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EDITORIAL

A window on use-inspired basic research

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Environmental Research Letters is, among other things, a venue to develop ideas about environmental systems that we hope will change and improve the world. This arena is described by Don Stokes in his famous book ‘Pasteur’s Quadrant’ as that of use-inspired research (Stokes 1997).

The past year, 2014, will surely go down in energy and climate history, if not all environmental history, as a time when change truly happened. Not only was 2014 the hottest year on record, it was also one where historians may say the path of both the policy framework, and the profile of use-inspired basic work was accelerated.

In the United States, President Obama can legitimately say that he has re-written the energy and environmental playing field. Not only does the United States Environmental Protection Agency’s Clean Power Plan (US EPA 2014) call on power plant emissions nationwide to be cut by 30 percent by 2030, compared to 2005 levels, but it has also opened the door to a true game-changing international dialog.

While all nations, were finalizing their announcements for the 20th Climate Conference of the Parties (COP) that was held in Lima in December of last year, the US and China were changing the rules of the conversation. The Lima conference is, of course, one in a series of meetings since the third such COP in Kyoto in 1997 when the first effort at a global climate accord was developed, debated, and then signed. It was, however, largely ignored by the nations that are the largest greenhouse gas emitters today.

COP3, or the third conference of the parties, was in fact an agreement between the then ‘developed’, or industrialized nations, to reduce slightly the rate of release of greenhouse gases to the atmosphere. It established an ‘us’ versus ‘them’ framework for discussions with the US, Europe and Japan as the industrial, or emitting nations, and India, China, and the vast majority of nations the ‘them’ of developing nations (even though we are all, of course ‘developing’ in some degree or another) who did not have binding emissions reductions targets. Further no agreement could be reached on how financial, technological or other support would be provided to developing nations so that they could afford the clean energy technologies and other investments needed to ‘green’ a national economy.

The framework for negotiation has stood since the COP3 agreement in 1997, and while it was arguably and honestly well intended …, it was neither universally ratified, adopted, or enforced. Global emissions simply continued to rise. Now, the US and China have stepped away from the developed-developing divide and looked for common climate ground, which, in fact, everyone on earth shares.

Then, at the 2014 APEC summit the United States and China took a dramatic step away from that process and agreed to each change course and define paths to reduce their climate impact. The steps do not address all the issues, including the magnitude of reductions that are needed now, and challenging it could be to sustain a high rate of innovation and clean energy deployment. Nevertheless, it is a major step.

The bi-national agreement is complex and yet it is simple. The US and China are not even agreeing to the same thing: the US committed to a reduction in emissions by 2025, and China agreed to halt the growth in emissions by 2030 (The White House 2014). These are separate and unequal commitments, and there is great debate about how effective they will be—even if they are achieved—at putting even these two superpowers let alone the world on the needed path to an overall 80% or more reduction in emissions (from a 1990 baseline which we are well above today) by mid-century, 2050.

The US–China accord builds on important actions in each nation. President Obama, can point to the EPA’s Clean Power Plan as a clear milestone in US domestic efforts to manage greenhouse gas emissions, while Premier Xi, can point to a significant slowing in coal demand, but also to China’s position a the world’s largest producer of solar panels, wind turbines, and batteries for electric vehicles.

Both the US and China, of course, plan on continued economic growth past 2030, and China has now said explicitly that this means that a tidal wave of development and deployment of low-polluting
technologies will be needed now, and in huge amounts post 2030.

The mechanisms to make this happen are the fascinating and critically important means to this end. We have seen dramatic reductions in the price of wind energy technologies, and now we are witnessing even more dramatical reductions in solar energy costs. These two technologies are on dramatic growth paths, but still represent very small percentages of global energy generation.

The cocktail of energy efficiency improvements, and in the deployment of clean energy technologies needed to meet these targets will vary from nation to nation. Natural gas has seen a revolution in North America in investment and production, yet it’s climate benefit or harm is unclear, and likely largely depends on how it is used. Will gas be a short term—with an emphasis on short—vehicle to usher in greater attention to energy efficiency and deployment of renewable energy? The role that hydropower, nuclear and other technologies will play is today hotly debated, but a new structure for the conversation now exists.

The steps that China and the United States will now take are to be developed and discussed, but an important foundation exists. Not only have both nations implemented changes in the coal industry, the reduction in the growth of coal use in China, and a dramatic actual drop in coal use in the United States, but other key signs of change exist, too.

Both the US and China have significant solar and wind energy resources. In a recent study published in Energy Policy, my student Cheng Zheng and I highlighted how the growth in solar energy manufacturing in China and solar energy deployment in the US complement and reinforce each other Zheng and Kammen 2014. Many have noted that the US market is large, as is Chinese solar module production But now, as part of emission reduction plans and efforts to build the clean energy sector each nation has the motivation to become more ‘well rounded’ in this field: US manufacturing is growing while Chinese domestic demand is growing.

Similarly, the vast solar and wind energy resources each nation has are, in fact, far from population centers, so both nations have much to gain by innovations in energy transmission, smart grids, and in energy storage (Mileva et al 2013). Expect parallel or even joint announcements in theses areas from the US and China as we approach the next climate conference in Paris in December 2015.

The next step in the US and China, and ideally soon elsewhere, is to put a price on greenhouse gas emissions. This is the single most effective way to implement without ‘picking winners’ a sustainable transition to a sustainable future.

Thankfully examples of this new carbon accounting exist in the form of carbon markets in California, and in the US New England and Mid-Atlantic states, and in five Chinese provinces. Through (Mileva et al 2013) mechanism of a cap and trade carbon market, or through a carbon tax or another pricing mechanism, we critically need the clarity that this pricing tool will bring.

Carbon prices have started modestly—only a few to a few tens of dollars per ton of emissions. Next these markets need to be expanded in scope and in price. In my own theoretical modeling work across many nations—including the US and China—I see a global trend where once the price rises to roughly $30–40 per ton of emissions. Well before then, however, I hope and believe that we will be saying, ‘the avalanche has begun, it is too late for the pebbles to vote’.

Not all revolutions succeed, of course and there is a huge amount of work to be done. But 2014 has in the US and China been a year where state of the nation addresses have much to build upon.

All of the topics that these experiments need to become real are central to the coverage in Environmental Research Letters:

- The evolving climate science.
- A deepening and increasingly diverse set of cases of implementing low-carbon and low-resource using human systems.
- A recognition of the linkages between scientific, technological and methodological innovation and the ‘demand’ that well crafted ideas and policies such as the US–China deal can bring to the equation.
- A recognition of the need for intellectual diversity in that studies in seemingly unrelated areas such as building management, cultural and behavioral economics; and the conservation of critically endangered species all fit together as sustainability science takes center stage.

Thankfully, Environmental Research Letters authors and readers have demonstrated a deep capacity to engage on all of these topics.

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