Environmental Science & Technology

pubs.acs.org/est

Viewpoint

U.S.−China Collaboration is Vital to Global Plans for a Healthy Environment and Sustainable Development

Ming Xu, Glen T. Daigger,* Chuanwu Xi, Jianguo Liu, Jiuhui Qu,* Pedro J. Alvarez, Pratim Biswas, Yongsheng Chen, Dana Dolinoy, Ying Fan, Huaizhu Oliver Gao, Jiming Hao, Hong He, Daniel M. Kammen, Maria Carmen Lemos, Fudong Liu, Nancy G. Love, Yonglong Lu, Denise L. Mauzerall, Shelie A. Miller, Zhiyun Ouyang, Jonathan T. Overpeck, Wei Peng, Anu Ramaswami, Zhiyong Ren, Aijie Wang, Brian Wu, Ye Wu, Junfeng Zhang, Chunmiao Zheng, Bing Zhu, Tong Zhu, Wei-Qiang Chen, Gang Liu, Shen Qu, Chunyan Wang, Yutao Wang, Xueying Yu, Chao Zhang, and Hongliang Zhang

Cite This: https://doi.org/10.1021/acs.est.0c08750

Read Online

ACCESS | Metrics & More | Article Recommendations

KEYWORDS: *sustainable development, Sustainable Development Goal, international collaboration, U.S., China*

The United Nations (UN) Sustainable Development Goals (SDGs) are a framework for national and international efforts to further economic development, end poverty, protect the planet, and ensure peace and prosperity for all people by 2030. In the first four years since the SDGs came into force (2016−2019), little to no progress has been made on 107 of the 169 SDG targets, and the world is even moving away from 39 of the targets.[1] In 2020, COVID-19 has created additional setbacks for SDGs.[2] With the year 2030 less than a decade away, an urgent and more ambitious response is crucial to enable SDGs to be realized globally. We need strong leadership to create secure and cooperative partnerships between governments, the private sector, and civil societies around the globe to move these goals forward at pace.

As leading economic powers, the U.S. and China are well positioned to take a leadership role in this action. By building

Received: December 27, 2020

Table 1. Key Stakeholders, Benefits, Barriers, And Solutions of Continuing and Expanding U.S.−China Collaboration in SDG Areas

stakeholder		benefit to	barrier	solution
academia	U.S.	• new research questions • access to talent, study areas, and data	• concerns on data sharing	• more data openness from publishers and funding agencies
	China	• identification of emerging scientific issues with global relevance • exposure to new frontiers in science and technology		
	both	• testbeds for new ideas, methods, and technologies • international experience through visits and exchanges • student training and educational opportunities		• bilateral agreements and guidelines on data sharing and IP protection
private Sector	U.S.	• manufacturing capability • sizable market in China • Institutional support for R&D	• concerns on IP protectionism	• joint funding on priority areas with mutual benefits
	China	• entrepreneur and social organization • technological know-how • international perspectives	• mistrust due to	• strengthening bilateral exchanges
	both	• business opportunities	• misunderstanding	
government	both	• improving domestic innovation capability • speeding up technology development for public good • tax revenue • employment	• limited mechanism for joint effort with global impact	• new mechanisms for joint, global effort
public	both	• speeding up solutions in critical SDG areas • better public service and social welfare		

closer collaborations at both governmental and nongovernmental levels and sustained collaborations on science and technology, the U.S. and China can act together to help achieve the SDGs by utilizing complementary expertise and resources. Moreover, the two countries can champion sustainable development through their global reach in trade, investment, aid, technology diffusion, and programs of talent exchange.[3]

U.S−China collaborations have a long history. Since the 1979 U.S.−China Agreement on Cooperation in Science and Technology, joint collaborations between the countries have created many synergies and facilitated innovation for many key technologies. Such innovations in both technology and policy from the U.S. have been developed and deployed rapidly at scale in China, offering lower production costs, a market at scale, and a strong desire for implementation.[4] This in turn helps adoption of new technologies in the U.S. as well as globally, through demonstrated benefits and low costs as a result of large-scale production and use in China.[5]

Despite a solid foundation, the prospect of an enhanced and sustained U.S.−China collaboration on SDGs remains threatened by increasing competition between the two countries. The new U.S. Administration is, however, resetting the U.S.−China relationship, and both countries have clearly made mitigating climate change a top priority. The U.S. and China must continue cooperative leadership for fast action and new policy. This leadership role also demands effective engagement with other countries and stakeholders to accelerate the transition to a more sustainable planet. A sustainable planet is simply not achievable without the cooperation and leadership of the U.S. and China.

Despite the many mutual and global benefits toward a sustainable planet, barriers exist to prevent a continuous and expanding collaboration between the U.S. and China to develop and implement SDGs. Here we identify some of the key barriers and suggest solutions (Table 1):

- ***Concerns on data sharing***. Many collaborations are delayed or prevented due to data-sharing sensitivities and risks to intellectual property (IP) or national security. However, a large portion of research in SDG areas does not involve sensitive data. In many cases, a lack of clear guidelines leads to risk-averse decisions to not share data, thus stymying collaboration and limiting progress. We suggest that funding agencies from the U.S. and China should update and develop new bilateral guidelines and agreements on data sharing that apply to the SDG-related research they fund.
- ***Concerns on IP protectionism***. The U.S. and China should consider developing bilateral agreements and guidelines for IP rights on research and commercialization in SDG areas which are mutually beneficial. Such documents could include a list of jointly identified basic research areas that do not normally generate sensitive IP, such as understanding emissions and transport of air pollutants.
- ***Mistrust due to misunderstanding***. Increasing geopolitical competition has generated greater mistrust between the U.S. and China, but a great deal of this mistrust results from misunderstanding. To improve and enhance mutual understanding and trust in SDG areas, the U.S. and China should establish regular, high-level dialogue on sustainable development. For example, the U.S.−China Strategic

https://doi.org/10.1021/acs.est.0c08750
Environ. Sci. Technol. XXXX, XXX, XXX−XXX

and Economic Dialogue has played a critical role in strong collaborations between the two countries on a wide range of regional and global strategic and economic issues over the past decade. A U.S.−China Environment and Sustainability Dialogue could similarly function as a solid platform to build and enhance trust, engage a wide range of stakeholders working toward SDGs, and coordinate global efforts. Funding agencies should also seek opportunities to fund joint global research projects in SDG areas for the common good.

- ***Limited mechanisms for joint effort with global impact.*** Existing programs between the U.S. and China to support efforts toward SDGs have already been successful. For example, the joint funding mechanisms between the U.S. Department of Energy and China Ministry of Science and Technology on Clean Energy Research Centers (CERC), U.S. National Institutes of Health and Natural Science Foundation of China (NSFC) on health sciences, and U.S. National Science Foundation (NSF) and NSFC on environmental sustainability have supported U.S.−China teams for collaborative research. However, many of these programs rely on government funding, and may not be financially sustainable in the long term. In addition, these existing mechanisms support joint efforts that primarily benefit the two countries, and focus less on global impacts. New mechanisms are urgently needed to support new joint efforts with both mutual and global benefits in SDG areas. A new and exciting trend is that many philanthropic organizations and individuals have become greater financial contributors. Many governmental development agencies such as USAID now seek a convener role to coordinate and leverage nongovernmental support to maximize impact. Joining up development agencies from the U.S. and China to work together in this convener capacity would have even greater impact than each country working alone.

The opportunities for the planet's two largest economies to generate greater global good in the area of sustainable development are many, and much of the world is desperate for more assistance in meeting SDGs. There are many examples of effective collaboration between the U.S. and China, but further progress has become increasingly hampered by misunderstanding and mistrust. Scientific collaboration has traditionally been an effective means for increasing trust and collaboration, as well as for generating knowledge that benefits not only the U.S. and China, but the rest of the world as well. Climate change, public health crises, population growth, biodiversity loss, increasing water insecurity, and other challenges grow rapidly around the planet; the prospect of achieving the SDGs is further undermined by COVID-19. Nevertheless, the U.S. and China have an opportunity to work in tandem to benefit not only their own people, but the people of the entire world, toward more sustainable development. A sustainable future will simply not be possible without the engagement and leadership of the U.S. and China. Proactive efforts are urgently needed to seize this opportunity.

AUTHOR INFORMATION

Corresponding Authors

Glen T. Daigger − *Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Michigan 48109, United States*; Email: gdaigger@umich.edu

Jiuhui Qu − *School of Environment, Tsinghua University, Beijing 100084, China*; Email: jhqu@mail.tsinghua.edu.cn

Authors

Ming Xu − *School for Environment and Sustainability, University of Michigan, Ann Arbor, Michigan 48109-1041, United States; Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Michigan 48109, United States;* orcid.org/0000-0002-7106-8390

Chuanwu Xi − *Department of Environmental Health Sciences, School of Public Health, University of Michigan, Ann Arbor, Michigan 48109, United States*

Jianguo Liu − *Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan 48824-1312, United States*

Pedro J. Alvarez − *Department of Civil and Environmental Engineering, Rice University, Huston, Texas 77005, United States;* orcid.org/0000-0002-6725-7199

Pratim Biswas − *Department of Energy, Environmental and Chemical Engineering, Washington University in St. Louis, St. Louis, Missouri 63130, United States;* orcid.org/0000-0003-1104-3738

Yongsheng Chen − *School of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, Georgia 30332-0355, United States;* orcid.org/0000-0002-9519-2302

Dana Dolinoy − *Department of Environmental Health Sciences, School of Public Health, University of Michigan, Ann Arbor, Michigan 48109, United States*

Ying Fan − *School of Economics and Management, Beihang University, Beijing 100083, China*

Huaizhu Oliver Gao − *School of Civil and Environmental Engineering, Cornell University, Ithaca, New York 14853, United States;* orcid.org/0000-0002-7861-9634

Jiming Hao − *School of Environment, Tsinghua University, Beijing 100084, China*

Hong He − *Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*

Daniel M. Kammen − *Energy and Resources Group, University of California Berkeley, Berkeley, California 94720, United States;* orcid.org/0000-0003-2984-7777

Maria Carmen Lemos − *School for Environment and Sustainability, University of Michigan, Ann Arbor, Michigan 48109-1041, United States*

Fudong Liu − *Department of Civil, Environmental, and Construction Engineering, University of Central Florida, Orlando, Florida 32816-2368, United States;* orcid.org/0000-0001-8771-5938

Nancy G. Love − *Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Michigan 48109, United States;* orcid.org/0000-0002-9184-2451

Yonglong Lu − *Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*

Denise L. Mauzerall − *Department of Civil and Environmental Engineering and Woodrow Wilson School of Public and International Affairs, Princeton University, Princeton, New Jersey 08544, United States;* orcid.org/0000-0003-3479-1798

Shelie A. Miller − *School for Environment and Sustainability, University of Michigan, Ann Arbor, Michigan 48109-1041, United States; Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Michigan 48109, United States;* orcid.org/0000-0003-0379-3993

https://doi.org/10.1021/acs.est.0c08750
Environ. Sci. Technol. XXXX, XXX, XXX−XXX

Zhiyun Ouyang − *Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*
Jonathan T. Overpeck − *School for Environment and Sustainability, University of Michigan, Ann Arbor, Michigan 48109-1041, United States*
Wei Peng − *School of International Affairs and Department of Civil and Environmental Engineering, Pennsylvania State University, University Park, Pennsylvania 16802, United States;* orcid.org/0000-0002-1980-0759
Anu Ramaswami − *Department of Civil and Environmental Engineering, Princeton University, Princeton, New Jersey 08544, United States;* orcid.org/0000-0002-0476-2315
Zhiyong Ren − *Department of Civil and Environmental Engineering, Princeton University, Princeton, New Jersey 08544, United States;* orcid.org/0000-0001-7606-0331
Aijie Wang − *Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*
Brian Wu − *Ross School of Business, University of Michigan, Ann Arbor, Michigan 48109-1234, United States*
Ye Wu − *School of Environment, Tsinghua University, Beijing 100084, China;* orcid.org/0000-0002-9928-1177
Junfeng Zhang − *Nicholas School of the Environment, Duke University, Durham, North Carolina 27708, United States; Duke Kunshan University, Kunshan, Jiangsu 215316, China;* orcid.org/0000-0003-3759-6672
Chunmiao Zheng − *School of Environmental Science and Engineering, Southern University of Science and Technology, Shenzhen, Guangdong 518055, China;* orcid.org/0000-0001-5839-1305
Bing Zhu − *Department of Chemical Engineering and Institute for Circular Economy, Tsinghua University, Beijing 100084, China;* orcid.org/0000-0002-2890-7523
Tong Zhu − *College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China;* orcid.org/0000-0002-2752-7924
Wei-Qiang Chen − *Key Lab of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, Fujian 361021, China;* orcid.org/0000-0002-7686-2331
Gang Liu − *Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*
Shen Qu − *School of Management and Economics and Center for Energy & Environmental Policy Research, Beijing Institute of Technology, Beijing 100081, China*
Chunyan Wang − *School of Environment, Tsinghua University, Beijing 100084, China*
Yutao Wang − *Department of Environmental Science and Engineering, Fudan University, Shanghai 200438, China*
Xueying Yu − *School of Economics and Management, Beihang University, Beijing 100083, China*
Chao Zhang − *School of Economics and Management, Tongji University, Shanghai 200092, China*
Hongliang Zhang − *Department of Environmental Science and Engineering, Fudan University, Shanghai 200438, China;* orcid.org/0000-0002-1797-2311

Complete contact information is available at: https://pubs.acs.org/10.1021/acs.est.0c08750

Notes

The authors declare no competing financial interest.

Biographies

Glen T. Daigger, Ph.D., P.E., BCEE is currently Professor of Engineering Practice at the University of Michigan and President and Founder of One Water Solutions, LLC, a water engineering and innovation firm. He previously served as Senior Vice President and Chief Technology Officer for CH2M HILL (now Jacobs) where he was employed for 35 years, as well as Professor and Chair of Environmental Systems Engineering at Clemson University. He is author of more than 200 peer-reviewed papers, 5 books, several technical manuals, and 15 patents, and he has advised many of the major cites of the world, including New York, Los Angles, San Francisco, Detroit, Singapore, Hong Kong, Istanbul, and Beijing. Deeply involved in professional activities, he is Past President of the International Water Association (IWA). The recipient of numerous awards, including the Kappe, Freese, and Feng lectures and the Harrison Prescott Eddy, Morgan, and the Gascoigne Awards, and the Pohland Medal, he is a Distinguished Member of the American Society of Civil Engineers (ASCE), a Distinguished Fellow of IWA, and a Fellow of the Water Environment Federation (WEF). Dr. Daigger is also a member of the U.S. National Academy of Engineering and the Chinese Academy of Engineering.

Jiuhui Qu, Ph.D. is currently Distinguished Professor at Tsinghua University and Professor at Research Center for Eco-Environment Sciences of the Chinese Academy of Sciences. His research mainly covers water science, technology, and engineering applications, focusing on drinking water safety, water purification and energy conversion, water treatment process, and basin-wide water pollution control and ecological restoration. He is the Vice Chairman of All-China Environment Federation, Vice President of the Chinese Society for Environmental Sciences, Vice President of the China Environmental Protection Industry Association, and Vice President of the Global Water Partnership China. He serves as the Editor-in-Chief of Blue-Green Systems and Editor-in-Chief of Frontiers of Environmental Science & Engineering. Dr. Qu is a Distinguished Fellow of

https://doi.org/10.1021/acs.est.0c08750
Environ. Sci. Technol. XXXX, XXX, XXX−XXX

International Water Association (IWA), a member of the Chinese Academy of Engineering and a member of the U.S. National Academy of Engineering.

REFERENCES

(1) United Nations. (2019). The Sustainable Development Goals Report 2019. https://unstats.un.org/sdgs/report/2019/.
(2) Naidoo, R.; Fisher, B. Reset sustainable development goals for a pandemic world. *Nature* **2020**, *583*, 198−201.
(3) Miyamoto, M.; Takeuchi, K. Climate agreement and technology diffusion: Impact of the Kyoto Protocol on international patent applications for renewable energy technologies. *Energy Policy* **2019**, *129*, 1331−1338.
(4) Govindarajan, V.; Ramamurti, R. Reverse innovation, emerging markets, and global strategy. *Global Strategy Journal* **2011**, *1* (3−4), 191−205.
(5) Elia, A.; Kamidelivand, M.; Rogan, F.; Gallachóir, B. Ó. Impacts of innovation on renewable energy technology cost reductions. *Renewable and Sustainable Energy Reviews* **2020**, 110488.

https://doi.org/10.1021/acs.est.0c08750
Environ. Sci. Technol. XXXX, XXX, XXX−XXX