://library.thinkquest.org/20331/types/fossil/> (last visited Mar. 11, 2009).

<sup>4</sup> Global warming is an average increase in the temperature of the atmosphere near the Earth’s surface and in the troposphere, which can contribute to changes in global climate patterns. “Global warming” often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities. Climate Change Basic Information, US Environmental Protection Agency, available at <http://www.epa.gov/climatechange/basicinfo.html> (last visited Mar. 11, 2009).

<sup>5</sup> Fred Krupp & Miriam Horn, *Earth: The Sequel: The Race to Reinvent Energy and Stop Global Warming*, (W.W. Norton & Company, Inc. 2008) at 249.

*Stop Global Warming*,<sup>6</sup> Fred Krupp<sup>7</sup> and Miriam Horn<sup>8</sup> present a refreshingly optimistic argument for combating global warming through the pairing of innovative green technology and economic incentives. As the authors put it, “this book is about the kinds of inventors who will stabilize our climate, generate enormous economic growth, and save the planet.”<sup>9</sup>

Krupp and Horn divide the focus of the book into two fundamental objectives: educating the reader about green technology and proposing attainable solutions. The authors initially concern themselves with alerting the reader to the urgency of investing in alternative energy sources. The first chapter is dedicated solely to addressing the past and present progression of global warming while setting the stage for future problems that will likely arise and which prompt the need to develop clean technology to preserve the Earth for future generations. After firmly establishing the basis for their discourse, the authors introduce a full spectrum of possible alternative energy sources, individually separated by chapter. This analysis comprises the majority of their discussion, and because each energy source is addressed independently, Krupp and Horn take full advantage of the text to discuss the various technologies in considerable detail.

The technologies presented run the gamut of engineering possibilities for clean energy alternatives from solar power to nuclear fusion, but these options also have limitations. The authors are consistently optimistic in their discussion of potential solutions to developing clean energy whether the technology is wholly novel or a derivation or improvement of existing

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<sup>6</sup> See *Earth: The Sequel*, available at <http://earththesequel.edf.org/> (last visited Mar. 11, 2009).

<sup>7</sup> Krupp is the President of the Environmental Defense Fund, a national nonprofit organization. He has participated in developing the acid rain reduction plan in the 1990 Clean Air Act, the U.S. proposal for the global climate treaty, and he helped launch the U.S. Climate Action Partnership. *Earth: The Sequel, The Authors*, available at <http://earththesequel.edf.org/authors> (last visited Mar. 11, 2009).

<sup>8</sup> Horn is a journalist currently on staff at the Environmental Defense Fund, and has written for numerous newspapers and magazines, including *Vanity Fair*, *The New York Times*, and *The New Republic*. *Earth: The Sequel, The Authors*, available at <http://earththesequel.edf.org/authors> (last visited Mar. 11, 2009).

<sup>9</sup> Krupp & Horn, *supra* note 5, at 1.

technology. While constraints arise from existing methodologies, such as the storage capacity inefficiency of the photovoltaic cells used to capture solar energy,<sup>10</sup> the greatest disadvantage in alternative energy engineering arises from the uncertainty of the emerging technologies. Some of the technologies are so innovative that their promise is purely speculative; solutions found in a lab may not translate to those which are globally viable.<sup>11</sup>

Although they focus mainly on the science behind the clean energy itself, the authors also interject their own proposed legislative solutions. Part of the challenge the authors face with their proposed solutions to reduce global warming is the lack of existing law as a guide. “Despite the recent focus on climate change issues, there are currently no overarching federal laws that explicitly require the government or corporations to mitigate their impact on global climate change.”<sup>12</sup> Krupp and Horn emphasize that ultimately the solutions to reversing global warming begin with striking a balance between technological innovation and a new form of economics, entrepreneurial capitalism.<sup>13</sup> It is here that the authors introduce their ideal starting point: instituting a cap-and-trade mechanism for carbon emissions (a parallel translation of the pre-existing cap-and-trade mechanism for sulfur dioxide (SO<sub>2</sub>) emissions under the Clean Air Act (1990 Amendment)).<sup>14</sup>

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<sup>10</sup> Krupp & Horn, *supra* note 5, at 16. Traditionally, energy storage has meant batteries, which can be prohibitively expensive when the sun is not shining. Therefore, researchers are working to develop alternative storage technologies. Until then, storage will remain a major impediment.

<sup>11</sup> See e.g., What is Wave Energy?, Pelamis Wave Power, available at <http://www.pelamiswave.com/content.php?id=157> (last visited Mar. 11, 2009).

<sup>12</sup> Lauren E. Schmidt & Geoffrey Williamson, *Recent Developments in Climate Change Law*, 37 Colo. Law. 63, 63 (2008).

<sup>13</sup> Krupp & Horn, *supra* note 5, at 7.

<sup>14</sup> See The Cap and Trade Success Story, Environmental Defense Fund, available at <http://www.edf.org/page.cfm?tagID=1085> (last visited Mar. 11, 2009). See generally, 42 U.S.C. §§ 7401–7412, 7470 – 7671 (amended 1990).

Under a cap-and-trade system, each large-scale emitter is limited to the amount of greenhouse gases it is allowed to discharge;<sup>15</sup> entities are granted “emissions permits” for every ton of carbon dioxide they release.<sup>16</sup> Over time the allowable limits are tightened until the reduction goal is achieved.<sup>17</sup> Efficient entities that emit less than their allowance are permitted to sell their extra permits to others exceeding their limits.<sup>18</sup> An active cap-and-trade market enables all participants to meet the total emissions cap cost-effectively and provides incentives to find the cheapest solutions for pollution control.<sup>19</sup>

One of the greatest strengths of the book stems from its structural format and organizational development. From the outset, the authors begin with a strong explanation of the underlying threat of global warming, setting the tone for the entire book. But, what is most compelling is how the authors manage to take the ominous subject matter and present it optimistically through a series of realistic solutions. Moving forward off of the central theme, each technology is discussed in its own chapter allowing the authors to provide thorough descriptions of the fundamental scientific principles behind each technology. Structurally, the layout is advantageous for the reader because it creates effective breaks in the material and eases the transition between chapters. This also gives the authors the freedom to explain how the technology may help to counteract the effects of global warming more comprehensively.

Substantively, the discussion of the United States’ role in global warming is particularly strong. The United States alone is responsible for an astonishing percentage of the world’s greenhouse gas emissions. In fact, “[the] US contributes about 30% of greenhouse gases so it

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<sup>15</sup> See generally Cap and Trade Resources, US Environmental Protection Agency, *available at* <http://www.epa.gov/airmarkets/resource/cap-trade-resource.html> (last visited Mar. 11, 2009).

<sup>16</sup> See Cap and Trade 101, Center for American Progress, *available at* <http://www.americanprogress.org/issues/2008/01/capandtrade101.html> (last visited Mar. 11, 2009).

<sup>17</sup> Cap and Trade 101, *supra* note 16.

<sup>18</sup> Cap and Trade 101, *supra* note 16.

<sup>19</sup> See The Cap and Trade Success Story, *supra* note 14.

needs to take the lead and be a model for other countries.”<sup>20</sup> The authors deliberately highlight this point because it is their contention that the ultimate solution will require clean energy initiatives across the globe.

The authors’ second objective, combating the effects of global warming, is addressed more subtly throughout the text as they transition almost effortlessly from the technical dialogue to their proposed solutions. The implementation of a carbon cap-and-trade system in the United States is central to the authors’ plan for reducing the effects of global warming. Krupp, in particular, is an avid supporter of this proposition, and likely biased, as this plan would mimic the Clean Air Act (CAA) Amendments of 1990, which he was involved in developing.<sup>21</sup> In effect this plan creates a new clean energy commodity, reduced carbon credits, as an economic incentive to “going green.” Nonetheless, this economically incentivized system has merit. There is the success of the acid rain cap on SO<sub>2</sub> under the CAA. During the first decade following its implementation, the program achieved 100% compliance in reducing SO<sub>2</sub> emissions.<sup>22</sup> Such success indicates the potential for a similar result in a parallel application of the protocol for reducing carbon emissions. Moreover, there is the continued investment by venture capitalists in

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<sup>20</sup> Krupp & Horn, *supra* note 5, at 249. “[An] international agreement to binding limits will not happen without the United States – which is now the only developed country in the world not under a carbon cap.” *Compare* United Nations Framework Convention on Climate Change, Clean Development Mechanism (CDM), About Clean Development Mechanism (CDM), Clean Development Mechanism, *available at* <http://cdm.unfccc.int/about/index.html> (regarding cap-and-trade mechanism in place in European Union), *and* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, U.N. Doc. FCCC/CP/1997/L.7/Add.1, 37 I.L.M. 22, *available at* <http://unfccc.int/resource/docs/convkp/kpeng.pdf> (following ratification by Russia, the Kyoto Protocol entered into force on 16 February 2005). *See also*, Alexander Adam, *Technology Transfer to Combat Climate Change: Opportunities and Obligations under TRIPS and Kyoto*, **9 J. HIGH TECH. L. 1** (2009).

<sup>21</sup> *See* Fred Krupp, Environmental Defense Fund, *available at* <http://www.edf.org/page.cfm?tagID=870> (last visited Mar. 11, 2009).

<sup>22</sup> *See* The Cap and Trade Success Story, *supra* note 14.

innovative clean technology representing a steadily growing market likely to subsist well into the future as the collective effort works to reduce the effects of global warming.<sup>23</sup>

The book, however, is not without weakness. One downside is that occasionally the authors summarize the scientific principles in a way that is directed towards persons already knowledgeable in the subject matter, making it difficult for someone without a scientific background to follow; this is particularly evident in the discussion of the weaknesses regarding the efficiency of photovoltaic cells in solar power capture methods. Additionally, the writers recycle opinions mechanically for each technology alternative while adding little to no new value to their argument. Despite these minor flaws, Krupp and Horn are successful in achieving their primary objective of educating the reader regarding innovative green technology and cleaner energy across the board.

*Earth: The Sequel* follows a wholly optimistic course through the spectrum of clean technology alternatives and their potential for combating global warming. It is heavily focused on detailed discussions of the underlying scientific principles behind these current and emerging technologies. The book is sure to appeal to scientists and environmentalists alike. However, a scientific background is not a prerequisite for understanding the authors' perspectives, so anyone interested in the global warming crisis is likely to take interest. Furthermore, *Earth: The Sequel* will remain relevant well into the future even as its science evolves because global warming is not a problem that will be solved overnight.

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<sup>23</sup> Krupp & Horn, *supra* note 5, at 91. “[T]op venture capitalists and the U.S. Department of Energy are investing big money...believing that both the time and the technology are now ripe.” See also, Vincent Barbera, *Tomorrow Today? Cellulosic Ethanol: How It’s Done, Who’s Getting It Done, and Its Environmental Impact*, 20 **Vill. Envtl. L.J.** 27, 44 (2009) (discussing venture capitalists’ increased involvement in “clean energy” technology production).