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## Removing Carbon Dioxide From The Air To Fix Climate Change: An Interview With Graciela Chichilnisky And Peter Wadhams

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Peter Wadhams

Climate change and global warming, caused by greenhouse gas emissions, pose a grave threat to humanity — even greater perhaps than that of nuclear weapons. Yet, just like with nuclear weapons, political inertia stands on the way of tackling the massive problem of climate change in an effective and meaning way. Moreover, the challenge of averting a climate change catastrophe can be met at the present juncture with the aid of carbon negative technology that can suck CO<sub>2</sub> from the atmosphere and thus stabilize and even begin reversing the warming of the planet.

Indeed, in the interview that follows, leading economist and climate change authority *Graciela Chichilnisky*, author and architect of the Kyoto Protocol Carbon Market and CEO and co-founder of Global Thermostat, and *Peter Wadhams*, Professor of Ocean Physics at Cambridge University and UK's most experienced sea ice scientist, highlight the necessity of sucking carbon dioxide from the air as the only way available right now to save the planet from the threat of climate change and global warming.



Graciela Chichilnisky

*J.Polychroniou with Marcus Rolle:* Climate change poses a massive threat to the world economy, to human civilization and to the planet on the whole, yet little seems to be done by the world community to break cultural and political inertia. What's your explanation for climate change inertia?

*Graciela Chichilnisky:* Climate change involves extraordinary and unprecedented risks that people and organizations are ill equipped to deal with. Put simply, most people do not know what can be done about it, and they do not even know how to think about climate change. This paralyzes them from action. In addition, there is an erroneous perception that the economic costs of taking action against climate change are too high making action impossible in economic terms, which is untrue. The global scope and complexity of the issue defies standard knowledge and paralyzes most people, and this couples with

economic interests of groups and businesses that are invested in conventional energy sources such as fossil fuels. About 45% of all global emissions come from electricity plants, which are a \$55 trillion global infrastructure that is 87% run by fossil fuels.

Exxon Mobil is facing several law suits after allegedly misleading the public about the risks of climate change caused by burning fossil fuels, the source of their revenues, and presenting obstacles for solutions. Dated economic interests couple with denial, ignorance and fear, and cause climate change inertia. Because the issue is complex, even well-meaning people and organizations can be confused or ill informed. For example, the United Nations Framework Convention on Climate Change (UNFCCC), which is the single global organization responsible for preventing climate change, and its Green Climate Fund created recently to make funding available to avert climate change, focus on "adaptation and mitigation" towards climate change, particularly in the developing nations that will suffer the worst damages. This would be a natural reaction to disasters such as earthquakes, droughts or tornados, which are of a smaller magnitude. The situation is quite different with climate change. It is not possible for human societies to adapt or mitigate the global damages caused by catastrophic climate change, and we should be focused on resolving the problem rather than in adapting to it, or mitigating it after the fact. The North and the South poles are melting, raising the world's oceans ravaging coastal areas around the world and eventually submerging under the swollen seas 43 island nations that make up about 20% of the UN vote. Very little can be done to "adapt and mitigate" the human damages in a nation that is quickly and inexorably submerging under the oceans. There is no way to adapt to the chaos and destruction in large cities like New York as they face several disasters a year of the scope of hurricane Sandy, severing access to electricity and drinking water and to law and order, making transportation and working conditions impossible, with cars and vehicles floating in the flooded streets.

Rather than well-meaning but illusory adaptation and mitigation to catastrophic climate change, what is needed is to resolve the problem. We need to reverse climate change and to do it now. This is possible with existing technologies and it can be done within reasonable costs and conditions. This requires action right away since the costs increase rapidly the longer we wait. The action required was summarized in a 2014 UN IPCC 5th Assessment Report that states (page 101) that what is needed is massive removal of CO<sub>2</sub> from the atmosphere to avert catastrophic climate change. The IPCC is the world's leading scientific authority on this area, and was awarded the Nobel Peace Prize for its work in documenting climate change. I used to be the US lead author of the IPCC and know that it no longer suffices to reduce emissions because CO<sub>2</sub> remains in the atmosphere for hundreds of years and we are dangerously close to the carbon budget that our atmosphere will tolerate before irreversible and catastrophic changes occur. We need to remove the CO<sub>2</sub> emitted by humans in the process of industrialization based on burning fossil fuels. There is hope if we act fast: there are now proven technologies to achieve these removals within manageable costs. Indeed, the project can itself create jobs and increase exports, providing a dramatic boost to innovation in the world economy. Why is this not already done? Most people have difficulties with innovation and in conceiving new solutions as the IPCC indicates are needed. But it is possible and indeed desirable for economic as well as environmental reasons. Existing

technologies can provide an extraordinary stimulus to the world economy; they are mild and safe, providing low cost solutions that increase energy available and help overcome poverty.

*Peter Wadhams:* There are several reasons, I think. One is the chronic failure by a mean, cowardly and corrupt press to bring climate issues to public notice and to press for action. Very often this is because the press is owned by fossil fuel interests (e.g. Murdoch). This is compounded by the placid, indeed complacent, approach of the Intergovernmental Panel on Climate Change (IPCC) which underplays really serious threats (methane emission from tundra and offshore, accelerated sea level rise from ice sheet melt) which require immediate action. The scientists involved with IPCC are themselves often complacent as they tend to be Government scientists who don't want to see their careers threatened by making waves. Finally, and most important I think, is the personal view held by many, or most people, that this is too horrible to think about. If I don't think about it, it might go away (similar to the response to Hitler's initial aggressions in the 1930s). That is bound up with the undeniable fact that our society, our cities, our communications, our industrial and economic system, are all bound up with fossil fuel consumption and it is hard to imagine how we can live without it. Green organizations haven't helped because they stress the moral need to reduce CO<sub>2</sub> emissions and cast shame on people for their lifestyles, while in fact we now know that we cannot achieve climatic goals by CO<sub>2</sub> emission reduction alone, but must make heroic efforts to develop methods to actually take CO<sub>2</sub> out of the atmosphere. This would solve the problem.

*Polychroniou with Rolle:* What about the scientific community itself? Is it living up to its responsibility in warning the world of the actual threat that climate change poses to the future?

*Chichilnisky:* Yes, but only to a certain extent. Science is handicapped from achieving its potential because climate change lies in the nowhere land between two types of sciences that do not communicate well with each other: the social and the physical sciences. Indeed, economics is the cause of climate change. Fossil fuels are mostly emitted to produce energy and advance industrialization. Yet the effects of climate change are physical: atmospheric concentration of CO<sub>2</sub>, melting of ice bodies, rising of the oceans, intensity and frequency of draughts and storms. The causes are economic, and the effects are physical. Since the effects are physical, economists do not measure them well. Since they causes are economic, there is little that physicists can do to solve the problem. The long standing division between the social and the physical sciences must be overcome: they should collaborate to solve the problem. Furthermore market economics does not measure the damages caused by climate change. A recent MIT study identified the true cost of gasoline when negative externalities are included and it is over \$15 per gallon. The current GDP measure of economic progress we use is dated, and global markets for the atmosphere, the hydrosphere and the biosphere is needed to change prices and align them with true values.

*Wadhams:* No, as I indicated above, the scientific community is not living up to its responsibilities, with certain exceptions. It is partly the result of overspecialization, even a climate change scientist might feel unqualified to make general remarks on climate change. And partly fear of losing career prospects.

*Polychroniou with Rolle:* How does the melting ice affect the environment, and is it too late to save Arctic ice?

*Chichilnisky:* The world's major physical systems are all connected. As CO<sub>2</sub> levels increase, the polar ice melts, the oceans rise because melted ice expands, and most life forms will go extinct with catastrophic climate change, possibly including our own human species. The atmosphere, the oceans, and the biosphere are a single global system. We are already in the midst of the 6th largest episode of extinction on planet Earth, comparable only to the one when the nightly dinosaurs disappeared. This time it can be us. Human extinction is indeed a likely outcome unless we take action. And, as humans, we have a unique capacity for awareness and to take action. It is possible as explained above, and must be done now before it is too late. Will we do it?

*Wadhams:* It is more or less too late. Melting ice causes many feedbacks that accelerate change: (1) albedo feedback due to ice melt and loss of snow area in the Northern Hemisphere, equivalent (as I show in my book) to increasing the quantity of greenhouse gas output by 50%; (2) sea level feedback, due to warmer air causing Greenland ice sheet to melt; (3) methane feedback, the increasing rate of emission of methane from Arctic coastal sediments due to warming of the water after sea ice removal; (4) weather feedback, where sea ice retreat changes shape of jet stream bringing extreme cold or warmth to food growing areas.

*Polychroniou with Rolle:* While reducing greenhouse gas emissions by moving away from a fossil-fuel based economy seems to be a necessary and critical step in Averting a climate change catastrophe, a case is being made recently for the removal of carbon dioxide already accumulated in the air. Why is this important or necessary?

*Chichilnisky:* It is necessary because, once emitted, CO<sub>2</sub> stays in the atmosphere for centuries. It does not decay like other forms of pollution, such as particulates. It stays there for a very long time. And we have used most of our carbon budget. We delayed taking action for too long, and we are very close to CO<sub>2</sub> levels that create a blanket, preventing the sun's heat from escaping and thereby causing irreversible heating and permanent change in climate that will kill the complex web of species that makes life on Earth. We are part of that web of life and our survival is at stake. The difference between us and the dinosaurs is that we know what is happening and what needs to be done about it. Will we do it?

*Wadhams:* It is important because of the persistence of CO<sub>2</sub> in the atmosphere. There is already more than enough CO<sub>2</sub> in the atmosphere to eventually cause a warming that exceeds 2 C, even if no more is emitted. So we have to take it out of the atmosphere instead.

*Polychroniou with Rolle:* There are plants already in existence, such as Global Thermostat in the Silicon Valley, which possess the technology to remove carbon from the atmosphere. The question here is twofold: firstly, what do we do with the carbon dioxide once it has been captured and, secondly, how many plants might be needed to clean up the air on a global scale.

*Chichilnisky:* Once CO<sub>2</sub> is removed from the atmosphere, Global Thermostat sells it as 99% pure CO<sub>2</sub> to be used for commercial products such as classic carbonated beverages — for

example Coca Cola and Pepsi — for refrigeration since CO<sub>2</sub> is in fact dry ice, for building materials such as degradable plastics made from CO<sub>2</sub> and carbon fibers that favorably replace metals, for synthetic fuels that are identical to gasoline but carbon neutral, and for water desalination. There is a huge CO<sub>2</sub> market on earth. In terms of numbers: we can build 30,000 Global Thermostat plants that capture each one million tons of CO<sub>2</sub> per year, thereby removing all the CO<sub>2</sub> that humans emit right now, which is about 30 gigatons. This process will take about 15-20 years using conventional measures of technology adoption and deployment, where capacity can be doubled every 12-18 months. The cost is about \$200Bn/year, which can be covered by the UN carbon market that I designed and wrote into the Kyoto Protocol, which by 2012 was trading \$175Bn/year according to the World Bank. Each dollar traded by the carbon market can be used for this purpose. We can build carbon negative power plants that provide energy for developing nations while cleaning the atmosphere. Think of it this way: Global Thermostat “farms” the atmosphere. A bit over a hundred years ago, oil barons opened holes in the ground and out came very valuable petroleum. We burned it, and it became atmospheric CO<sub>2</sub>. Now we farm the skies bringing down the CO<sub>2</sub>. It can be easier to bring down the CO<sub>2</sub> than it was to bring the petroleum up. We need \$200 BN/ year for fifteen years – a total of US\$1 trillion over fifteen years — to clean the planet’s atmosphere and avert climate change. Actually, the upfront money is recuperated in two years by selling the CO<sub>2</sub> that the plants produce. We can build “carbon negative power plants”(TM), these are Global Thermostat plants that clean the atmosphere while they produce electricity – one such plant is in Silicon Valley at SRI in Menlo Park, where the Internet was created. Building Global Thermostat modular plants produces profits, creates jobs and increases exports: it leads to innovation and economic progress. There is every reason to adopt this or related technologies and avert catastrophic climate change while helping the economy grow.

Once carbon is removed from the atmosphere, climate will stabilize and temperatures will stop rising. On this note, let me also add some technical aspects about the plants like Global Thermostat using carbon negative technology: Each plant unit is 12’ by 16’ by 40’ and you put several units together to make a larger plant. Each single unit can remove between 100 tons and 25,000 tons of CO<sub>2</sub> per year and they last 20 years. To make a GT plant removing 1,000,000 tons/year we simply put several units together.

*Wadhams:* Any development of the kind that Graciela Chichilnisky has just described with Global Thermostat is highly promising.

*Polychroniou with Rolle:* Assuming that we possess the ability to reverse climate change, how do we go about doing away with political inertia?

*Chichilnisky:* The business sector implemented the Montreal Protocol and overcame acid rain once the limits on CFC’s emissions were established by international law. Similarly, we need to continue the mandatory CO<sub>2</sub> emission limits created by the UN Kyoto Protocol which is international law since 2005. These limits are then traded by the UN carbon market, which was trading already US\$175 Bn/year by 2012. With national CO<sub>2</sub> emission limits in place, the business sector has a price on carbon emissions to guide its actions. Six of the worlds largest oil companies already support a price on carbon. Businesses can now use carbon negative

technologies that don't emit CO<sub>2</sub>. Indeed, there are reasonable robust and proven technologies that reverse climate change as Forbes Magazine and KPMG validated in recent publications and videos. The CO<sub>2</sub> removed from the atmosphere can be sold at a profit. The UN carbon market has shown it can provide enough funding to build all the necessary carbon negative power plants in developing nations, resolving poverty and the climate change problem together, at once. The road is clear. The tools we need to resolve climate change are in our hands. We just need to choose the right path and move to action, and we need to do it right now.

*Wadhams:* We just keep plugging away! Or else demonstrate that CO<sub>2</sub> removal methods are not only economically acceptable but may even be profitable.