



©MERNYÓ FERENC/ BUDAPEST, HUNGARY

FINANCIAL INNOVATIONS & CARBON MARKETS

By GRACIELA CHICHILNISKY

A Modest Extension of the Kyoto Protocol Can End the Impasse Between Industrial and Developing Nations

THE POINT OF NO RETURN

For the first time in recorded history, humans are altering the planet in ways that can endanger its basic life-support systems. We are rapidly transforming the planet's atmosphere, its bodies of water and the complex web of species that makes up life on Earth. Human emissions of carbon dioxide and other greenhouse gases have changed the Earth's atmosphere, unleashing a potentially catastrophic climate change that can threaten the survival of human civilization. This is real, and it is happening now. As the polar caps and Greenland's permafrost start to melt, the sea level rises. Entire towns in Alaska are sinking into the warming seas. Species such as the polar bear are on the verge of extinction. Island nations like

the Seychelles and low-lying countries such as Bangladesh risk sinking into the ocean. And hundreds of millions of people could follow suit. Indeed, 50 million "climate change refugees" are expected by 2010 and more than 200 million, by 2050—one out of every 45 people who will be alive at the time.¹

Graciela Chichilnisky is Professor of Economics and Statistics, Columbia University.

In June 2009 the UN General Assembly invited the UN Security Council to intensify its efforts in addressing climate change and its possible security implications.² In as little as 20 years' time, we could be past the point of no return.

We are at a critical point in the history of humankind. This article explains what we must do now to prevent significant and irreparable damage to our planet and its life support systems. The Kyoto Protocol is the only international agreement we have to address the risk of climate change, and it expires in 2012. Its fate will be decided this December at the UN Climate Change Conference in Copenhagen. This may just be the most important event you read about in 2009. I will explain what we can do to resolve

Developing nations
house 80 per cent of
humankind but emit
only 40 per cent of the
world's emissions, while
60 per cent of global
emissions originate from
the rich nations that
house 20 per cent of the
world's population.

the climate crisis in practical terms, and how Copenhagen can resolve the impasse between the industrial and the developing nations in the global negotiations. I will propose two entirely practical and feasible solutions that build on existing law, in effect, modest extensions of the Kyoto Protocol's "carbon market" and its Clean Development Mechanism (CDM). These two proposals can overcome the gulf between rich and poor nations. They involve financial and technological mechanisms and have elicited positive responses in various

nations including China, India and the United States; they reflect the requests of developing nations at the recent meeting of the Group of Eight main industrialized countries (G8) in July 2009; and they elicited a positive reception at the Expert Meeting on Trade and Climate Change held by the UN Conference on Trade and Development (UNCTAD), with the official participation of 100 nations and members of the UN Framework Convention on Climate Change (UNFCCC) Secretariat, in April 2009.³ Copenhagen could be the beginning of a cold war about limiting emissions between the largest economies in the world—such as China and the United States—or it could initiate an era of international cooperation that could benefit all nations.

CARBON CYCLE AND KYOTO PROTOCOL

Climate change is a truly global issue and we all must be part of the solution. Carbon in the atmosphere is uniform across the globe and is produced by all nations. It resembles a physical law which does not depend on economics or politics. As the sea level rises there is nowhere to hide. The Organisation for Economic Co-operation and Development (OECD) ranks Miami, Florida as the most threatened city in the world, facing \$3.1 trillion in damages from global warming; Shanghai comes second with \$2.3 trillion.

While much of the world remains in denial, UN representatives from all 192 Member States have been trying to hammer out a solution. The Kyoto Protocol, signed by 160 nations in 1997, is an historic agreement, based on the creation of a new market-trading in user rights to the atmosphere. The critical aspect is that it reduces emissions from wealthy nations, which cause the majority of the world's emissions, and accelerates a solution by changing market values so that emitting becomes costly, while clean technologies and sustainable development become profitable.

Kyoto is the first global agreement based on a global market solution—one that changes the value of global commons. For the first time in history, we are enlisting financial innovation for the conservation of the planet's global commons, and the survival of our species. Nearly 100 per cent of all species that have ever existed have become extinct. Our challenge is to be the exception, not the rule.

The Kyoto Protocol took almost 13 years to negotiate and ratify. As an insider with 25 years of working with the UN system and an architect of the carbon market, I know how it originated, the main protagonists behind its creation and the current issues that threaten to undermine it.⁴ Key to the survival of the Kyoto agreement, and that of the Earth as we know it, is a greater cooperation between developing countries and the West, closing the global income divide while simultaneously resolving the climate crisis. The growing wealth gap between the rich and the poor nations is not incidental to this situation. It is its root cause. It is at the foundation of an unsustainable use of the Earth's resources.⁵

The fate of the Kyoto Protocol will be decided this December in Copenhagen. The last and most formidable bastion of opposition to the Kyoto Protocol, the U.S. House of Representatives, unexpectedly fell in the summer of 2009, endorsing emissions limits and cap-and-trade legislation. On the face of it, the Protocol's record has been almost implausible—walking along a knife-edge of success and failure—the international equivalent of *Rocky II*. Yet, despite a heroic performance, it is now on its last legs. It is generally believed that its odds of survival at Copenhagen are vanishingly small.

Modest changes in Kyoto's carbon market could shift the playing field on which the Copenhagen agreement will be negotiated—making it much more likely to have a successful outcome—one that is more advantageous to the

United States, the European Union and Japan while acceptable to Brazil, China, India, and Mexico as well as all the developing nations—and one that fits the needs of the Small Island Developing States (SIDS), whose survival is directly at stake. Oil nations could benefit from the technological innovation I propose—Saudi Arabia is on the record espousing a commitment to become a leader in solar power in this century.⁶ Significantly, a representative of the Chinese delegation at the April 2009 UNCTAD Expert Meeting on Trade and Climate Change, has gone on the record agreeing to this proposal in principle, and several members of the U.S. Congress have expressed support.

COPENHAGEN: “LAST STOP”

The Danish capital city is the last stop on the rollercoaster ride of hope and despair since the Protocol became international law in 2005. Partial attempts to move negotiations forward have limped from failure to failure. The world’s two largest emitters—the United States and China—cannot agree on limits, and the outlook looks bleak.

Every nation has an incentive to procrastinate: nobody wants to reduce carbon emissions on their own. Global warming is the first true global problem

we have ever faced, and we need every nation to participate, or else there is no solution. By burning its own fossil fuels, Africa could unwillingly cause trillions of dollars worth of damage to the United States when sea levels rise and polar caps melt. There is nowhere to hide—we must all cooperate.

But at Copenhagen negotiators will be sophisticated diplomats who will not break cover. Without compulsion to agree, there will be no agreement. The Berlin Mandate in 1995 committed the world to an agreement, and the Kyoto Protocol was born in 1997. In 2007, the UN Climate Change Conference in Bali concluded that the 2009 conference in Copenhagen would resolve the problem of Kyoto post-2012. So, in this context, Copenhagen is truly “do or die”.

The Conference could become the impetus for a major confrontation between the United States and China, and, more generally, the rich and the poor nations. The amount of greenhouse gases that these two nations alone emit into the Earth’s atmosphere could cause catastrophe for the world. The United States does not want to limit its emissions unless China does, but developing nations are not required to reduce emissions without compensation.⁷ This is where the environment meets geopolitics.

Developing nations need energy to stave off poverty, and 89 per cent of the world’s energy comes from fossil fuels. Over 50 per cent of the world’s population lives on less than \$2 per day, and in excess of 1.3 billion people are at the edge of survival with \$1 per day. Developing nations house 80 per cent of humankind but emit only 40 per cent of the world’s emissions, while 60 per cent of global emissions originate from the rich nations that house 20 per cent of the world’s population.

Poor nations can hardly reduce energy use and compromise economic growth that is sorely needed to eradicate poverty. Independently from one’s sympathies, there is a stark reality that is

pointed out by conservatives in the U.S. Senate: there is no point for the United States and other rich nations to reduce emissions on their own. Developing nations contribute today a minority of the emissions, but in 20 or

30 years, as they grow, they will hold the deciding card on global warming. Undoubtedly, this is truly a global game of “chicken”: we are now playing with the metabolism of the planet and nobody can hide as the seas rise.

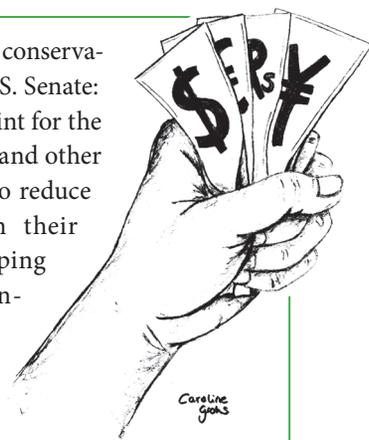
The stand-off between the United States and China is reminiscent of the cold war between the Soviet Union and the United States in the middle of the twentieth century. Both refused to limit their nuclear arsenals unless the other did first. The times are different, the weapons are different, but the situation is the same.

TWO-SIDED COIN

The carbon market that I designed and crafted into the Kyoto Protocol is key. Each year, \$60 billion in carbon credits is traded in the European Union’s Emissions Trading System (ETS) and this promotes accelerated clean technology and financial assistance for sustainable development. It is the basis for a solution.

Developing nations do not trade in the carbon market because they have no limits on emissions, but they use the CDM, which compensates (with carbon credits) private investments from industrial nations that do reduce emissions. According to the World Bank, this has led to more than \$23 billion in successful, productive and clean transfers.

So far, more than 60 per cent of all CDM funding has gone to China, because the CDM is designed to reduce emissions and China, the largest



The Intergovernmental Panel on Climate Change (IPCC) was formed jointly in 1988 by the United Nations Environment Program and the World Meteorological Organization. The IPCC brings together the world’s top scientists in all relevant fields, synthesizes peer-reviewed scientific literature on climate change, and produces authoritative assessments of the current state of knowledge of climate change. It produces periodic reports on scientific, technical, and socio-economic information relevant for the understanding of climate change, its potential impacts, and options for adaptation and mitigation.

emitter, has the most to reduce. Africa is responsible for only 3 per cent of the world's emissions and therefore has little to reduce, obtaining little CDM funding. The same is true for Latin America. This needs to change.

How can we reach a consensus between the industrial and the developing nations?

The interests of the industrialized and developing nations are so opposed that we need a solution that is truly a “two-sided coin”—one that looks the opposite to each party. Is this impossible? No. It was achieved in Kyoto when the carbon market became the two-sided coin that allowed the Kyoto Protocol to be signed by 160 nations. The carbon market starts from bounding wealthy nations' emissions, and therefore was supported by developing nations. Yet the carbon market offers flexibility, since some nations can be above their limits and purchase rights to emit from others that are below—so the world implements important and needed reductions limits. The market flexibility appealed to the United States and to other industrialized nations. This is how the Protocol was born in 1997.

It is possible to forge a similar solution now?

We need two sides of the same coin. Indeed, it is the only type of solution that will work in Copenhagen. This is what I propose here.

CONSENSUS BETWEEN INDUSTRIAL AND DEVELOPING NATIONS

There is a formula that uses the Kyoto Protocol's own structure and updates it to overcome the impasse and forge a consensus between the rich and the poor nations.

Copenhagen is the
“do or die” mission for
the climate negotiations.
The price of failure could
be catastrophic but there
is a solution available.

It has two aspects, *financial* and *technical* assistance, both of which were highlighted at the G8 Summit in July 2009, and it has been officially supported by the Chinese delegation at the April UNCTAD Expert Meeting on Trade and Climate Change.

The *financial* part is a modest extension of the carbon market—engineered so that both sides get what they want—and the *technological* aspect makes sure that the reductions are feasible. The former is a modest extension of the carbon market, and the latter a modest extension of the CDM. Both are reasonable and acceptable interpretations of existing law.

UNFCCC does not say that China and the developing nations should never have limits. It says they should have no limits unless they are compensated. This is quite different. What we need, therefore, is a form of “compensation” that fits the bill and eliminates the opposition on both sides. I am talking

about trade rather than unilateral compensation—and in the United States, we are very comfortable with that term. Nobody needs to be the first mover: a simultaneous financial solution makes this all possible.

For example, the United States can buy an option to reduce Chinese emissions, thus obtaining what it wants while providing “compensation” to China, as is required by the UNFCCC for developing nations. At the same time, the Chinese can secure a minimum price for the credits, ensuring that they would not be selling economic growth for a pittance. This one-two punch reduces the overall monetary exchange while giving each party what they want. It can be a modest extension of the carbon market and sold in secondary markets to provide liquidity and stability for the carbon market.

The new financial mechanism I am proposing is a modest update on the carbon market I originally crafted, allowing the United States and China to each say that they are sticking to their original position—while at the same time both countries may also say that they got what they want from the other. Two sovereign options based on the carbon market do the trick. The United States buys an option sold by China which establishes a “compensation”, while China buys the right to ensure a minimum floor for its emissions reductions. This eliminates developing nations' fears of the Faustian deal: selling much needed economic growth for a pittance. The entire transaction could involve little in terms of monetary exchange, but it will set emissions limits on both nations at the same time. Secondary markets can trade the corresponding options, thus providing liquidity and stability to the carbon market and its CDM.⁸

At the July G8 Summit, developing nations were loath to accept any obligation without specific commitments of financial and technical assistance and failed to agree on a formula. This is the sticking point in the negotiations. The



The greenhouse effect was first described in theoretical terms by a Swedish researcher, Svante Arrhenius, in the late 1800s. However it wasn't until the following century that Arrhenius' theory was observed. In the 1930s, scientists realized that parts of the globe had warmed during the previous half-century. Then in the early 1960s scientists discovered that the level of carbon dioxide in the atmosphere was rising. Researchers began to take an interest and found a strong relationship between the increasing levels of carbon dioxide and average global temperature.”

We need solutions that can reduce the carbon in the atmosphere rapidly, rather than gradually lowering emissions. These are called “negative carbon technologies”, because they reduce more carbon than they emit. Negative carbon technologies could work for both the industrial and the developing nations.

formula proposed here provides for financial and technical assistance that should work for both sides.

Compensation can also take the form of export credits for technology that makes emissions reduction possible; a modest extension of the CDM can certify new technologies that produce energy while reducing carbon from the atmosphere. When used in Africa, the technologies can help the region reduce more carbon than it emits, meaning the continent can attract significant CDM funding that was not possible until now.

For rich nations, this involves \$43 trillion in energy infrastructure—the right size to stimulate today’s world economy—creating technology jobs, increasing exports and stimulating trade.

FRAMING A RESOLUTION

Let’s zoom in to the solution that can be provided by Article 4 of the UN Framework Convention on Climate Change concerning commitments by developed and developing States Parties to, among other things, emissions limits.

My proposal is really a financial interpretation of Article 4 designed in a way that eliminates the most sensitive political opposition in the United States, as well as in China. The UNFCCC does not say that China and the developing nations should never have limits: it says they should have no limits unless they are compensated. This is quite different. What we need, therefore, is a form of “compensation” that fits the bill: a new financial mechanism that works as a combination of derivatives on the carbon market and uses widely-accepted financial principles.

The OECD and the developing nations can each say that they are sticking to their original position—while at the same time both groups of countries can also say that they got what they want from the other.

The first part of the mechanism works as an option that is bought by the OECD nations and sold by developing nations. Think of it as the United States buying a “call” on emission reductions from China. It puts a relatively low upper limit on the cost to the United States of getting China to reduce its emissions. This is a “derivative” with the carbon market of the Kyoto Protocol as the “underlying” market, and the actual price to be paid is determined through use of classic financial formulas for derivatives that are used every day in the global economy. In this way, we establish the “compensation” I just mentioned.

The second part of my financial mechanism is critical to giving both sides what they want while reducing monetary costs to them. It behaves as a “put option” bought by China from the United States. It is again a derivative of the Kyoto Protocol carbon market. China can put its emissions reductions to the United States at a minimum price that is related to the carbon credit price, thus eliminating fears about selling emission reductions for nothing.

The best analogy is to view this financial mechanism as two interlocking options: one that the United States will buy from China and another that China will buy from the United States. In practice, the entire transaction would almost be a “wash” in monetary



exchange, while setting emissions limits on both nations at the same time. In addition to overcoming the diplomatic stand-off, the proposal can also help implement a real solution: a practical way to reduce carbon concentration from the atmosphere when the options are called, without undermining urgently needed economic development. This involves a modest extension of the CDM to certify technologies that can increase available energy, while at the same time reducing carbon in the atmosphere. It seems a tall order, but it is real and possible.⁹

Given a modest extension of the Kyoto Protocol's Clean Development Mechanism could provide the financial and technical assistance needed to increase energy sources while reducing carbon emissions. We need solutions that can reduce the carbon in the atmosphere rapidly, as opposed to providing for gradually lowering emissions. These are called "negative carbon technologies", because they reduce more carbon than they emit. Negative carbon technologies could work for both sides—the industrial and the developing nations. There are new technologies that can extract carbon from air while producing electricity, thus transforming fossil fuel plants into net carbon "sinks" and solar plants into even larger sinks, while also encouraging a transition to renewables.¹⁰ Such technologies can produce more energy in developing nations, while cleaning up the atmosphere at an accelerated pace. The capital cost involved is about \$100 million for one million tonnes of CO₂ captured per year,¹¹ and a total of \$3 trillion would suffice to capture the entire stock of human emissions today.¹² Less than 5 per cent of the gross domestic product (GDP) of the planet would have to be deployed over a ten year period, or 0.5 per cent of the GDP each year, which compares very favourably with Government subsidies to the financial industry in 2008/09. The total amount of the stimulus for G20 nations alone

is about \$692 billion for 2009, approximately 1.4 per cent of the combined GDP of these nations.¹³ In the United States alone that figure was \$825 billion, and in China \$586. The cost involved is definitely lower than the 2.5 per cent premium that the world economy pays today to insure catastrophic risks.¹⁴ It is reasonable and possible.

Saudi Arabia and the Gulf States' aspirations to reach a leadership role in solar power will be boosted by such technologies, which increase the deployment and profitability of solar plants, such as concentrated solar power (CSP). For the 42 island nations whose populations are at risk today, negative carbon is the only accelerated mitigation policy that can work in the short and medium term, while boosting energy production and improving development infrastructure.

For the rich nations this encourages technology exports that create jobs in a \$43 trillion energy infrastructure market: a global stimulus package of the right proportions for today's global economy. Perhaps most important is that the plan would allow developing regions with little emissions, such as Africa, which accounts for only 3 per cent of the world's emissions, to benefit from the Clean Development Mechanism in a way that has not been possible before—by capturing more carbon than they emit. This creates jobs, improves productivity, alleviates poverty and cleans up the planet's atmosphere, benefiting everyone involved.

NEXT STEPS

A modest extension of the Kyoto Protocol carbon market, which would fix a heretofore intractable impasse, will itself not solve all the political challenges that still remain. However, I believe it is necessary to have any chance of a successful outcome. The United States has a unique political opportunity to be the country spearheading the push for this critical change.

Of course, there are many terms to determine here—when and how and how much. But this is good, not bad: it provides a framework that can be established in principle and allows for serious negotiation in Copenhagen and beyond. This is what happened after the Kyoto Protocol in 1997.

We need a solution to the zero-sum game of escalating emissions. Otherwise, we face a new cold war, all about warming. Copenhagen could be the dawn of a new cooperative global future. unc

I thank Nemat Sadat for data support.

Notes

- 1 IOM Report: www.iisd.org/pdf/2008/migration_climate.pdf and UNDP Human Development at: hdr.undp.org/en/reports/global/hdr2007-2008/.../brown_oli.pdf
- 2 <http://www.reuters.com/article/environmentNews/idUSTRE5525W920090603>
- 3 See <http://www.unctad.org/Templates/meeting.asp?intItemID=1942&lang=1&m=15861>
- 4 See Chichilnisky and Sheeran, *Saving Kyoto* (2009).
- 5 Chichilnisky and Sheeran, *Saving Kyoto* (2009); Chichilnisky and Heal, *Environmental Markets: Equity and Efficiency* (2000); Chichilnisky, *Beyond the Global Divide: From Basic Needs to the Knowledge Revolution*, to appear; Chichilnisky, *Development and Global Finance: The Case for an International Bank for Environmental Settlements* (1996).
- 6 This statement was made by Ali Al-Naimi, Minister of Petroleum and Mineral Resources, Saudi Arabia, at the Energy Pact Meeting in Geneva, 2009, <http://www.energypact.org>.
- 7 This is Article 4 of the United Nations Framework Convention on Climate Change (UNFCCC) (1992).
- 8 This was proposed earlier by the author in Chichilnisky, "The Greening of the Bretton Woods" (1996).
- 9 See N. Jones, *Nature* December 2008, April 2009 and G. Chichilnisky, *Nature* June 2009.
- 10 The technologies described here involved air capture of CO₂ and are different from the traditional carbon capture from the flue, also called CCS (Carbon Capture of Sequestration). The latter is at best carbon neutral and has been opposed in the climate negotiations because it seems to encourage the continued use of fossil fuels. The former (air capture) can be carbon negative, namely it can reduce more carbon than is emitted in the process of producing power. See Jones, "Sucking carbon out of the air" (2008) and Jones, "Sucking it up" (2009); Chichilnisky and Eisenberger, "How air capture could help to promote a Copenhagen solution"

(2009); The Royal Society, "Geoengineering the climate: science, governance and uncertainty" (2009); and Chance et al, "Global Warming and Carbon-Negative Technology: Prospects for a Lower-Cost Route to a Lower-Risk Atmosphere" (2009).

- 11 See Chance et al, op.cit. (2009) and Chichilnisky and Eisenberger "Energy Security, Economic Development and Carbon Capture" (2009).
- 12 Each million of CO₂ captured requires a \$100 million plant, approximately. There are today approximately 30 gigatons of carbon emitted from human sources.
- 13 The Group of Twenty (G20) Finance Ministers and Central Bank Governors was established in 1999 to bring together systemically important industrialized and developing economies to discuss key issues in the global economy. According to the Brookings Institute, the total amount of stimulus for G20 countries totals approximately \$692 billion for 2009, which is about 1.4 percent of the combined Gross Domestic Product (GDP) of these countries, see Report at: http://www.brookings.edu/reports/2009/03_g20_stimulus_prasad.aspx. This figure does not account for what the individual countries spent in fall 2008 to rescue their own banks and shore up their national economy. For that figure, the U.S. alone spent \$825 billion,

\$586 billion for China, etc. Please see this Report for exact figures for the major countries in the global economy: http://www.ppionline.org/ppi_ci.cfm?knlgAreaID=108&subsecID=900003&contentID=254895

- 14 See "Insuring the Future", Chapter 2 in Chichilnisky and Sheeran, op.cit, 2009

References

Chichilnisky, G. and K. Sheeran, *Saving Kyoto*, New Holland, London, 2009.

Chichilnisky, G. and G. Heal, *Environmental Markets: Equity and Efficiency*, Columbia University Press, New York, 2000.

Chichilnisky, G., *Beyond the Global Divide: From Basic Needs to the Knowledge Revolution*, to appear, 2010.

Chichilnisky, G. *Development and Global Finance: The Case for an International Bank for Environmental Settlements (IBES)*, United Nations Educational, Scientific and Cultural Organization (UNESCO) and United Nations Development Programme (UNDP), Office of Development Studies, New York, Discussion Paper no. 10, September 1996.

Chichilnisky, G., "The Greening of the Bretton Woods" *Financial Times*, Wednesday, 10 January, 1996, p. 8.

Chichilnisky, G. and P. Eisenberger, "How air capture could help to promote a Copenhagen solution", *Nature* vol. 495, 25 June, 2009.

Chichilnisky, G. and P. Eisenberger, "Energy Security, Economic Development and Global Warming: Addressing short and long term challenges", *International Journal of Green Economics*, 2009.

Eisenberger, P., R. Cohen, G. Chichilnisky, Chance, R., et al., "Global Warming and Carbon-Negative Technology: Prospects for a Lower-Cost Route to a Lower-Risk Atmosphere", *Energy and Environment*, 2009.

Jones, N. "Sucking carbon out of the air", *Nature*, 17 December, 2008. Published online at <http://www.nature.com/news/2008/081217/full/news.2008.1319.html>

Jones, N. "Sucking it up", *Nature* vol. 485, 30 April, 2009.

The Royal Society, UK: "Geoengineering the climate: science, governance and uncertainty" September 2009 Report, <http://royalsociety.org/displaypagedoc.asp?id=35217>

United Nations Conference on Environment and Development (UNCED). *United Nations Framework Convention on Climate Change (UNFCCC)* 1992.

Global Warming: *Could Be Cool*

by Tamim Ansary



I am both alarmed and encouraged to realize that global warming and the finitude of oil are really the same problem. Oil is running out so fast that by the time my daughters are my age (I am sixty), it will all be gone; but if global warming goes unchecked, it won't matter because melting icecaps will have triggered worldwide catastrophe.

What could I possibly find encouraging in all this? Well, with oil running out, we absolutely must harness wind and sun to power our civilization (using hydrogen to store and transport the energy) and if we do, we'll also stem our contribution to global warming.

Amazingly enough, the necessary technology already exists in embryo. Our only real hurdles are social and political: to make wind and solar energy viable, we'll have to generate power not from a few centrally controlled plants but from millions of tiny facilities distributed across the globe, with just about every household

harvesting and feeding energy into a flexible global grid for all to draw upon as needed. I see no other option.

The industrial age saw catastrophic wars driven by competition for scarce fossil fuels. Wind and sun are not scarce; they pose a different problem. In any one place they are erratic. Only in sum is their output constant and dependable. Making use of these energy sources will, therefore, *require* cooperation instead of competition, which implies a landmark social transformation.

Wind and sun exist everywhere. Even the (currently) poorest folks on Earth will be able to (and must) contribute to the global grid. With our very survival at stake, the only viable solution to the twin problems of global warming and the finitude of oil may drive our species to invent the social and political institutions we need to build a better and more peaceful world.

Tamim Ansary is the author, most recently, of Destiny Disrupted: A History of the World Through Islamic Eyes.