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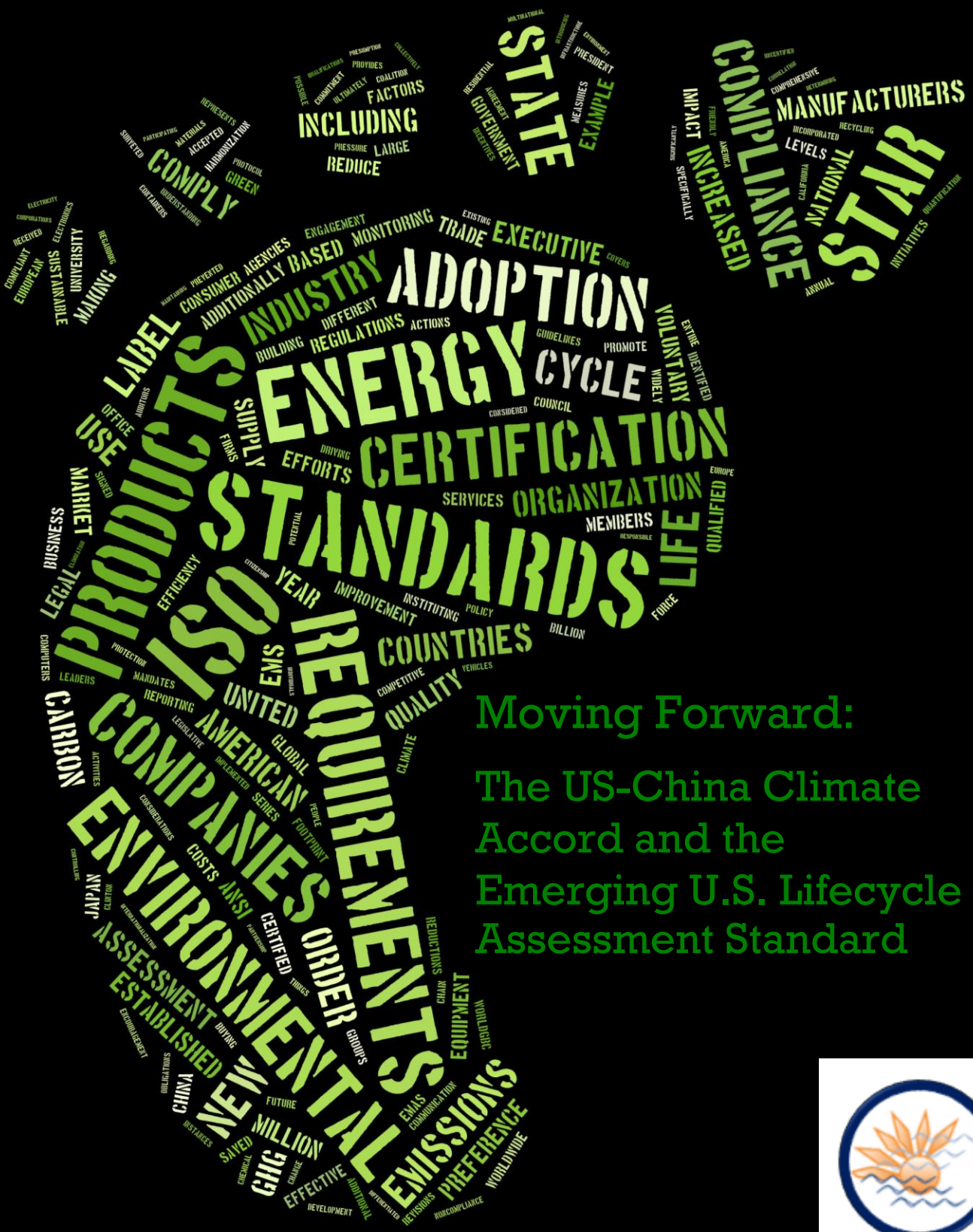


Moving Forward:

The US-China Climate Accord and the Emerging U.S. Lifecycle Assessment Standard

BUILDING ON THE COMBINED MOMENTUM OF THE U.S. –CHINA CLIMATE ACCORD AND THE EMERGING U.S. ANSI LCA STANDARD

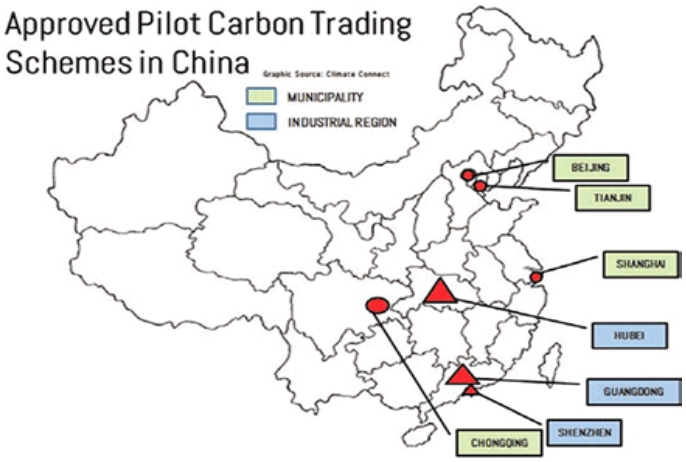
Commentary by John C. Topping, Jr., President, Climate Institute

Events of fall 2014 produced mixed blessings for proponents of strong action on climate protection. U.S. Congressional elections saw the victory of a sizable number of new legislators either in denial on climate science or on the need for emissions reduction. At the same time there were heartening signs that the U.S. non-profit and corporate sectors are assuming a world leadership role in emissions reduction. For example, in September 2014 on the eve of the Climate March in New York City, the Rockefeller Brothers Fund led 800 global organizations, including 67 foundations, to join in a pledge, over the medium term, to divest themselves of approximately $50 billion in fossil fuel investments.

Perhaps even more consequential, a multi-year standards development process under the auspices of the American National Standards Institute (ANSI) seems on track to produce a U.S. Life Cycle Assessment standard that will have climate metrics providing for valuation of reductions of black carbon and other short-term climate forcers not addressed in the Kyoto trading system and will encourage inclusion in assessments of projects' contributions to climate change in the Arctic, now perilously close to crucial tipping points. It appears this Life Cycle Assessment standard is likely to be promulgated by the end of 2015. Even before then, the process leading to its development has encouraged some climate protection finance entities to fund pilot projects seeking to slash black carbon emissions, particularly in the transportation and residential cookstove sectors. The ANSI standards process has also catalyzed movement to incorporate these new climate metrics into Life Cycle Assessment and related standards of the International Standards Organization (ISO). Although participation in the ANSI and ISO processes is ostensibly voluntary, sometimes, as indicated in the articles in this issue by Schuyler Lystad of Georgetown Law School and his team members , Fiona Wissell of Hamilton College, Rosaly Byrd of University of California San Diego, Alison Singer of Appalachian State University, and Denielle Harrison of Dartmouth College, such voluntary programs as Energy Star and Green Buildings have had a remarkable effect both in transcending national boundaries and reducing energy consumption. Sometimes by incorporation into procurement specifications at the national, state, provincial or municipal level, previously voluntary standards have even gained official force.

Just as the divestment efforts driven by U.S. philanthropies and investment groups have helped catalyze movement well past U.S. boundaries, the emerging U.S. ANSI Life Cycle Assessment standard has already sparked a rethinking of emissions reduction valuation metrics by some carbon market funds. Actions in the past year in China, with the U.S. one of the world's largest economies and greatest greenhouse emitters, have also provided a ray of hope in an otherwise bleak climate protection scene characterized

by excessive rhetoric and blame shifting in international negotiations and climate forcing feedbacks in Polar Regions. In June 2014 China announced that it was launching a carbon trading system, initially with pilot efforts in five cities- Beijing, Shanghai, Chongqing, Tianjin, and Shenzhen- and two provinces- Hubei and Guangdong- with this effort slated to go nationwide in 2016. The article by Jiaqi Lu of the University of Wisconsin Madison, Climate Institute Graduate Research Fellow and a native of Shenzhen, discusses the potential value of this initiative in China and the feasibility and advantages of integrating black carbon valuation in carbon dioxide equivalence into its emerging climate trading system. Not only would this provide an opportunity for China to demonstrate leadership in climate response, it would enable it to leverage its multi – billion dollar annual spending on climate emissions mitigation to reap an additional dividend in reducing the mortality- now in the hundreds of thousands annually – of its citizenry to air pollution. Moreover, if these steps could help nudge international climate-trading entities to integrate black carbon



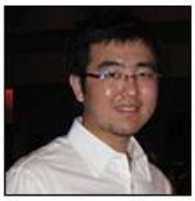
Source: Carbon Market Watch, 2013

reduction valuations into their trading systems, they could catalyze movement of external carbon market funds to enhance investment in air pollution efforts in China.

This might also enhance prospects of success of the China- U.S. climate accord, announced November 11 in Beijing by Presidents Xi Jinping and Barack Obama. In this agreement, the U.S. committed to ambitious emissions reductions that could be accomplished if Obama and subsequent presidents exercise authorities under existing environmental statutes. The Chinese commitments were a blend of commitments to much greater use of renewable energy and enhanced energy efficiency, and efforts that are already underway and at the core of the emerging Chinese trading system, with the goal being to cap CO2 emissions by 2030. Although the Chinese commitments are viewed by most independent analysts as roughly commensurate to the U.S. commitment and a snap poll by USA Today showed the American public providing over 2-1 support for the accord, climate naysayers in the U.S. have characterized the agreement as one –sided because stabilization of Chinese emissions is deferred until 2030. Aggressive action on black carbon would have dual benefits, likely saving hundreds of thousands of lives in China and providing visible evidence to non – Chinese observers of Chinese action on environmental pollution. It might also encourage other nations that at the Lima COP agreed to climate mitigation action to take similar actions to reduce air pollution deaths while slowing climate warming.

U.S.-China Climate Agreement: Can It Be Achieved?

By: Jiaqi Lu, Graduate Research Fellow



The year 2014 may turn out to be a turning point for actions, or at least commitments, on climate change. While the UN Climate Summit in September in New York City attracted attention from both private and public sectors and set an optimistic environment before the 2015 Paris conference, the U.S.-China climate agreement pushes this optimism further. Climate experts deem this agreement as a milestone in the history of climate negotiations.

According to the agreement, the United States will cut its greenhouse gas emissions by 26 to 28 percent below its 2005 level by 2025 and China agrees to hit its peak emission before 2030 and to meet 20 percent of its energy demand with renewable and nuclear sources.[1]

The goals will not be easy to achieve for either nation. Right after the joint announcement, the agreement and President Obama came under fire in Congress. Speaker of the House of Representatives John Boehner and the soon to be Senate Majority Leader Mitch McConnell both, not surprisingly, criticized the emissions reduction agreement, claiming it would raise U.S. electricity bills and negatively impact the job market. Senator McConnell also said that one of the major tasks for the next Congress would be to limit the negative impact of EPA regulations on the U.S. economy. [2] For China, the pressure is mainly technical and economic. Currently only 9.8 percent of China's energy comes from non-fossil sources. This means China will have to double its non-fossil energy capacity in the next 15 years at the same time that its economic growth continues. In other words, China will need to achieve 800 to 1,000 GW capacity from nuclear and renewable, [3] which equals the total amount of its current installed capacity, or close to the total electricity capacity of the United States.

Presidents Barack Obama and Xi Jinping

The EU announced a similar binding agreement covering its member nations just before the U.S.-China accord. EU members agreed to reduce their total greenhouse gas emissions to 40 percent below their 1990 level and to get 27 percent of their energy from non-fossil fuels, all by 2030. [4] With Europe, China and the United States, which together account for about 60 percent of the world's total emissions, committing to binding targets, the atmosphere for global climate negotiations is significantly changed.

For the first time in history, the three largest economic blocs

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[1] Biello, David. "Everything You Need to Know About U.S.-China Climate Change Agreement." *Scientific American*. November 12, 2014. http://www.scientificamerican.com/article/everything-you-need-to-know-about-the-u-s-china-climate-change-agreement/

[2] O'Keefe, Ed, David Nakamura and Steven Mufson "GOP congressional leaders denounce U.S.-China deal on climate change." *The Washington Post*. November 12, 2014. http://www.washingtonpost.com/politics/gop-congressional-leaders-denounce-us-china-deal-on-climate change/2014/11/12/ff2b84e0-6a8d-11e4-a31c-77759fc1eacc_story.html

[3] Biello, David. 2014.

[4] Mooney, Chris. "The U.S.-China climate deal is historic, but it will still take more to save the planet" *The Washington Post*. November 12, 2014. http://www.washingtonpost.com/blogs/wonkblog/wp/2014/11/12/the-u-s-china-climate-deal-is-historic-but-it-will-still-take-more-to-save-the-planet/

have agreed to a schedule for their mitigation efforts. International attention is now fixed on how the other significant emitters, including Canada, Australia, Japan and India, will respond. Recent actions by these nations is not encouraging. Canada withdrew from the Kyoto Protocol and has not committed to the new international climate negotiation framework. Australia repealed its carbon tax and this led to emission growth. Japan and India both still derive a large fraction of their energy from coal. Each of these parties will be under great pressure leading up to the 2015 negotiations in Paris.

However, the clock is ticking. There is less and less time left to take the actions needed to limit the increase in global average temperature to 2 C (or even 3 C) above the preindustrial baseline. The scientific findings summarized in the IPCC's recent Synthesis Report suggest that emissions of CO2 must be limited to about 1,000 additional gigatonnes before passing the CO2 concentration that will lead to crossing the 2 degree Celsius threshold. And the global emissions are projected to reach this point in about 2040, [5] so only 25 years from now. Also, the model results summarized by IPCC suggest that even if one takes the new U.S.-China agreement and EU plan into account, there is only about a 1 percent chance that the global average temperature will not exceed 2 degrees Celsius by 2100 (so about 1.2 C above its present level). [6] To live up to the agreed-upon 2 C upper bound, greater cutbacks will be needed and, as of yet, there is no indication that they will push further. [7]

China's Pollution

Unlike the U.S., emissions control is more urgent for China. The Chinese government has been under serious political pressure because of pollution problems. Cutting emissions thus means much more than fulfilling its international obligations with respect to limiting greenhouse gas emissions. For example, reducing CO2 emissions by cutting coal consumption would also have large co-benefits in terms of reducing particulate pollution, especially black carbon loadings. Among others, the Climate Institute is encouraging opportunities for limiting black carbon emissions that might encourage and enable China to exceed its limited plans to reduce emissions.

Black carbon (BC), which is also referred to as soot, is one of the most important short-lived climate forcers (SLCFs) to control because it has far-reaching impacts affecting public health, climate, and water and food resources.[8] BC is typically released as a result of incomplete combustion, with black carbon particles ranging in diameter from a few nanometres (nm) to a few micrometers (μm) in size. The effects of these BC particles are mostly observed at a regional scale due to their short lifetime. Although not a greenhouse gas, BC exerts a similar warming influence equivalent to about 40 percent of the warming effects of the increases in greenhouse gas concentrations and accounts for about 30 percent of the melting of Arctic sea ice. However, current model simulations suggest that the level of uncertainty about its climate effect is relatively high.[9] Because of the short lifetime of BC, reducing BC emissions can quickly reduce the overall warming influence of human activities. Despite this, China's current carbon cap and trade program fails to account for the warming influence of BC. To try to change this, the Climate Institute is examining three potential policies that could lead to reductions in BC emissions in China: 1) accounting for BC in the carbon cap and trade program, 2) financing installation of

[5] Ibid.
[6] Ibid.
[7] Friedman, Lisa."Obama announces 'major milestone,' a landmark climate agreement with China" *EENews*. November 12, 2014. http://www.eenews.net/stories/1060008744

[8] Anenberg, S.C., Schwartz, J., Shindell, D., Amann, M. et al. (2012) "Global Air Quality and Health Co-benefits of Mitigating Near-Term Climate Change through Methane and Black Carbon Emission Controls." *Environmental Health Perspectives* 120(6): 831-839.
[9] Baron, Robert E. et al. "An Analysis of Black Carbon Mitigation as a Response to Climate Change." *Copenhagen Consensus on Climate* (2010).

emissions filters on heavy-duty trucks, 3) implementing a residential energy development project.

In terms of total emissions, China is the world's largest emitter of BC. Based on results from the MEIC model,[10] current BC emissions are estimated to be about 175 million tonnes/year (estimated for 2010). Major sources of China's BC emissions include residential, industry, and transportation, which account for 51.7, 32.6, and 15.6 percent respectively.[11] However, the definitions and distinctions between residential and industry emissions, which account for more than 80 percent BC emission, are not well defined and detailed data are not presently available and are quite uncertain because of the lack of understanding and monitoring data of residential emission. [12]

Although China's BC emissions create serious local and global impacts, the Chinese government doesn't have an emissions standard or control policy that targets BC directly. The particulate matter (PM) emissions control policies and energy efficiency programs could help to reduce BC emissions, but the scale of effectiveness remains unclear. Fortunately, the new carbon market approach has the potential to lead to reductions in BC emissions.

China's Mitigation Plan: Carbon Cap and Trade System

Since 2013, China's National Development and Reform Commission (NDRC) has launched pilot carbon cap and trade programs that aim to reduce carbon emissions through market mechanisms. By 2014, China had pilot cap and trade program in seven metropolises or provinces, including Beijing, Guangdong, Chongqing, Hubei, Shenzhen, Shanghai and Tianjin, and intended to establish national carbon market by 2016. Details of each pilot program are listed in *Table 1*.

Local NDRCs have authority to develop and to implement specific plan for their city or province and to supervise the overall performance of the program. The pilot programs have at least three components: allocation method, trading mechanism and punishment mechanism. First, for allocation method, each program has its own formula for calculating the emission allowance. In general, the annual allowance of each entity equals the average annual energy consumption multiplied by the emission factor and then multiplied by the emission control factor. Therefore, for an energy consumer, the only way to meet the target without reducing production is to improve its energy efficiency. For an energy supplier, improving efficiency or changing fuel would meet its reduction target. Second, each program chooses its own trading mechanism based on the characteristics of the local economy (details are given in *Table 1*). Third, entities that fail to comply would be punished with a combination of financial penalty (three times the average market price), equivalent to the deduction of next year's emissions allowances, social credit penalty and financial credit penalty.

Table 1. Basic information of seven pilot programs

Location	Allowance (mt CO2/y)	Coverage	Trading Mechanism
Beijing	50	490 entities	auction, fixed-price pick, block trading
Chongqing	125	254 entities	block trading
Guangdong	408	242 entities	auction, fixed-price pick, block trading
Hubei	300	138 entities	auction
Shanghai	160	191 entities	spot trading, block trading
Shenzhen	50	635 entities	fixed-price pick, spot trading, cyber auctions, block trading, governmental repurchase, selling of price moderation reserves.
Tianjin	160	114 entities	auction, block trading, spot trading

Moreover, China's carbon market is far from complete. First, the economic liquidity is very low across all the pilot markets. For example, in Shenzhen, the most active carbon market, only 3.44 percent of the total 60 million tons allowance was traded in the market. Next, some

[10] Hongxing, Xie, et al. "Summary Report of China Black Carbon Emission Control Study." *Clean Air Alliance of China* (2013).

[11] Wang, R., Tao, S., Wang, W., Liu, J., Shen, H., et al. "Black carbon emissions in China from 1949 to 2050." *Environmental Science and Technology* (2012): 46: 7595-7603.

[12] Hongxing, Xie, et al. 2013.

critiques questioned the legitimacy of the pilot programs and overlapping jurisdiction between the NDRC and Ministry of Environmental Protection. Given the political structure in China, NDRC usually has more authority than the Ministry of Energy and Ministry of Environmental Protection in terms of planning and carrying out new programs.

Helping China Go Further

The climate and local environmental and public health impacts of BC seem to clearly indicate the value of further actions. Three policy alternatives for reducing BC emission from industry, transportation and residential sectors are of particular value.

To reduce industrial BC emissions, we recommend that NDRC incorporate industrial BC emissions into the carbon cap and trade system. Like the cap and trade system, each entity has an assigned emission allowance and is able to trade these allowances as CO2 equivalent on the carbon market platform. Allowance calculation is based on the emission factor of fuel that the entity used for production. Detailed policy and calculation methods need further research.

To reduce transportation BC emissions, we recommend the government enforce and finance the installation of BC capture filters on heavy-duty trucks and construction equipment. The MEIC model estimates that such a policy could reduce BC emission by more than 10 percent by 2030.[13] Baron et al. (2010) calculated the cost of particle trap technology, finding it was in the range of 11-23$ per tonne of CO2 equivalent.[14] Compared to the social cost of carbon (a measure of the external environmental damage per tonne of CO2) of about $35 (and there are a number of indications that this cost is quite low compared to the actual costs), society would significantly benefit from a policy subsidizing installation of BC filters, at least in the U.S. We are planning to develop estimates of the comparative costs in China. With the extensive air pollution from such emissions, including the co-benefits for improving air quality and reducing health issues, this policy seems very likely to yield a similar beneficial ratio.

To reduce residential emissions of BC, cleaner technologies need to replace residential solid fuel combustion (wood and raw coal). Currently, only 9.4 percent of rural energy consumption comes from electricity and gas.[15] Coal, wood and other soil fuels make up the rest of it. The MEIC model projected that effective development policies could reduce residential BC emissions by more than 50 percent by 2030.[16] Moreover, Baron et al. (2010) estimate that the benefit-cost ratio of the cook-stove replacement project ranges from 3.6 to13.6, including health benefits estimated to be between $0.9 billion to $4.5 billion.[17]

In conclusion, the U.S.-China climate agreement opens a gate of opportunity to reduce global warming. The short lifetime of BC when emitted into the atmosphere and commercially available reduction technologies create a unique advantage for China to contributed to cost effectively reducing GHGs emission over the next two decades. Three policy alternatives that would target BC emissions from industry, transportation and residential sector are important to pursue. We at the Climate Institute plan to focus attention on how to encourage appropriate cost-benefit analyses of each policy approach. We plan to cooperate with partners in China to increase access to data and gain recognition for what appears to be possible.

[13] Ibid.
[14] Baron, Robert E. et al. (2010).
[15] Hongxing, Xie. et al. (2013).
[16] Ibid.
[17] Baron, Robert E. et al. (2013).

THE NEW LCA STANDARD: FULL POTENTIAL

By Schuyler Lystad, Fiona Wissell, Rosaly Byrd, and Alison Singer.

Integration of ANSI and ISO Standards in the Public Sphere.

I. The ISO

The International Organization for Standardization (ISO) is an organization based in Geneva, made up of the standardization organizations for 163 different countries. Its standards are entirely voluntary. The ISO 9000 series for the establishment of quality management systems in companies is one of its most implemented standards worldwide. A standard is submitted by a technical committee, which is appointed by members. The finalized standard from the technical committee is voted on by all members. A period of five months is given for comments and revisions, after which it goes for a final vote. If more than one quarter of members vote in the negative, or the affirmative votes are less than two thirds, the standard is not accepted. If the standard is agreed upon, it is published by the Central Secretariat in Geneva. The American member of ISO is the American National Standards Institute (ANSI).

In 1996, the ISO created an environmental impact standard series, ISO 14000, which imposes three related requirements [1]:

1. An organization must identify all of its environmental legal obligations and be familiar with all applicable environmental laws and regulations. Additionally, the organization must have some mechanism for ensuring that new legal obligations are identified in a timely fashion.

2. The environmental policy must contain a commitment to understand and comply with all applicable environmental laws and regulations. Words on paper aren't sufficient. An organization must make every effort to fulfill its commitment to do what it says it is going to do.

3. Compliance with identified legal requirements must be evaluated on some self-defined periodic basis. Whether an organization engages in a comprehensive compliance audit or employs a variety of monitoring activities, it must know whether all identified legal requirements are being met. In the event a regulatory noncompliance is identified, the organization must take action to correct the noncompliance and prevent it from recurring.

II. Energy Star – A Case Study

The 1997 Kyoto Protocol is a legally-binding international treaty that commits signatories to greenhouse gas (GHG) emission reductions [2]. The Protocol contains four methods by which countries can reduce their emissions: 1) Joint Implementation, 2) the Clean Development Mechanism, 3) emissions trading, and 4) compensation for emissions by increasing the number of a country's carbon sinks. On average, industrialized nations were called upon to reduce their average annual emissions by 5.2% below their 1990 levels by 2012. Although the U.S. did not ratify the treaty, its stated target for the 2008-2012 compliance period was 7% below 1990 levels [3]. In 2012, however, U.S. emissions had increased by 5.4% above their 1990 levels according to EIA data. Despite this, the U.S. has taken measures to promote emission reductions, particularly through energy efficiency measures and programs, such as Energy Star. [4]

The Energy Star program has largely been driven by state legislative actions and executive orders. For example, Massachusetts Executive Order 515 requires state agencies to only procure Energy Star rated office appliances and equipment. The state's central purchasing office, the Operational Services Division (OSD), has incorporated specifications for energy efficiency into requests for statewide contracts, including electrical and lighting supplies, IT hardware, and cleaning equipment. To facilitate the adoption of Energy Star rated appliance and equipment, OSD offers free procurement training opportunities for both the buyer and seller

communities that explains Energy Star requirements. Additionally, state agencies are required to purchase supplies through the state Procurement Access and Solicitation System, which links buyers to the appropriate state contracts, all of which require Energy Star required products.

Other states have similar programs. Alabama's Executive Order 33 requires state facilities, when replacing or purchasing new equipment, to buy Energy Star labeled equipment whenever it is cost-effective to do so. Similarly, Arizona House Bill 2324 mandates that all state agencies procure Energy Star labeled products when cost-effective to do so. California, Colorado, New Jersey, Connecticut, Delaware, DC, Hawaii, Illinois, Kentucky, Louisiana, Maryland, Michigan, Nevada, New Hampshire, New York, North Carolina, Texas, Vermont, and Virginia all have legislative requirements or Executive Orders requiring the purchase of Energy Star qualified products by the state. Furthermore, many state and city governments require the use of the Energy Star Portfolio Manager tool by both businesses and state agencies to benchmark and track energy improvements in building infrastructure [4].

In addition to the actions taken by state and local governments, the U.S. military also has initiatives to increase energy efficiency. For example, the U.S. Air Force, tasked with reducing IT energy use, established and implemented new procurement and power management guidelines for computers and monitors. This policy aligned with the 2007 Federal Executive Order 13423 that requires federal agencies to purchase Energy Star qualified computers and activate the power saving features on such computers and monitors. The U.S. Air Force, to ensure Energy Star qualified computers were in fact purchased, established an outreach program that reminded workers about the new procurement requirement as well as made models easily available for purchase through AFWay, a web-based system for purchasing IT, which guides users through the computer procurement process. These computer procurement requirements are expected to lead to savings of $15 million annually and reduce power plant carbon dioxide emissions by over 100,000 tons per year [5].

Universities have also played a role in driving the adoption of Energy Star products. The University of Maine, for example, requires that all bids show a preference for Energy Star qualified products. In one instance, the purchase of Energy Star qualified water coolers saved the university close to $3,000 per year. Additionally, in 2009, Northern Kentucky University revised its procurement policy to state that the university must purchase Energy Star qualified products whenever possible [5].

Nation-wide, businesses, governments, schools, and individuals have realized the potential of Energy Star to achieve savings while reducing their environmental footprint. The Energy Star program has been widely adopted across the United States, where the label has an 85% recognition rate. In 2012 alone, Americans purchased around 300 million Energy Star certified products, adding to a cumulative total of more than 4.5 billion products since 1993. The Energy Star program has prevented more than 1.8 billion metric tons of GHG emissions and saved users over $230 billion on utility bills.

A. Driving Forces for Adoption of the Energy Star Program

There are various different factors that led manufacturers to adopt Energy Star products, depending on the market and industry type, including retailer requirements, competition and consumer preferences. After the Energy Star program was established in 1992, President Clinton signed an executive order in 1993 (Executive Order 12845) requiring federal agencies to purchase Energy Star qualified products when buying new office equipment. This drove manufacturing companies producing office products (in both the U.S. and abroad) to introduce Energy Star standards into their products in order to continue to do business with the U.S. government. Other factors,

including maintaining competitiveness, have also been driving forces for manufacturers to adopt Energy Star qualifications. For example, in the clothes washing machines [7] market, where products are differentiated based on features, quality, and price, manufacturers used Energy Star's voluntary program to separate their products from other brands. In other cases, consumer preferences have driven manufacturers to adopt the program. In 2012, Americans saved $26 billion [6] on their utility bills due to Energy Star energy efficient products and collectively purchased 300 million [7] Energy Star qualified products.

B. Energy Star on the International Level

The Energy Star program first received international attention in 1993 with President Clinton's executive order 12845. This prompted international firms to accept the Energy Star standards as a market standard. In 1995 the first international [8] Energy Star agreement was established between the U.S. EPA and Japan (three years after the Energy Star program was first established in the United States). This laid the foundation for other future agreements with the European Union, Canada, Australia, New Zealand, and Taiwan, and led to the international harmonization of voluntary energy efficiency qualifications for products traded on the global level. In 2001, the European Union signed an agreement with U.S. EPA, introducing an Energy Star Program partnership specifically for office equipment between the two global economic leaders and allowing European firms to sign up for the program through the European Commission. Over the last 20 years, the Energy Star program has evolved to include international standardization in not only energy efficiency of office equipment products, but also residential and commercial products. In 2008, Japan's Energy Star Council signed a partnership with Residential Energy Services Network (RESNET), with the primary goal being to "create a harmonization [9] of the methodology of how buildings are rated for their energy performance in North America and Japan."

C. Energy Star Impact on GHG Emissions

Between 1993 and 2012, the Energy Star program in the United States reduced cumulative emissions by 1.9 billion metric tons of CO2e (MMTCO2e) [10] in the industrial, commercial, and residential sector (equivalent to taking about 40 million passenger vehicles off the road per year. In 2012 alone, the program prevented "more than 254 million metric tons of GHGs [7]" in the United States, which is equivalent to the annual electricity use of 25 million homes or 54 million passenger vehicles.

III. Globalization of Other Standards

There are instances where ISO standards have been accepted into sovereign countries as their own national standards. India has adopted ISO international standards as Indian standards as a way of harmonization; for example, ISO 14044: 2006 'Environmental management — Life cycle assessment— Requirements and guidelines' was adopted by the Bureau of Indian Standards and became IS/ISO 14044: 2006 [11]. In other cases, national guidelines are adopted based on ISO standards, such as the ILCD (International Reference Life Cycle Data System) handbook in Europe that is modeled off of ISO 14040. Adoption of ISO standards that involve GHG accounting and management are still voluntary. Because international carbon footprint/GHG management standards for products are relatively new, compulsory national legislation has not yet been adopted. Manufacturers, especially in competitive markets, do have the potential to promote life cycle standards; in late 2013 HTC [12] became the first mobile phone manufacturer to have a phone meet international standards for carbon footprint and lifecycle analysis, including ISO/TS 14067:2013, which sets standards for determining the carbon footprint of products including requirements and guidelines for quantification and communication.

However, there are other analogous programs at play on the international stage. For example, the Blue Angel [13, 14] is a German certification of products and services that are environmentally friendly. The Blue Angel was the first worldwide environmental label, established in 1978, and it covers around 80 product categories. Each label specifies that the product or service focuses on one of four different protection goals: health, climate, water, or resources. The goal is to inform customers about environmentally friendly products and to promote both environmental and consumer protection by selecting products and services that are beneficial for the environment and that also fulfill high standards of occupational health, safety, and fitness for use.

Germany's Blue Angel label

Similarly, the Green Swan [15, 16], the voluntary official Nordic Ecolabel and an ISO 14024 type 1 labelling system, was established in 1989 by the Nordic Council of Ministers as a tool to help consumers buy more environmentally-friendly products. The label covers around 65 product groups. The label is established and well-known, with 67% of people in the Nordic countries understanding the label. Additionally, 77% of Swedes consider that the Swan makes a brand extremely reliable. The Swan is a comprehensive label, meaning that in order to be awarded the label, a product's entire life cycle is considered; as such, climate change considerations are key elements of the assessment. The overall goal of the Swan label is to act as a guide to consumers for green purchasing and stimulating green product development. This definition is one of behavioral environmental effects; concrete environmental effects are difficult to measure in a relevant way.

The World Green Building Council (WorldGBC) which many are familiar with through its LEED certifications, began as a U.S. based group, the U.S. Green Building Council (USGBC), consisting of American industry, government and advocacy groups. Before the development of the WorldGBC, representatives from various nations participated in USGBC LEED certifications and expos. The internationalization of the USGBC into the WorldGBC took full form in 1999 with eight countries composing the council, including Australia, Canada, Japan, Spain, Russia, United Arab Emirates, the UK as well as the United States. In 2002 the WorldGBC was formally incorporated, its primary role being to "formalize international communications, help industry leaders access emerging markets, and provide an international voice for green building initiatives" [40]. The WorldGBC now has 100 member councils and associated groups.

IV. Future of ANSI Life Cycle Assessment Standard

The international adaptation of Energy Star standards as well as other ISO standards provides examples of how the ANSI Life Cycle Assessment Standard could become an international standard for valuing black carbon reduction. Ultimately, the internationalization of this ANSI standard would have to occur either by adoption by ISO or a large manufacturing firm, or by encouragement by economic leaders such as the United States, in the same fashion the Energy Star program was adopted. Government procurement and incentives play a large role in getting manufacturers to adopt different standards. Even if the standard is globalized it would most likely remain a voluntary standard in the near future, as are most other ISO, GHG and carbon footprint quantification systems. Another current concern with the standardizations for product GHG management that the ANSI Life Cycle Assessment Standard may encounter is that several standards exist outside of the ISO standards that often make it confusing for companies to decide which standards to adopt (e.g. ISO 14067, the Japanese CF program, PAS 2050, GHG Product Protocol standard, European EMAS, BP X30-323, etc.) Since the quantification of product carbon footprinting is relatively new, it is possible that these programs will become harmonized in the near future. Additionally, the ANSI Life Cycle Assessment Standard would differentiate

itself in focusing on arctic climate and black carbon.

ISO Adoption in the Private Sphere

I. International Adoption

Adoption of the new standard LEO SCS 002 into ANSI will open the door to updating ISO 14000. Written in 1996, the ISO 14000 standard has seen quick and wide adoption around the world. By 2001, there were 36,000 ISO certifications worldwide [17]. In 2006, the ISO reported at least 128,211 sites in 140 countries and economies. In 2007, this had increased to 154,572 sites in 148 countries and economies [18]. The greatest increases in Europe that year were with Italy gaining 2,232 certifications, Spain 2,727, and the United Kingdom 1,253. Africa and the Middle East experienced moderate growth, as did South America, but China and Japan led the pack, getting 11,647 and 5,002 respectively. In 2007, the top 10 countries for ISO 14001 certificates were: 1. China: 30,489; 2. Japan: 27,955; 3. Spain: 13,852; 4. Italy: 12,057; 5. United Kingdom: 7,323; 6. Republic of Korea: 6,392; 7. United States: 5,462; 8. Germany: 4,877; 9. Sweden: 3,800; 10. France: 3,476 [18]. As of 2011 (the latest date for which numbers are available), China received 31% of all new certifications, and half of ISO 14000 certifications in in that year Europe are received by Italy, Spain, and the UK [19]. Total certifications worldwide had reached 267,000, with Europe and East Asia being the most compliant regions.

A. North America, and Problems of Certification

In the U.S., adoption has been less robust. As of 2009, there were only 5,225 certifications in the U.S. [20, 21]. The U.S. ranks behind China (55,316), Japan (39,556), and even Romania (6,863) and Germany (5,865), where a different system is more widely used [14, 22]. Growth has also slowed; a 63% increase in certifications worldwide in 2000 and 60% increase in 2001 has dropped to 22% in 2008, and 18% in 2009, even dipping to 6% in 2011. The BSI suggests the reasoning behind the slowing in growth is possibly the saturation of the market, and further revisions to the ISO are hoped to change this. Still, the British Standards Institute estimates that ISO 14000 is the third most widely used standard in the world [19].

In some instances, compliance with the ISO is artificially lowered, due to compliance with other programs and certifications that mirror or surpass ISO 14000 requirements. For example, the Eco-Management Audit Scheme (EMAS) covers all of the requirements in the ISO 14001 environmental management system (EMS) [23]. While ISO only requires acknowledgment of legal requirements and efforts to meet them, EMAS requires full compliance with all legal requirements for environmental impact control. (Another program of note, which is based on ISO 14000 requirements, is Green Seal [24].) Likewise, many American companies feel the pre-existing need to comply with the EPA's requirements is already too burdensome, and consequently these companies have little incentive to take on voluntary programs. In fact, the ISO estimates that many more companies in America are *de facto* compliant, and merely lack certification [19]. Additionally, there is a fear in North American companies of exposure to liability if stock is taken of which legal requirements are and are not being complied with. Another reason for less robust adoption is that, unlike in East and South Asia, environmental compliance has not been seen as a barrier to trade; American and Canadian products are often seen as of high enough quality to be accepted in international trade without the additional support of international standards.

One company that has declined to become certified is Alcan Smelters & Chemicals, Ltd, based in Quebec [25]. While management believed certification would improve their company's corporate image, many were unsure whether compliance would ultimately improve the company's real environmental impact. The feeling of management was that their emissions were quite low to begin with, and instituting an EMS that required constant improvement in addressing environmental issues would have limited returns; the large amount of paperwork required would merely make evaluation easier for the required auditors, and much more difficult at several other stages of production. Reliance on

independent auditors was also not desirable, nor were the associated costs, both of certification (which can be anywhere from $24,000 to $128,000 [26]), and of purchasing goods from suppliers who were compliant, as opposed to those who were not. If an EMS were to be adopted, EMAS was felt to be superior. Finally, there was a loyalty felt to traditional suppliers, which trumped environmental considerations. This last point is a common obstacle to adoption of ISO standards worldwide.

This approach is indicative of the chemical industry writ large. Many European chemical companies lobbied for a relaxation of environmental regulations for themselves, and ended up switching from EMAS to ISO in order to not have to certify their supply lines [17].

There have been some exceptions. In the U.S., the Departments of Agriculture, Defense, and Education; the Forest and Postal Services; and the Army, Navy, Coast Guard, and Marines, have all either fully complied with ISO 14001 or have been successful getting sites certified [28]. This was accomplished by Executive Order 13148 from President Clinton, which was re-confirmed by President Bush in 2001 as a national priority. However, this removed the voluntary nature of the standard.

B. East Asia, and Factors Leading to Certification

China is the world leader in ISO adoption. There are often blurred lines between violator and government regulator, as well as corruption; therefore, fines and regulations within an industry in China are often felt to be less effective than market incentives [26]. Certification by the ISO has also helped create a presumption of quality regarding Chinese goods, making them more competitive in the international market.

The rationale for China's full embrace of the ISO certification system is theorized to be about, among other things, promoting international trade. Aside from trying to increase the quality of their goods, it has been observed that countries with high levels of ISO 14001 certification trade more with each other [29], even if there is no specific preference shown by the individual importers. Preference for a supplier with an EMS was found in 49% of surveyed companies when the purchaser themselves had an EMS [17]. Compliance is quite high in the electronics industry, with 60% of Japanese certifications being in this field [19]. As mentioned before, there is a perception in East Asia that lack of environmental compliance can be a barrier to trade. While this bodes well for adoption of ISO 14000, the same cannot be said for net environmental effects.

Exporters with a strong environmental ethos are much more likely to adopt an EMS [17]. Adoption is correlated with firm size and profitability, which may help with costs of certification. Firms that have adopted ISO 9000 are also statistically more likely to adopt 14000, not only for the additional benefit and boost to company image, but also because much of the work for certification is identical, and compliance with one makes compliance with another much easier.

II. Supply Chains

A. The ISO

When looking for suppliers, the top three factors for consideration for a purchaser tend to be: 1. Price, 2. Quality Management System (ISO 9000), 3. EMS (ISO 14000) [26]. While companies are largely not willing to absorb certification costs in order to favor certification, they will require certification throughout a supply chain if desired by a client [19]. In a survey, two main factors why buyers preferred certified suppliers were a presumption of quality (42%) and internal consumer pressure (14%). Many companies stated that an EMS was only a factor if the price was equal (21%), and many more gave no preference to a supplier with an EMS (23%).

As many as 71% of companies surveyed in the study above reporting that they had “no EMS” were under 100 employees. Multinational companies tend to be popular candidates for ISO adoption, likely due to increased exposure to customer demand and regulation, as well as an ability to better handle the costs [26]. The two systems (9000 and 14000) share a similar structure and are designed to work together

[28]. Some American "interviewees stated that requirements by multinational companies for their suppliers to register under ISO 14001 are providing new motivation for U.S. companies to adopt the standard [19]."

There is also a suspicion that the positive correlation between ISO 14000 and foreign ownership share reflects differences in productivity between certified and uncertified firms. In China, exports to Japan and other high-compliance countries signified a likelihood of compliance domestically [29]. Some major corporations like Sony and Sumitomo are publishing their compliance with ISO 14000, listing what sites meet the standard [30, 31].

This is also occurring in the U.S. Companies like Ford and GM have led the way in requiring their suppliers to be compliant with ISO standardization, despite their final product being inherently harmful to the environment. Ford is forcing first tier suppliers to drive Ford's environmental and social expectations down the supply chain [32]. Land Rover and Jaguar, Ford subsidiaries, are also encouraging their suppliers to achieve certification [19]. Other businesses in other industries are following suit: Dell requires compliance with ISO 14000 through its supply chains, Cisco preferences GHG-responsible suppliers, Gap is also doing a lot to educate people regarding their purchasing, and Hewlett-Packard monitors third party environmental reports of suppliers, rewarding environmental compliance with increased business [32].

Abbott Labs is also determined to follow their products throughout their entire lifecycle, and they are already complying with the life cycle assessment (LCA) requirements of the new standard being analyzed here [33]. In their report, Abbott Labs states that factors considered when buying products include: "1) Maximization of recycled products used in product life cycle; 2) Environmental cost of entire product life cycle; 3) Reuse of existing products or materials in product life cycle; 4) Recyclability of product…8) Elimination of uncertified hardwoods in product life cycle…10) Ultimate disposal of the product." All in all, CERES reports that 47%, or 291 companies in their annual survey demonstrated at least some inclusion of environmental and/or social criteria (e.g., equitable labor conditions) in the procurement decision-making process. This is up slightly from 46% in 2012 [32].

B. Analogous Efforts

Just as EMAS mirrors the efforts of the ISO 14000 series, the LCA assessment also has precedence in other parallel yet unrelated efforts. Often suppliers service more than one company, and there are efforts on the part of one company to encourage the supplier to become certified under a standard, or to comply with a given requirement. Companies then join into organizations that pressure and negotiate with suppliers collectively. Some of the more prominent efforts include the Global e-Sustainability Initiative (GeSI) for Information and Communication Technologies (ICT), the Sustainable Apparel Coalition (SAC) for clothing, the Electronics Industry Citizenship Coalition (EICC) for the technology industry, and the Auto Industry Action Group (AIAG) for vehicles. A list of members to each of these can be found in the Appendix.

The Global e-Sustainability Initiative has many projects; one such works on applying ICT products to reduce carbon in sectors such as energy, building, transport, and commerce. Another is the elimination of "conflict minerals" from their suppliers. There is also an e-waste recycling effort, and an Electronics Tool for Accountable Supply Chains, looking at environmental impacts, labor, fair business practices, and sustainable procurement [34].

The Sustainable Apparel Coalition represents more than one third of global apparel and footwear production. To gauge the compliance of a company, ISO 14000 certification is taken into consideration, along with monitoring the environmental impact of suppliers, reduction of the environmental impact of

product materials, conducting full life cycle assessments that must be shared publicly, and notification of suppliers about their need to comply with environmental regulations, among others [35].

The Electronics Industry Citizenship Coalition represents companies worth $2.6 trillion, and employing over 5.5 million people. The EICC has centralized auditing, which includes monitoring and recommending improvements for life cycle sustainability. The EICC also requires Tier 1 (direct) suppliers to members (covering 3.5 million people in 120 countries) to adhere to the EICC's Code of Conduct, which itself is based on both ISO 14000 and EMAS, and mandates, among other things, obtaining all required environmental permits; monitoring, controlling, and treating particulates in the air along with other climate forcers; and labelling things for recycling and disposal [36].

The Auto Industry Action Group already requires auditors to be trained in the ISO 16000 series, which suggests that adoption of the 14000 series would not be a significantly larger burden. The AIAG institutes maintaining quality within supply lines, bar code standardization, preparations around importation (making standards to allow use of FAST border lanes), reusable containers, conflict materials (in order to comply with the Dodd-Frank Wall Street Reform and Consumer Protection Act, which goes into effect this year), managing chemicals during production, and improving working conditions. Tier I suppliers are required to comply with the AIAG's policies, and most Tier II and III suppliers are now compliant. While none of these are specifically environmental in nature, most of the infrastructure for eventual adoption has been erected.

III. Conclusion: Atmospheric Pressure

The requirements of instituting the LEO SCS 002 life cycle assessment would not burden companies who are attending to their environmental responsibilities significantly more than they already have opted to do, many none at all. Much of the groundwork for this engagement has already been laid. Pressure on companies to engage suppliers is growing along with Americans' belief in a living wage and fair trade.

Additional campaigns have sprouted up that mimic the intentions of the LCA requirement for LEO SCS 002. California passed SB-657 in 2010, which requires retail sellers and manufacturers doing business in California to publicly disclose the engagement of their direct suppliers regarding, among other things, trafficking and slavery [37]. According to their website, 391 of 492 companies required to comply with the mandate are participating.

Field to Market engages in measuring, promoting, and reporting on continuous improvement in various foods and crops related to seven sustainability indicators: land use, soil conservation, soil carbon, irrigated water use, water quality, energy use, and greenhouse gas emissions [38].

The rising belief of Americans in climate change as a byproduct of human activity [39] is likely to have many repercussions, several outlined above. While the ISO may not be the universally preferred vehicle for managing and mandating reductions in emissions that cause climate change, it is very unlikely that compliance will not be forthcoming. The ISO sets a baseline for many other programs and initiatives, and strengthening it will not only raise the bar for those companies and organizations that currently pride themselves on compliance, but will also inspire many other parallel programs to reconsider and revise their requirements. Additionally, much of the organization required for adoption exists has been put in place in the last twenty years. Therefore, there is a strong likelihood that, should LEO SCS 002 be adopted as an ISO standard, it will be as successful, if not more so, than previous iterations.

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Can REDD+ Be Used To Incentivize Compliance With The ANSI Standard?

By Denielle Harrison

I. Background

REDD is a climate change mitigation mechanism that was first discussed in 2005 under the United Nations Framework Convention on Climate Change during the 11th session of the Conference of the Parties (COP 11) in Montreal, Canada. The purpose of the mechanism, as the name suggests, has been to address the significant amount of greenhouse gas emissions that result from deforestation and forest degradation and provide a mechanism to adequately mitigate climate change related emissions that result from the aforementioned activities [1]. The 'road map' for REDD implementation was agreed upon at COP 13 in Bali, Indonesia. It included the Bali Action Plan, which requested an assessment of the drivers of deforestation and the demonstration of activities that would reduce emissions from deforestation [1]. In 2009 at COP 15 in Copenhagen, Denmark, **R**educing **E**missions from **D**eforestation and forest **D**egradation (REDD) evolved into REDD+, which includes conservation, enhancement of forest carbon stocks, and the sustainable management of forests. COP 19 in Warsaw, Poland in 2013 arrived at seven key decisions (Warsaw Framework), which are intended to further promote the viability of REDD+ [2].

REDD+ provides financial incentives to developing nations that build the capacity, implement REDD+ projects, and provide continuous demonstration of emissions reductions from REDD+ activities [1]. Currently, REDD+ is financed through bilateral or multilateral channels, such as the Norwegian Agency for Development Cooperation (NORAD), USAID, and the World Bank [3, 4]. The underlying financial scheme of REDD+ is to compensate developing countries that have demonstrated the ability to measure and verify increases in forest cover through the allocation of carbon credits. Such credits would be tradable on an international market between governments and private industries that wish to offset their emissions. REDD+ is still in its early development stages.This creates an opportunity for the inclusion of a non-greenhouse gas climate forcer, such as black carbon, to be addressed by the mechanism.

II. Intersect of REDD+ and Black Carbon ANSI Standard

Globally, open biomass burning (including wildfires) was responsible for approximately 37% of black carbon emissions in 2000 [5]. Most of this burning occurs in tropical latitudes, which coincides with data from 2000 that show that Asia, Africa, and Latin America accounted for nearly 80% of black carbon emissions, though it is unclear which countries contributed the most from open biomass burning [5]. The vast majority of the countries on the aforementioned continents are developing nations, many of which are forested. Black carbon could be included into REDD+ as forest stocks are being lost to deforestation or degraded from burning, and conservation of forest carbon stocks would offset such burning.

A. Opportunities

Forests cover approximately 60% of Indonesia. A 2012 study found that open biomass burning accounted for 24 gigagrams of black carbon, which was a small fraction of all toxic air pollutants and greenhouse gas emissions [6]. Indonesia, however, is one of the largest recipients of domestic and international committed and dispersed REDD+ funds [3, 4]. Despite the low emissions of black carbon, Indonesia provides an example of how black carbon can be incorporated into the REDD+ mechanism. Developing countries that practice slash and burn agriculture in tropical forests or that have significant incidence of wildfires would first need to be assessed within the intended context of the

LCA. The ANSI standard could also benefit from one of the core issues of REDD+, permanence, which will ideally utilize satellite monitored measurement, reporting, and verification (MRV) to prove that REDD+ projects are permanent and are not being deforested or degraded via fire or logging.

B. Challenges

While REDD+ does provide an avenue to incentivize a black carbon LCA, there are various barriers that may prevent incorporation into REDD+ from being effective. India has a large problem with black carbon emissions from cook stoves. The only way this could be addressed through REDD+ is if the wood being used in cook stoves were to be coming from a protected area. While India has recently been engaged in REDD+ discussions, the approximate time scale to go through the implementation phases of REDD+ is unknown. In contrast, another large emitter, China, has not successfully engaged with REDD+, which means a country that is complying ideally with the ANSI standard would not be addressed through this avenue. Both countries have forest cover of about 23% and are looking for ways to decrease their overall emissions, which could potentially lead to further engagement in REDD+ to receive financial incentives.

Further research needs to be done on the following questions to determine if REDD+ would be a viable option to provide financial incentives to a voluntary black carbon LCA: What countries are significantly contributing to black carbon emissions? Do the identified countries meet the criteria (developing, significant forest cover, deforestation) to be included in REDD+?

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Appendix: Participants

Global e-Sustainability Initiative

Alcatel-Lucent, Amdocs, AT&T, Bell, Blackberry, BT, Carbon Trust, Deutsche Telekom, EICC, Ericsson, Etno, Greentough, Hewlett Packard, Huawei, Institute of Contemporary Observation (ICO), UN's Agency for Information and Communication Technology, KPN [Dutch Telecom Company], Microsoft, Nokia / Nokia Siements Networks, Orange France Telecom Group, OTE (Greek & Southeastern European Telecom Company], Sony Mobile, Sprint, Solving E-Waste Problem (STEP), Swisscom, TDC [Dominant Danish Telecom company], Tele2 [European Telecom company], Telecom Italia, Telefonica [Spanish Telecom company], Telenor [Dominant Norwegian Telecom company], TeliaSonera [Dominant Sweden/Finland telecom company], Telstra [Largest Australian Telecom/media company], Turk Telekom, UN Env Programme (UNEP), Verizon, VimpelCom, Vodafone, Wbcsd, World Resources Forum, World Resources Institute, ZTE [Multinational Chinese Telecom company, worth ~$16 billion. Works in Australia, Germany, the US, Brazil, and Pakistan].

Sustainable Apparel Coalition

Brands: Adidas, Asics, Brooks, Burberry, Coca-Cola, Columbia, Desigual, Ecco, Eileen Fisher, Esprit, Fenix Outdoor Group, Hanes, IC Companys, IKEA, Keen, Kering, Levi's, Loomstate, Lululemon Athletica, Madura Fashion, Malwee, Marmot, New Balance, Nike, Patagonia, Pentland Brands, PUMA, PVH, Reckitt, VF Corp.

Retailers: Ann Inc, C&A, GAP, H&M, Inditex, JCPenney, Kohl's, L.L. Bean, Macy's, Mountain Equipment Co-op, Nordstrom, Otto Group, REI, Target, Wal-Mart, Williams-Sonoma.

Manufacturers: 1888 Mills, Advansa, Archroma, Artistic Milliners, Arvind Mills, Avery Dennison, Bayer, Bemis, Birla Cellulose, Charming Trim, CRAiLAR, Crystal Group, CWS-boco, DuPont, DyStar, Esquel Group, Gildan, WL Gore & Associates, Hirdaramani Group, Hong-Kong Non-Woven Fabric Ind. Co., Huntsman, Indo Count, Invista, KG Denim, Lenzing, Li & Fung, Lubrizol, Makalot Industrial Co., MAS Holdings, Novozymes, Pinneco Research Ltd, Pratibha Syntex Limited, Ramatex Group, Rubia Natural Colors, Saitex Int'l, TAL Apparel, Teijin Fibers Ltd, Tiong Liong Corp, Toray Industries, Freudenberg Vildona, Wah Fung Group, Yunus Textile Mills, Yu Yunag Group.

Industry Affiliates: American Apparel, Bluesign Technologies, Bureau Veritas, Control Union Certificates, Cotton Connection, Cotton Incorporated, Cradle to Cradle Products Innovation Institute, European Outdoor Group, FITI, Flo-Cert, Green Earth Cleaning, Hellman Worldwide Logistics, Indicate, Int'l Wool Textile Org, MGH Group, Outdoor Industry Ass., Oeko-Tex, RESET Carbon, SGS, Valora, Verite, Xeros Cleaning.

NGOs: Aid by Trade Foundation, Better Cotton Initiative, Caux Round Table, Danish Fashion Institute, Duke Center for Sustainability and Commerce, Env. Defense Fund, Fair Trade USA, Fair Trade Int'l, Made-By, U.S. EPA, Natural Resources Defense Council, Stockholm Int'l Water Institute, Solidaridad Network, Sustainable Fashion Academy, Sustainable Fashion Business Consortium, Textile Exchange, Swedish School of Textiles, Univ Delaware, Utrecht Univ, World Resources Institute.

Electronics Industry Citizenship Coalition Members

Acbel Polytech Inc., Acer, Adobe Systems Incorporated, Advanced Micro Devices, Amkor Technology, Analog Devices, Apple, Applied Materials, ASML Holding, Best Buy, Black berry, Broadcom, Celestica, Chicony ELectronics, Ciena, Cisco, Citrix, Compal Electronics, Dell, DirecTV, Eastman Kodak Co., Edwards, EMC Corp., Fabrinet, Fairchild Semiconductor, FCI, Flextronics Int'l, Freescale, Foxconn, Garmin Ltd, Global Advanced Metals, Hewlett-Packard, HTC Corp, HGST, IBM, Intel, Isola Group, Int'l Rectifier Corp, Jabil, KLA-Tencor, Konica Minolta, KYE Systems Corp, Lenovo, Lexmark, LG Electronics, Logitech, Longwell Co., Marvell, Medtronic, Molex, Micron Tech, Microsoft, ModusLink, Motorola Mobility, Motorola Solutions, Inc., NetApp, Netgear, New Kinpo Group, Nvidia Corp, NXP Semiconductors, ON Semiconductor, Oracle America, Pace Plc, PCH Int'l, Pegatron, Philips, Qualcomm Inc., Quantra Computer Inc., Samsung, SanDisk, Sanmina-SCI, Seagate Tech, Senju Metal, SK hynix, Skyworks, SMART Modular Tech., Somima SPRL, Sony Corp., Spansion, SunEdison, STMicroelectronics, Symantec, Synopsys, Taiwan Chinsan Electronics Industrial Co., Texas Instruments, TomTom Int'l, Toshiba Corp., TriQuint Semiconductor Inc., TT Electronics Plc, Viasystems, Vishay Intertechnology Inc., Western Digital, Winstron Corp., Xerox, XP Power.

Auto Industry Action Group

Membership encompasses 800 original equipment manufacturers, parts manufacturers, and service providers. Includes Ford, GM, Chrysler (original members), Volvo, Jaguar/Land Rover, Peugeot/Citroen, Toyota, Honda, Nissan, Caterpillar, Navistar International.

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Currently, 391 companies are compliant with the bill.

Notable companies include: 99 Cent Only Stores, Abbott Laboratories, Abercrombie & Fitch, ACER, Activision Blizzard*, Adobe, Advanced Micro Devices, Aéropostale, Amazon.com, American Apparel, American Eagle Outfitters, Amgen Pharmaceuticals, Apple, Amtel, AutoZone, Bausch & Lomb, Bayer, Bed Bath & Beyond, Behr, Best Buy, Big 5 Sporting Goods, BJ's Wholesale Club, Bridgestone Americas, CafePress, Campbell Soup Co., Caterpillar Inc., Chevron, Chrysler Group LLC, Cisco Systems Inc., Colgate Palmolive, ConocoPhillips, CostCo Wholesale Corp., CVS Caremark, Dell Inc., Dole Food Co.*, Eastman Kodak Co., Estée Lauder, Five Guys Enterprises LLC, Foot Locker, Ford, Forever 21, Fruit of the Loom Inc., Frye's Electronics Inc., GameStop Corp., Garmin, General Electric, General Mills Inc., General Motors Co., Gerber Products Co., GE Wind Energy LLC, Goodwill Southern California*, Goodyear-Dunlop Tires North America Ltd., Goodyear Tire & Rubber, Guess? Inc.*, Guitar Center, Harmnic Inc., Hershey's, Hewlett-Packard Co., Hillshire Brands, Home Depot, Honda North America Inc., Hot Topic Inc., Hyundai Motor America, IBM, In-N-Out Burgers, Intel Corp., Intuit Inc.*, J.C. Penney Co., J.M. Smucker, Kellogg Co., Kelly-Moore Paint Co., Kohl's Corp., Kraft Foods Group Inc., Krispy Kreme Doughnuts Inc., K-Swiss Inc.*, Lenovo Group, Lenox Corp., Levi Strauss & Co., L'Oreal, Lowe's, Lululemon, Macy's Inc., Mattel Inc., Microsoft, MillerCoors LLC, Mitsubishi Motors North America, Monster Beverage Corp.*, Motorola Mobility Holdings Inc., Navistar International Corp., Nestle, Netflix Inc.*, Nike, Nordstrom Inc., Office

Depot Inc., Onyx Pharmaceuticals Inc., Oracle Corp., O'Reilly Automotive Inc., OshKoshB'gosh, Panasonic, Patagonia, PepsiCoPetco, Pfizer Inc., Proctor & Gamble, RadioShack Corp., Ralph Lauren, Raytheon, Ricoh Electronics, Riteaid, Ross Stores Inc., Safeway Inc., Samsung Electronics Co., SanDisk Corp., Sears Holdings Corp., Sherwin-Williams, Skechers U.S.A. Inc., Staples Inc., Starbucks Corp., Sun-Maid Growers of California Inc., Symantec Corp., Target, Tesla Motors Inc, Texaco Inc., Texas Instruments Inc., Coca-Cola Co., The Dow Chemical Co., The Gap Inc., The Walt Disney Co., TiVo Inc.*, TomTom NV, Tootsie Roll Industries Inc., Toys "R" Us Inc., Trader Joe's, Tyson Foods Inc., Volcom Corp., Walgreen, Wal-Mart Stores Inc., Whole Foods Market Inc., Williams-Sonoma Inc., and Xerox Corp.

* Not complaint with SB-657.

Field to Market.org

Agrium US, Inc.; American Crystal Sugar Company; American Farm Bureau Federation; American Soybean Association; Archer Daniels Midland Company; Bayer CropScience; BASF; Biotechnology Industry Organization; Bunge; Cargill; CHS, Inc.; Conservation Technology Information Center; Cotton Incorporated; CropLife America; CropLife International; Dow AgroSciences; Ducks Unlimited; DuPont Pioneer; Environmental Defense Fund; FleishmanHillard; General Mills; Indiana Soybean Alliance; Innovation Center for U.S. Dairy; International Plant Nutrition Institute; John Deere; Kellogg Company; Land O'Lakes, Inc.; McDonald's Corporation; Monsanto Company; National Association of Conservation Districts; National Association of Wheat Growers; National Corn Growers Association; National Cotton Council of America; National Potato Council; North Carolina State University; Penton Media; Procter & Gamble; Syngenta Corporation; The Coca-Cola Company; The Fertilizer Institute; The Freshwater Trust; The Mosaic Company; The Nature Conservancy; Thompson Coburn LLP; Unilever; United Soybean Board; University of Arkansas Division of Agriculture; University of Wisconsin-Madison College of Agricultural and Life Sciences; U.S. Soybean Export Council; USA Rice Federation; USDA Natural Resources Conservation Service; Wal-Mart; World Resources Institute; World Wildlife Fund.

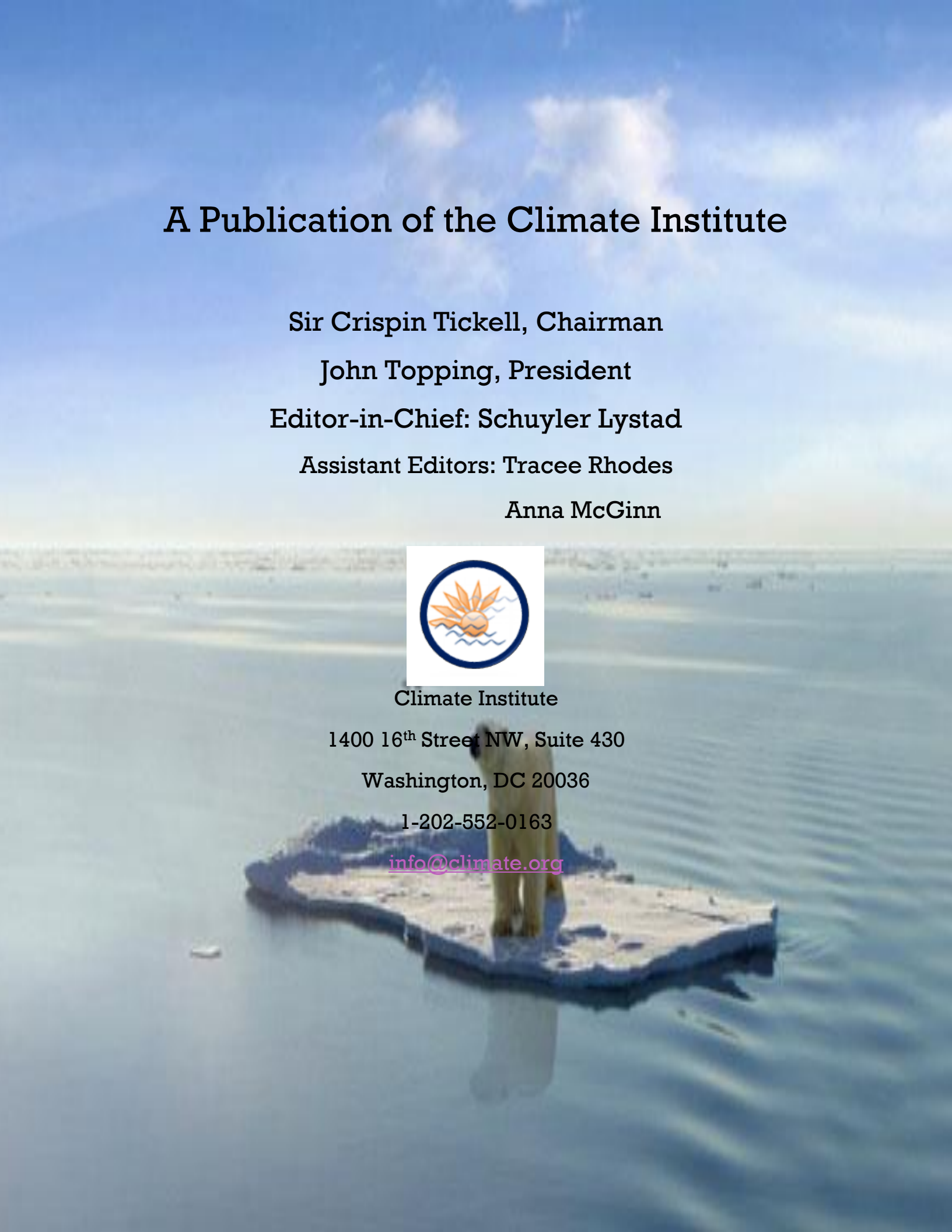
Michael MacCracken, Climate Institute Chief Scientist for Climate Change Programs, whose first legal declaration on the science of climate change was cited at length by Justice John Paul Stevens in his majority opinion in the landmark case of ***Massachusetts et al. v. EPA*** decided in 2007, has continued to assist in legal cases seeking to reduce emissions of CO_2 and other greenhouse gases. This past November, he provided a scientific declaration in a lawsuit filed by Friends of the Earth and the Western Organization of Resource Councils calling on the US Department of Interior and its Bureau of Land Management (BLM) to update their outdated environmental impact statement from the 1980s that has been used to justify offering leases on public lands for mining of coal. These leases have tended to be offered at below-market prices and with no consideration of the global-scale impacts on climate of the coal being mined, whether in the US or abroad. In support of the action, Microsoft co-founder Paul Allen, who is also owner of the Seattle Seahawks and Portland Trailblazers, authored an op-ed in the ***Huffington Post*** entitled "This Land is Our Land" describing the rationale for the lawsuit.

MacCracken also joined in an *amicus curiae* brief filed in November on behalf of the Sisters of Mercy and others on behalf of a youth group (**Our Children's Trust**) that is seeking to secure "the legal right to a healthy atmosphere and stable climate for all present and future generations." The brief was filed with the US Supreme Court appealing a US Court of Appeals ruling that the federal government had no responsibility to take actions to protect the environment under the long-established legal principle of the Public Trust Doctrine, which requires our government to protect and maintain survival resources for future generations. The Supreme Court turned down the appeal in December, leaving the lower court ruling in effect that such actions are a state rather than a federal responsibility.

On a more hopeful note, ***MacCracken*** is also participating on an expert panel of the Gold Star Foundation that is working toward coming up with an international methodology for accrediting potential reductions in emissions of black carbon and other short-lived species. This is one step in moving toward creating a market-based system of credits for reducing emissions of such species.

A new determination of the "Social Cost of Carbon" was published in January 2015 in the journal **Nature Climate Change**. The article, co-authored by former Institute Intern **Frances Moore** and Delavane Diaz, both at Stanford University, uses a more comprehensive, but still not complete, pricing model to make the calculation of the global environmental and societal costs of releasing a ton of CO_2 to the atmosphere. Their new estimate places the social cost of carbon at $220 per ton of CO_2 emitted rather than the $37 per ton of CO_2 emitted currently being used by the federal government based on now-outdated pricing models. The study found that early models that were used accounted only for the economic damages to economic input and did not take account of the long-term effects on economic growth. Using this much higher value, many more types of mitigation measure are likely to pass a cost-benefit analysis than under the value currently being used.

Moore is presently a Ph. D candidate and researcher with the Emmitt Interdisciplinary Program in Environment and Resources at the Stanford School of Earth Sciences. She graduated in 2007 with a B.A. in geophysics from Harvard and a Master's Degree in 2011 from the Yale School of Forestry & Environmental Studies before being awarded a five-year Ph.D. fellowship to Stanford. She was a co-editor of the 2008 Climate Institute publication, ***Sudden and Disruptive Climate Change*** and co-authored a number of publications with **Michael MacCracken** based on work growing out of her internship with us.



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