CLIMATE CHANGE

Political agency: The key to tackling climate change

Individuals play a central role in the transformations required to avoid dangerous climate change

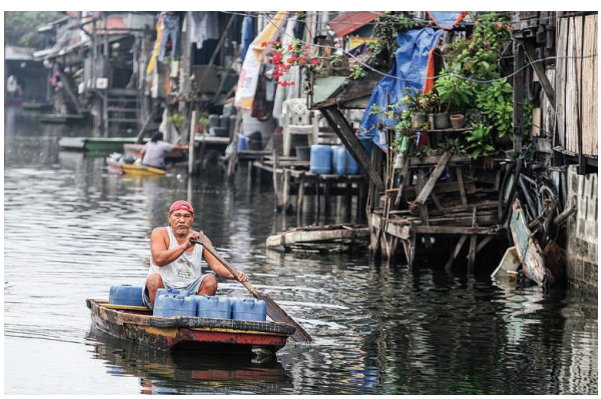
By **Karen O'Brien**

This month, representatives from more than 190 nations are gathering in Paris to participate in the 21st Conference of the Parties (COP21). There is widespread demand for a universal and binding political agreement that will limit the global average temperature increase to less than 2°C above its preindustrial value. But an agreement by itself does not guarantee action and desirable outcomes, and current pledges are far from sufficient to limit warming to 2°C. Nor are new technologies and energy infrastructure a panacea. Meeting this ambitious target and adapting to the impacts and risks associated with a warmer world will require transformations of a scope, magnitude, speed, and penetration that are unprecedented in human history. Without an instruction manual, where do we begin?

A good place to start is to look at political agency, which in the context of climate change refers to the capacity to positively influence the collective future through transformative change. Research on transformation identifies various pathways through which to address climate change, including technological innovations, market mechanisms, government regulations, new economic models, and the promotion of lifestyle and behavioral changes. The relative importance of each is widely contested (*1*). Should we call upon individuals to ride a bicycle, eat less meat, and avoid flying, or instead try to create support for such behaviors by constructing bicycle lanes, increasing vegetarian options, and ending fossil fuel subsidies?

Climate solutions are likely to emerge from interactions among all of the above. But can individuals really make a difference? Their perceived influence has generally been limited to behavioral change, consumption choices, voter participation, and the setting of examples. Such actions are important but do not address structural factors—the norms, rules, regulations, and institutions that influence individual and collective preferences and actions that are key to social transformations.

Increased consumption, long-distance vacations, and individualized transportation are material and cultural manifestations of a larger social context (*2*). Some argue that changing this context calls for radical approaches, such as transforming the capitalist economic system with its assumption and goal of continuous growth (*3*). The current emphasis on "green growth" is considered to be a reformist approach, rather than one that will effectively reconfigure systems and practices (*4*).



Rising waters. Floodwaters in Malabon City north of Manila, Philippines on 15 March 2012. Climate change is expected to increase the flood risk in many parts of the world unless greenhouse gas emissions are reduced drastically.

PHOTO: ROLEX DELA PENA/EPA/CORBIS

Because of the scope and scale of transformations needed to reduce climate change risks and vulnerability, a more expansive view of political agency is required—a view that captures an individual's ability to contribute to transformations both by changing behavior and by influencing structures and systems. Political agency has traditionally been reserved for political parties, unions, bureaucracies, states, and international actors, as well as individual leaders who are entrusted with the power to act on behalf of others (*5*). A broader and deeper understanding of political agency recognizes that individual change and collective change are, in fact, connected.

In recent years, committed individuals have been working with cities, schools, businesses, communities, nations, and government institutions and networks, with the intent to challenge energy policies, change investment practices, rethink disaster risk management strategies, and transform aspects of everyday life that were previously considered nonnegotiable (*6*). A broader notion of political agency recognizes that such seemingly small actions of individuals can have widespread global effects (*7*). Cooperative behavior can cascade through social networks, and each person in a network influences more people than they might think (*8*). The prevailing opinion in a population can be reversed rapidly when only 10% of the committed agents propose and argue for an alternative opinion (*9*). Rapid large-scale transformations thus can and often do emerge from changes at the individual and local levels. By expressing political agency, individuals play an important, yet often overlooked, role in transformations toward sustainability.

The political agency of individuals is evidenced through a proliferation of climate change initiatives. These include grassroots movements such as 350.org, the World Mayors Council on Climate Change, the Youth Climate Movement, the Women's Earth and Climate Action Network, and other organizations made up of individuals who are confronting entrenched interests, challenging old practices, and engaging directly with alternatives that emphasize sustainability and social justice. The political agency of individuals can also be expressed through decisions made within traditional organizations, such as companies involved in the Oil and Gas Climate Initiative, the Norwegian government's withdrawal of pension fund investments in coal-burning utilities, and the Guardian newspaper's expanded focus on climate change.

Nonetheless, the speed of transformations necessary to mitigate and adapt to climate change in an equitable and sustainable manner is likely to require not only a broader notion of political agency, but also a deeper one. A deeper notion of political agency draws attention to the beliefs, values, and world views that maintain habits and the status quo (*10*). Beliefs may include the ideas that change has to come from the top, that economic legacies are separate or more important than ecological legacies, or that reducing CO_2 levels alone will address the challenges of climate justice and global sustainability. Political agency involves questioning assumptions and challenging what is taken by many as given, recognizing that

Department of Sociology and Human Geography, University of Oslo, 0317 Oslo, Norway. E-mail: karen.obrien@sosgeo.uio.no

worldview transformations can play an explicit role in the development of prosocial, life-affirming behavior (*11*). It also involves engaging with alternatives and pursuing solutions that may be invisible to the mainstream view, such as permaculture.

A wider and deeper sense of political agency is a potent but so far mostly latent force for transformation. Changing one's diet, mode of transport, or political vote can be important. But transformations to sustainability will depend on individuals expressing political agency in many different ways, which can include participating in grassroots community initiatives such as the transition town movement, starting conversations with family and friends about alternative vacation ideas, or engaging with sustainability solutions though art and literature. What is important here is the recognition that individuals can effect change by engaging with ideas, activities, and conversations that trigger reflection and collaborative action.

COP21 is expected to attract as many as 50,000 participants, reflecting a growing recognition that business-as-usual approaches are insufficient for avoiding dangerous climate change (*12*). A recent survey conducted in 20 countries by the Pew Research Center shows that most of the public believes that policy changes will not be enough, and that lifestyle changes will be necessary to address climate change (*13*). In the aftermath of the Paris climate conference, one lifestyle change will stand out as key: cultivating political agency to lead transformative change. The delegates who gather at COP21 will define the boundaries for climate change that are considered acceptable and achievable, but it is individuals who will ultimately decide the future. ■

REFERENCES

1. K. Ehrhardt-Martinez *et al.*, in *Climate and Society: Sociological Perspectives*, R. E. Dunlap, R. J. Brulle, Eds. (Routledge, London, 2015), pp. 93–106.
2. E. Shove, *Contemp. Soc. Sci.* **6**, 2158 (2012).
3. M. Pelling, D. Manuel-Navarrete, M. Redclift, in *Climate Change and the Crisis of Capitalism: A Chance to Reclaim Self, Society and Nature*, M. Pelling, D. Manuel-Navarrete, M. Redclift, Eds. (Routledge, London, 2012), pp. 1–17.
4. F. W. Geels *et al.*, *Glob. Environ. Change* **34**, 1 (2015).
5. R. Marchetti, in *Contemporary Political Agency: Theory and Practice*, B. Maiguashca, R. Marchetti, Eds. (Routledge, London, 2013), pp. 1–13.
6. F. R. Westley *et al.*, *Ecol. Society* **18** (3), 27 (2013).
7. A. El Khoury, *Globalization Development and Social Justice: A Propositional Political Approach* (Routledge, London, 2015).
8. J. H. Fowler, N. A. Christakis, *Proc. Natl. Acad. Sci. U.S.A.* **107**, 5334 (2010).
9. J. Xie *et al.*, *Phys. Rev. E* **84**, 011130 (2011).
10. K. O'Brien, E. Selboe, in *The Adaptive Challenge of Climate Change*, K. O'Brien, E. Selboe, Eds. (Cambridge Univ. Press, Cambridge, 2015), pp. 1–23.
11. M. M. Schlitz, C. Vieten, E. M. Miller, *J. Consciousness Studies* **17** (7-8), 18 (2010).
12. T. Neeff, *Environ. Sci. Policy* **31**, 157 (2013).
13. Pew Research Center, *Global Concern about Climate Change: Broad Support for Limiting Emissions* (5 November 2015); www.pewglobal.org/2015/11/05/global-concern-about-climate-change-broad-support-for-limiting-emissions.

10.1126/science.aad0267

CATALYSIS

Silica-supported catalysts get a new breath of life

Methods emerge for dispersing metals as stable nanoparticles on silica surfaces

By **Stuart Soled**

In heterogeneous catalysis, metals, metal oxides, and metal sulfides are traditionally dispersed as nanoscale particles on a support with a large surface area, so as to maximize the number of exposed active sites. Historically, alumina supports have been used for the majority of refining applications, but where acid sites catalyze unwanted isomerization or oligomerization reactions, silica would be a better choice. Despite this advantage, silica has often been considered a problematic support—an "ice skating rink"—because of the difficulty of forming strongly interacting precursors that wet the surface to yield well-dispersed particles. However, the past two decades have witnessed slow but steady progress in advancing several science-based approaches that will allow industrial-scale preparation of silica-supported catalysts.

"The present state of knowledge also allows a reassessment of processes where alumina has been used but may not be optimal."

Noble metals used as industrial catalysts play key roles in hydroisomerization, dehydrocyclization, hydrogenation, and ring-opening reactions, which are important in catalytic reforming, aromatic saturation, and lubricant dewaxing. Because noble metals often cost thousands of dollars per kilogram, low loadings of the metal (generally 0.1 to 1 weight percent) are necessary, and forming nanoscale particles is necessary to expose a large fraction of surface atoms. Worldwide, the refining market for catalysts is a >$5 billion enterprise in which the two largest process areas for supported catalysts, catalytic reforming and hydroprocessing, constitute >50% of that total (*1*). Reported data indicate that silica-supported catalysts represent <1% of the total in these two areas.

An early design strategy for supported metal catalysts was reported in an intriguing 1979 paper that applied colloidal chemistry methodology to supported catalysts (*2*). Specifically, the surface of a metal-oxide support particle suspended in water will assume a charge depending on the pH of the suspension and the nature of the metal oxide surface. Small, highly charged cations attached to surface OH groups keep the surface negatively charged through a wide pH range. An electrostatic attraction between the oxide support and the impregnate can be created by matching the impregnate charge (by using either an anionic or cationic species) with the pH of the suspension. When the pH of the suspension containing the small support particles is at a pH lower than the support isoelectric point, the support surface is positively charged and an anionic precursor is chosen; the opposite is done if the pH is above the isoelectric point of the support. For example, platinum tetraamine hydroxide cationic complexes adsorb on a negatively charged alumina support at pH above 9. This approach is widely applicable as long as an appropriate precursor complex is available in the correct pH range. This technique also scales fairly easily to the complex surfaces of industrial catalyst supports. In newer embodiments, core-shell metal structures on bimetallics are created by sequential addition of appropriate precursors (*3*). This approach has been applied to multiple systems by Regalbuto and co-workers (*4*).

Another approach controls the environment used during precursor decomposition by creating discrete intermediates that can interact more strongly with the support. For example, with supported copper or cobalt catalysts, introduction of nitric oxide (NO) during the thermal decomposition (calcination) of the cobalt nitrate precursor on silica produces evenly spaced metal-oxide nanoparticles that are then easy to reduce to uniformly distributed metal crystallites (*5*, *6*).

The introduction of NO appears to create hydroxy-nitrate intermediates that wet the silica well, whereas metal oxides formed by calcining the noninteracting nitrate precur-

Corporate Strategic Research, ExxonMobil Research and Engineering Co., 1545 Route 22, East Annandale, NJ 08801, USA. E-mail: stu.soled@exxonmobil.com

Political agency: The key to tackling climate change

Karen O'Brien

Science **350**, 1170 (2015);
DOI: 10.1126/science.aad0267

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published weekly, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005.