Using charcoal to fix the price of carbon emissions

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While the societal aspiration to become carbon neutral is very laudable it will, unfortunately, be virtually impossible to achieve. Almost everything we do or purchase requires energy derived primarily from fossil fuels that release carbon dioxide (CO_2) and other greenhouse gases (GHGs). So it is perverse that increasing numbers of companies, as well as individuals, are currently claiming to be "carbon neutral," yet continue to travel, to heat buildings, and to produce and purchase manufactured goods in much the same way as before this miraculous transformation took place. A major mechanism in achieving apparent carbon neutrality is through offsetting, whereby someone else is paid to eliminate the CO_2 you have emitted by investing in carbon-reduction technologies and projects. Air and automobile travel, electricity, gas and oil use, in fact whole business and household GHG footprints, can ostensibly be neutralized by a quick visit to an offsetting company website and the payment of an appropriate fee.

Investment in an offsetting project is clearly not eliminating the CO_2 contribution to global atmospheric GHGs; at best it is a contribution to reduce the rate of emissions in the future. The most popular option for businesses and individuals alike is tree-planting as this alternative appears to actually turn your CO_2 into a fixed carbon product. However, these trees are destined to be harvested and the wood used for fuel or building, or they will eventually fall down and decay. In both cases, almost all of the available carbon taken up by the trees will eventually be released back into the atmosphere as CO_2 when the wood is either burned or allowed to decompose. The carbon that has been stored in the forest soil is also very vulnerable to decay with CO_2 released when the forest is harvested, replanted or even when environmental conditions, such as temperature, change. The idea that trees can be planted in cycles to maintain offsets is a misconception. Only new forests can offset fresh carbon emissions and these, like any other CO_2 sequestering system, must be maintained forever. Therefore, harvested and damaged tress must be replaced to maintain the amount of CO_2 originally offset, which means that maintaining this ever increasing forest area is simply not possible on either a national or global scale.

So planting trees as a mechanism of carbon sequestration simply results in a temporary storage of the CO_2. As the area of land available for tree-planting is limited, this is clearly neither a realistic nor sustainable option for neutralizing CO_2 emissions.

The only certain way to reduce CO_2 emissions is to use less fixed carbon fuels and fewer products that employ them either in their manufacture or production, which pretty much includes everything from computers to food. However, in practice, GHG emissions remain well in excess of the required reduction targets, a fact that may in part be due to offsetting. Unfortunately, offsetting allows businesses and individuals to continue to use fixed carbon without any constraint and is widely seen to validate or endorse its continued use at those rates. The attraction of offsetting is that it prevents CO_2 from becoming a limiting factor either in business decision making or personal lifestyles. That offsetting enables one to take the moral high ground without any pain has been fully exploited in business GHG footprinting. The companies and organizations that supply offsetting tend to accept its limitations, but believe such arrangements play an important role in supporting low-energy technologies, while both educating and encouraging the public to reduce its CO_2 output. In most cases, selling offsets is a company's only source of income, and this feature of the industry makes the offsetting market very competitive and results in a wide variety of charges and charging mechanisms. However, charges are not actually based on any scientific measurement, but merely on what the market is prepared to pay.

Neither a direct carbon tax nor a cap-and-trade scheme will succeed unless a credible price for carbon is set. Making carbon expensive would be an incentive for both carbon reduction and innovation of low-carbon technologies. These aims, however, can only be achieved if carbon prices are both high and stable over the long term so as to stimulate the investment in low-carbon technologies that is urgently needed. The current European trading price of carbon fluctuates around €12 (US$18.10) per metric ton (1 US ton = 0.907 metric tons). This low market value is a major disincentive for both innovation and reduction activities and will need to be much higher and credible for global warming to be taken seriously within the marketplace. So how do we set the price? What is required is something similar to the gold standard.

Currently, the cost of offsetting is quite arbitrary and is based largely on what the market can sustain. Outside the European Climate Exchange, the leading market for trading CO_2 emissions in Europe, prices vary between €2.5 to €10 (US$4 to US$15) per metric ton of CO_2 in the United States and United Kingdom respectively, with 75–97% of this sum being spent on offsetting activities depending on whether the provider is a private company or a nongovernmental organization (NGO). The ability to offset CO_2 at these extremely low prices is a major disi

ncentive for the adoption of real CO2 reduction policies and actions, which would be far more expensive and inconvenient.

The impact of GHG emissions can presently be reduced only by using less fixed carbon energy or actually removing CO2 from the atmosphere. While there is a great deal of interest in sequestering CO2 by capturing and storing the gaseous emissions from power stations and major manufacturing installations, it is already possible to sequester CO2 through the production and storage of charcoal or biochar. While charcoal is universally used as a fuel, and so the fixed carbon is released as CO2 on combustion, biochar is an innovative method of incorporating the fixed carbon into the soil.

Biochar is finely graded charcoal that is produced solely for use in agriculture using modern pyrolysis technology. When the material is incorporated into the soil, it increases water retention, enhances plant growth by stabilizing the movement of nutrients, and makes the nutrients more biologically available (which reduces fertilizer use). Within the soil environment, biochar is estimated to remain stable for hundreds, and possibly thousands, of years, thus effectively sequestering the CO2. While biochar is extremely promising, its practical use may be limited due to land availability and the relatively small level of application per unit area, as well as concerns about its effects on long-term soil quality and ecology. To date, the possibilities for its use in land reclamation, especially in arid areas, and in the reduction of nitrous oxide and methane released from soils have yet to be fully realized. However, these uses may become its major applications with enhanced environmental benefits in relation to global climate change.

In contrast, the production of charcoal and its long-term storage provides an exciting possibility of large-scale, safe, and relatively cheap carbon sequestration. Unlike other recovery strategies being developed, this method can also provide a real fixed cost for CO2 removal. Commercial charcoal prices vary around the world as do potential production rates, manufacturing methods, and scale of production. Bulk charcoal prices in the United Kingdom range from €310 to €425 (US$466 to US$640) per metric ton giving an average price of €365 (US$553). If we allow €35 (US$53) per metric ton for other costs like forest and production development, storage, and security, €380 (US$572) appears a realistic estimate for the production and long-term storage cost per metric ton of charcoal. As CO2 comprises only 27.3% of carbon by weight, this is equivalent to an offset cost of approximately €104 (US$157) per metric ton of CO2 produced.

Charcoal has a number of key advantages over other sequestering technologies. First, it can be produced and affordably stored with no danger to the environment because it is an extremely stable and nonpolluting material. Second, charcoal provides a low cost solution to sequestration because it requires less energy than its potential alternatives, and it can be reused as a clean fuel when more efficient carbon-sequestration technologies are developed. Finally, the most modern production methods use less valuable timber fractions, thus limiting pollution and using only a small amount of energy (with potential for heat recovery and combined heat and power generation). The challenge is to produce charcoal in a sustainable manner in the volume required.

So what could this mean in practice? It will never be possible to sequester all the carbon produced by industry or the commercial and domestic sectors. However, charcoal provides us with an immediate carbon-sequestration solution that hopefully will become part of a wide portfolio of scientific and technological interventions. Perhaps more importantly, it provides a fixed carbon price that is both economically stable and high enough to act as a real incentive to encourage us to meet our carbon-reduction targets. For example, a round-trip flight from New York to London produces 2.5 metric tons of CO2 (or 4.8 metric tons when radiative forcing is included) and these emissions can be offset when purchasing a ticket for approximately €18 to €35 (US$ 27 to $53) respectively by most companies. Using the charcoal derived cost, the offset would increase to €260 to €499 (US$391 to US$752). This is the reality of our high energy lifestyles and the actual cost of negating the associated emissions.

Using charcoal as a model is probably as close as we can come at present to developing a realistic cost for offsetting CO2 emissions. Of course, carbon taxation needs an equitable basis for calculation and, unlike the current offset costs that are based largely on what the voluntary market can sustain, fixed emission charges per weight may well be the incentive required to achieve elusive GHG reduction targets.