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Why is China Taking Action on Clean Energy and Climate Change?

What motivates China and other countries, and what are the implications for the U.S.?

KEY POINTS

- There is a strong evidence base that demonstrates that China sees important benefits in its shift toward a clean energy, low carbon economy.
- This issue brief examines five reasons for China's actions:
 - A higher priority for environment in development
 - Economic competitiveness
 - Energy security
 - Threats from climate change
 - An opportunity to assert leadership in the international community
- Both the actions and the drivers for those actions are relevant to the United States and other countries around the world as they consider policy choices in the clean energy and climate fields.

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OVERVIEW

For China, as for many other countries, concrete national interests underlie its pursuit of clean energy and climate goals. Particular circumstances may differ from country to country, but in fact many of these national interests, such as energy security, competitiveness, and sustainable development are universal. This Issue Brief is organized into two main sections. The first explores five key drivers behind China's tangible actions on clean energy and climate change and why these actions are likely to be sustained. The second section provides brief highlights of progress in other countries, showing the needs addressed and the benefits of action, and suggests that the United States and other countries can learn from each other the need for and the value of stronger action to make progress on clean energy and climate.

A misperception continues to exist that China is not taking significant action on clean energy and climate change.1 China has experienced extraordinary economic growth over the past three decades, lifting millions of its citizens out of poverty, growing its middle class, and rolling out infrastructure at an unprecedented scale. This growth has come at a cost, including serious impacts on health and the environment due to heavy reliance on coal. The country went through a period where coal consumption was rising rapidly, and although that rate is declining,2 coal will continue to feature in China's energy mix for the foreseeable future.³ As a result, China has become the world's largest greenhouse gas emitter and energy consumer. In recent years, however, China has recognized the need to change course and is developing policies to check its emissions and deploy more clean energy. It is now also the world's largest producer and installer of some renewable energy technologies,4 and invests more in renewables than any other nation.⁵ While Chinese leaders have increased attention to environmental concerns in its Five Year Plans of the past decade and produced tangible outcomes, beyond the Middle Kingdom it is sometimes suggested that China is stoking its growth engine without regard for environmental costs.

Some of China's top leaders have said that environmentally sustainable development is not a drag on the economy, but an opportunity to stimulate growth. They see it as a matter of self-interest to address the threats of climate change and to improve the quality of life in China through sustainable economic growth, and they are ramping up their efforts, outlined below. This ChinaFAQs issue brief seeks to

provide a deeper understanding of why China is pursuing meaningful climate and clean energy policies, what it is doing, the resulting benefits, and the implications to be drawn in favor of U.S. action on climate and clean energy. It identifies five key drivers of China's actions: 1) a higher priority for environment in development policy; 2) economic competitiveness; 3) energy security; 4) threats from climate change; and 5) an opportunity to assert leadership in the international community.

China's Actions: Policies and Achievements

Speaking after a cabinet meeting in 2009, China's then-Premier Wen Jiabao said "Controlling greenhouse gas emissions and adapting to climate change," would become "an important basis for setting the medium and long-term development strategies and plans of government at every level." Reportedly, current premier Li Keqiang also has been concerned about the environment.⁷ China's actions and accomplishments of the past few years, and new policies that are already guiding its future development, indicate that this is more than political rhetoric. In its recent planning periods, the Chinese government set ambitious goals for improving its energy situation and environmental and climate performance and has made significant progress. For example, China has instituted a national energy policy that includes measures to rein in emissions and promote clean technology. It has also set targets for deploying renewable energy, reducing the energyand carbon-intensity of its economy, and protecting environmental quality.

Fossil fuels are expected to remain an important part of China's energy mix for the near future, but cleaner forms of energy are gaining ground, bringing tangible benefits. The previous rapid rise in coal consumption is diminishing.8 Energy has fueled economic growth, and China is pursuing all available sources, but it is also taking steps to change the energy mix and to improve the efficiency of its use. China is expected to continue to use coal for some time. Faced with growing economic and social pressure, it has built the most advanced and efficient power plants in the world and is working on regulations and pilot programs to limit emissions and energy consumption.^{9,10} For example, the final data are still being tallied, but in the first three years of the 11th Five Year Plan (2006 – 2008), China saved an estimated 527 million tons coal equivalent through policies of

shutting down old plants and improving efficiency.¹¹ It is also currently piloting carbon emissions trading systems in select regions, with a goal of developing a national system after 2015.¹²

The country also continues to enjoy the fruits of policies that have spurred a rapid expansion of renewable energy industries and generating capacity. It now has more installed capacity in hydroelectricity and wind than any other nation, and a sizeable share of global markets.¹³ As a result of these and other current policies, demographic trends, and developmental progress, China's coal use is projected to peak around 2020, and, according to some projections, CO2 emissions could plateau around 2030.¹⁴

The Importance of Understanding Why China is Taking Action

With signs that China is entering a period of slower growth while demands from its citizens for continued development and quality of life improvement remain high, energy and climate concerns will have increasing importance in the policy decisions of its leaders. Desire to ensure security of energy supplies, reap economic benefits, be a responsible and respected global power, and protect public health and environmental quality all factor in the policy decisions Chinese leaders face as they strive to continue China's development. This issue brief examines these forces driving China's policies and progress on cleaner energy and climate change, and also the benefits China and other nations such as Germany, Australia, and India are all seeing as a result of pursuing their own strategies.¹⁵

The evidence that China is pursuing its clean energy and climate goals because this serves its own national interests helps demonstrate that China's actions are real and can be expected to endure. Understanding the drivers and the results of China's action also has important implications beyond China. Policies that make sense in one country may or may not be appropriate for the United States. However, common themes can be found in the drive for clean energy in various countries. Countries, including the U.S., can learn from each other the need for and value of stronger action on clean energy. Even where there are differences, there are opportunities to learn. The Chinese example is particularly noteworthy as the country has taken a

lead on the pursuit of clean energy in terms of the scale of its effort. Other countries, including the U.S., have their own special circumstances and therefore there is opportunity to learn from and leverage each other's strengths and experiences in order to achieve greater progress on climate and clean energy. Examples from China and other countries, and the implications for the U.S. will be covered below.

I. CHINA'S MOTIVATIONS FOR PURSUING A CLEAN ENERGY & CLIMATE STRATEGY

Background: Energy and Development in China

China's unique endowment of energy resources will invariably have an impact on its policy choices. Its development path of the past three decades has led to a number of serious environmental challenges, but leaders have also realized that the solutions to those challenges, namely clean energy alternatives, provide opportunities for further development and sustainable growth, and have begun to take advantage of those benefits.

Fossil fuels are important now, but problematic in the long term

Like many nations, fossil fuels dominate China's energy mix today. Coal provides China with 70% of its energy, and nearly 80% of its electricity.¹⁶ The nation possesses over 13 percent of the world's coal reserves, but if current production rates continue, it would run out in just 33 years.¹⁷ According to Kelly Sims Gallagher, Associate Professor of Energy and Environmental Policy at Tufts University, "China either needs to find alternatives to coal or bear the energy-security risks of becoming a massive coal importer."18 Natural gas use in China is increasing, but accounted for only 4% of total energy use in 2009.19 Although it is speculated that China has large reserves of unconventional gas,²⁰ its use faces challenges of technological capacity, infrastructure, regulatory hurdles, and competition from other energy sources, meaning a mature industry is still some time away.21 China's domestic oil reserves are relatively small, and it currently relies on imports from Africa and the Middle East to help satisfy rapidly increasing demand, driven in part by growing vehicle ownership among an expanding middle class.

This reliance on fossil fuels is causing many problems for China in terms of pollution, energy security, and climate change. The country is now the world's largest emitter of CO2, followed by the US, and together the two account for 43% of global emissions.22 At the same time, China considers itself among the countries most vulnerable to the negative effects of climate change. A white paper issued by the State Information Council stated that "weather and climate disasters have impacted China's economic and social development as well as people's lives and property in a large degree," with natural disasters affecting 430 million people and causing direct economic losses of roughly \$50 billion in 2011 alone.²³ Pollution-related protests from citizens are increasing in frequency and size.²⁴ Estimates of the annual costs of environmental degradation in China range from 3.5%25 to 9%26 of China's economic output.

Leading the world in renewables

Chinese leaders acknowledge that transitioning from fossil fuels to renewables will be part of the solution. China's renewable energy endowment is primarily in wind, solar PV, and hydropower, which together with geothermal, concentrated solar, and biomass resources, could potentially satisfy its entire domestic energy demand.27 At the end of 2011, China led the world in total installed generating capacity for renewables with 282 gigawatts (GW), including 62GW of wind, 3GW of solar, and 212GW of hydro,28 and the National Energy Administration announced in January 2013 that the country plans to add 49GW of renewable generating capacity by the end of the year, including 10GW of solar, 18GW of wind, and 21GW of hydro.29 Although there have been challenges integrating some new renewable capacity with the electrical grid, that situation is improving, and some analysts expect the percentage of idle wind capacity could fall to 10% in 2013, compared with 25% in 2011.30 Long-term government plans have set targets for 11.4% non-fossil energy with total

installed capacity reaching 21GW of solar, 100GW of wind, and 290GW for hydro in 2015. There are also targets to reach 15% non-fossil energy and for carbon intensity of the Chinese economy to drop 40-45% below 2005 levels by 2020.^{31,32}

Evolving development strategies

China's development priorities have also evolved over time. Environmental protection has been increasingly prominent in the past three Five Year Plans, with developments such as making environmental performance a criterion for promotion of government officials, elevating the agency for environmental protection to the rank of full Ministry, and promoting new laws governing renewable energy, efficiency, and emissions. The Party leadership began to express changes in its thinking about what development means when former President Hu Jintao first proposed the concept of fostering an "ecological civilization" at the 17th National Congress of the CPC in 2007.³⁹ There are signs that this line of reasoning will continue under China's new leadership. In November of 2012 at the beginning of the transition of power, China's 18th National Congress amended the Party constitution to emphasize the need to promote ecological progress for the first time.⁴⁰ The amendment stated that "promoting ecological progress is a long-term task of vital importance to the people's wellbeing and the Chinese nation's future."41 President Xi Jinping has advocated for strengthened adherence to the Constitution,⁴² and Premier Li Keqiang has long been a strong advocate for environmental protection and renewable energy.43

China has laid out fairly clear, long-term goals and policies supportive of cleaner energy development and improving the efficiency of its economy. When Hu Jintao came to power in 2002-2003, he began promoting the concept of "scientific development," which placed less emphasis on GDP growth as the goal of development, and more consideration for social- and sustainable

TABLE: RENEWABLE ENERGY RESOURCES IN CHINA

	RESOURCES ³³ (exploitable capacity)	INSTALLED CAPACITY ³⁴ (end 2011)	2013 CAPACITY ADDITION TARGETS35	2015 TOTAL INSTALLED CAPACITY TARGETS ³⁶
Hydro	402 GW	212 GW	+21 GW	290 GW
Wind	2750 GW	48 GW (on grid)	+18 GW	100 GW
Solar	2200 GW	3 GW	+10 GW	>21 GW (35 GW) ³⁷
Bio-energy	280 Mtoe	7 GW		13 GW ³⁸

development.44 One outgrowth of this thinking is the Renewable Energy Law, established in 2005 and revised in 2009, which "created four mechanisms to promote renewable energy: (1) a national renewable energy target; (2) a mandatory connection and purchase policy; (3) a feed-in tariff system; and (4) a cost-sharing mechanism, including a fund for renewable energy development."45 In 2011, the National Development and Reform Commission (NDRC), the main economic planning organ of the government, announced the 12th Five Year Plan, which continued the official pursuit of "scientific development" to accelerate economic growth. The Plan set targets to reduce the energy-intensity and carbon-intensity of the economy by 16% and 17% respectively and for the nonfossil fuel share of the energy mix to grow to 11.4% by 2015 on the path to 15% by 2020, and called for transition away from an energy-intensive export economy toward a more service- and innovation-oriented economy through "economic rebalancing."46

China's leaders acknowledge the country's dependence on carbon for energy is a problem. A high-level policy document issued by the State Council in October of 2012, "China's Energy Policy 2012", called for addressing present low energy efficiency, limited resources, energy security, and increasing environmental pressures. It states that these challenges are a result of international energy competition, China's level of development, and the country's "irrational industrial structure and energy mix" and "sluggish reform of relevant systems and mechanisms." It notes that while "fossil energy resources have been exploited on a large scale, causing a certain amount of damage to the eco-environment," these energy sources must feature prominently in China's energy supply for the foreseeable future, but "a more environmentally friendly energy mix is urgently needed."47

Progress on renewables and energy targets

China has been making progress on environmental issues over the past decade. For most of the late 20th century, the energy intensity of China's economy (EI, or amount of energy needed to produce a unit of GDP) gradually improved. But a sudden reversal of this trend during the 10th Five Year Plan (2000-2005) prompted China to enact policies to ensure a return to improvement.⁴⁸ As a result of these policies, China improved the energy intensity of its economy by nearly 20% during its 11th Five Year Plan (2006-2010),⁴⁹ saving the equivalent

of over half a billion tons of coal in just the first three years.⁵⁰ The 12th Five Year Plan (2011-2015) set a goal of further improving EI by 16%, and added an additional target to improve carbon intensity (CI, or CO2 emissions embodied in a unit of GDP) by 17%. With a 3.5% reduction in CI in 2012, China is making progress towards meeting this goal,⁵¹ and in mid-2012, the State Council announced a major investment of \$372 billion in further pursuit of these targets.⁵² These examples show how China's leadership can mobilize policy to address pressing environmental problems and achieve results.

The country is now a leading global manufacturer of wind, solar, hydro, and biomass power technologies and solar hot water heaters, and it is at the forefront of developing advanced coal combustion and carbon capture, utilization and storage (CCUS) technologies.⁵³ It invested \$52 billion in renewables in 2011, more than any other nation and 20% of the global total.⁵⁴ And it is not slowing down. In 2012 it invested \$67.7 billion in renewables, 50% more than the U.S., even while global investment fell by 11%.⁵⁵ And it remained one of the most attractive markets for investment at the end of 2012, ahead of Germany and the U.S.⁵⁶

China is clearly taking action, but why? The remainder of this issue brief identifies five key drivers of China's clean energy policies and actions, notes how these drivers are not unique to China and are also motivating other nations, and explains what the implications of this global pressure for cleaner development are for the U.S.

Our people ... expect better education, more stable jobs, better income, more reliable social security, medical care of a higher standard, more comfortable living conditions, and a more beautiful environment.

Driver 1: A Broader Notion of Development

Economic rebalancing

China has experienced rapid prosperity gains since it opened up to the global economy in 1978, roughly doubling the size of its economy every 7 years since then58 and lifting hundreds of millions of its citizens out of poverty in the process.⁵⁹ Much of this growth has come from encouraging heavy manufacturing and exports, as many have referred to the nation as "the world's factory." Energy from fossil fuels has underpinned this growth, with detrimental effects on the environment (as was also the case in the industrial revolutions in the U.S. and the U.K.). However, since late 2004, leaders have come to recognize this model as unsustainable, and have advocated shifting the economy from heavy manufacturing toward services, and strengthening domestic consumption over investment in order to drive more sustainable economic growth.60 This rebalancing is unlikely to be easy, but it may already be underway. Although consumption's share of GDP is still unusually low, it is growing and has contributed over half of China's growth since 2011.61 This effort to rebalance the economy includes a focus on encouraging innovation and industries further along the value chain. The 12th Five Year Plan, as with earlier plans, stresses the importance of "building a resource-saving and environment-friendly society" in transforming the economy, and identifies seven new key "strategic emerging industries" (SEIs) in areas such as new energy sources, advanced transportation, and environmental protection technologies as the drivers of this transition.⁶² Five of these industries relate to clean energy and energy efficiency (see Driver 3: Economic Competitiveness for more details on China's SEIs).

Shifting China's economy toward these industries will not only provide more higher-wage jobs for the country's growing educated middle class (official Chinese statistics show 500,000 new engineering, science, math and IT graduates entered the workforce in 2010).63 It can also deliver many co-benefits in improved environmental quality and reduced healthcare expenditures due to the lower energy-intensity of many of these industries themselves, and due to environmental improvements if these technologies are deployed domestically. One MIT study found that particulate matter pollution in China caused \$112 Billion in health-related costs, and 656,000 premature deaths in 2005.64 Air and water pollution as well as overuse of chemical fertilizers and pesticides cause an estimated 400,000 deaths in China each year,65 and the public is increasingly vocal about demanding a solution. China noted in its Second National Assessment Report on Climate Change that food production also faces threats from sea level rise in eastern rice-growing regions and from severe droughts in the northern wheat belt by 2050.66

Rising Public Demand

CONGRESS⁷³

This new concept of development has tangible benefits beyond economic planning. Better quality of air, water, food, environment, and economic growth all add up to one thing: better quality of life, which China's citizens are increasingly demanding. The Chinese leadership's plans to reduce poverty and increase quality of life for all citizens are driving up energy demand.⁶⁷ But satisfying this demand with coal and other highly-polluting energy sources, and focusing on highly polluting energy-intensive industries has generated another growing problem-"mass incidents" of environmental protest from local citizens.68 "The number of environmental protests has increased by an average of 29% every year since 1996, while in 2011 the number of major environmental incidents rose 120%," according to Yang Zhaofei, vice-chair of the Chinese Society for Environmental Sciences.⁶⁹ The air pollution crisis in many eastern Chinese cities in 2013 shows how critical the situation has become, with Premier Li Keqiang

Faced with increasing resource constraints, severe environmental pollution and a deteriorating ecosystem, we must raise our ecological awareness of the need to respect, accommodate to and protect nature.

— PRESIDENT HU JINTAO, REPORT TO THE 18TH PARTY

promising decisive central government action following intense public outcry.⁷⁰

China's leaders are listening; to many of them, economic, energy, and environmental security also add up to job security. China has put increasing pressure on its officials over environmental concerns, tying career advancement to environmental performance since the 11th FYP. Not only does this provide motivation for local officials to improve environmental performance, it is also macro-level policy for increasing political legitimacy of the Chinese Communist Party.⁷¹ The central government has been releasing more environmental data in some areas, and it remains to be seen whether this improved transparency will lead to greater action and results.⁷²

Driver 2: Economic Competitiveness

A Growing Market

China's leaders are focused on delivering economic growth and improving quality of life for citizens. They understand that global and domestic markets for clean energy and environmental goods and services will continue to grow in the coming years, and they see that as an opportunity to deliver that growth. While public opinion in some countries sees clean energy as a costly drag on economic growth, China's leadership recognizes that these two goals are not mutually exclusive, and they continue to develop policies to help maintain China's position as a major global player. China's former Premier Wen Jiabao, speaking at a forum on sustainable development, said that "greening-of the economy is not a burden on growth; rather, it is an engine that drives growth and an effective means to achieve sustainable development."74 Premier Li Keqiang also noted that "it is estimated that the output of green sectors – pollution treatment and energy saving – can exceed 10 billion Yuan (\$1.58 billion) during the 12th Five-Year Plan (2011-2015) period."75 In fact, Li and others also see these industries as ones where China can compete toeto-toe with the developed world.76

The success of China's wind industry validates this viewpoint. The government very deliberately set out to create a national wind industry consisting of Chinese-owned firms and technologies. The origins of this campaign can be traced back to policy support for science and technology initiatives (including energy, specifically) in the early 1980s. Since then, emphasis has shifted from importing foreign technology to domestic innovation as

STRATEGIC EMERGING INDUSTRIES (SEIS) OF THE 12TH FIVE YEAR PLAN

Industries with implications for energy and climate:

- Energy Conservation and Environmental Protection
- High-end equipment manufacturing including high-speed rail and urban traffic equipment
- New Energy including nuclear, solar, biomass, smart grid, and wind
- New Materials including rare earths, superconductors, and nanomaterials for energy applications
- Advanced Automobiles including large-scale commercialization of electric and hybrid vehicles

Other Industries:

- New Generation IT Industry including next generation networks, software, and information services
- Biological Industry including genetics, pharmaceuticals, bio medical engineering

a strategy to spur enterprise growth, with major policy support specifically for wind beginning in the mid-1990s and intensifying through the 2000s. The result of this farsighted effort brought China's wind power industry from close to zero to a global leader in a little over a decade.⁷⁷ China did encounter difficulty in maintaining the pace of grid connections for domestically installed capacity, but as discussed above, has made progress in addressing that challenge.⁷⁸

Some analysts forecast the size of the global market for low carbon technology will double or even triple by 2020, to between \$1.5 and \$2.7 trillion annually. In clean energy technology investment alone, China could attract a cumulative \$620 billion, and the US up to \$342 billion between 2010 and 2020. China had about 1.6 million jobs in renewable energy industries in 2011. It created nearly 10,000 jobs in solar and 40,000 jobs in wind annually from 2006-2010, and the wind sector alone could create 34,000 jobs annually between 2011 and 2020. A UNEP report projected that globally there could be 8.4 million jobs in solar PV and wind energy, and 12 million jobs in biofuels by 2030. Seizing a share of these benefits is a critical component of China's plans for future development.

Seeking to take advantage of the economic opportunity this burgeoning market offers, the 12th Five Year Plan outlines a strategy of restructuring the Chinese economy

away from heavy industry exports, and toward services and innovation. The Plan identified seven key "new strategic emerging industries," (SEIs) five of which directly relate to clean energy and energy efficiency (see box). The State Council of the PRC has noted that these knowledge and technology intensive industries have "huge growth potential" and are key to promoting sustainable development and modernization of the country. "Accelerating the fostering and development of strategic emerging industries is an urgent demand for building new advantages in international competition and getting an upper hand in development."84 The Plan aims to grow these industries' share of the economy from 1% at present, to 8% by 2015 and 15% by 2020, 85 aided by policies driving RMB10 trillion (USD 1.6 trillion) worth of foreign and domestic investment into these industries by the end of the 12th Plan. 86 Government support for "scientific progress and innovation" will also help drive this transition.87 The 12th FYP has a target for R&D expenditure to account for 2.2% of GDP.88

China is pursuing not only its own domestic market, but also investments in clean energy abroad,89 and in joint ventures with global partners. Chinese firms invested \$264 million in the US clean energy sector in 2011, with an annual growth rate of 130 percent over the previous two years.90 Chinese company investment in projects in the U.S., such as Goldwind's 110MW wind farm in Illinois, contributed to the U.S. economy by procuring components manufactured in the U.S. by producers Broadwind, Timken, and LM Windpower, creating over 400 jobs.⁹¹ Joint efforts allow countries to pool resources and leverage comparative advantages to make progress more quickly than they would alone. For example, the U.S.-China Clean Energy Research Center (CERC) gathers national teams from government labs, universities and the private sector to work together on technology advancement in clean coal, electric vehicles, and building efficiency. Already this effort has generated an innovative technology management plan that is helping ease private sector concerns over intellectual property, as well as spurring real technology advancements.92 More can be done to encourage Chinese investment in American clean energy,93 and the recent trend of increasing overall Chinese FDI in the US has the potential to strengthen bilateral relations.94

Driver 3: Energy Security

Growth of Domestic Demand and International Competition for Resources

As China continues to modernize and more citizens move into cities,95 building more infrastructure and providing more of the goods associated with modern lifestyles requires increasing amounts of energy. The IEA projects China's energy demand will rise by 60% between 2010 and 2035, contributing roughly half of global demand growth for coal and oil, and over a quarter for natural gas.⁹⁶ Much of China's growing energy demand is being filled by rising oil imports from Africa and the Middle East, coal imports from Australia, Indonesia, and the U.S., and gas imports from Central Asia, Australia and others. Formerly a net exporter of oil and coal, China became a net importer of oil in the early 1990s,⁹⁷ and a net importer of coal in 2009.98 As China's oil imports grow, according to Mikkal Herberg with the National Bureau of Asian Research, "China will increasingly be deeply dependent on the stability of the global oil market."99 This growing dependency on foreign energy is a strategic concern among China's leaders.100

While China currently derives almost 90% of its energy from fossil fuels, there are problems with accessing its vast domestic coal and gas resources, causing it to increasingly rely on foreign imports.¹⁰¹ Domestic coal production is also increasingly hindered by transportation bottlenecks. 102,103 Electricity prices have remained predetermined by the government while coal prices have risen, which has resulted in many electricity producers losing money from coal generation since 2011.104 This combined with weaker energy demand growth due to the economic slowdown has led to development of new coal power trailing off, and may be providing some incentive for a move toward renewables.¹⁰⁵ Although some view natural gas as a possible bridge to clean energy, 106 generating less pollution per unit of energy than coal,107 China is currently a net importer and its consumption is growing. And while it has identified potentially large unconventional gas resources, possibly 50 percent larger than U.S. resources, 108 there are barriers to large-scale production in the near-term.¹⁰⁹ Now the world's second largest oil importer, foreign sources now account for over half of Chinese consumption, and are expected to rise to meet 75% of consumption by 2035.110

Many of China's leaders appear to understand that developing non-fossil energy is an opportunity to address these energy security concerns.¹¹¹ Increasing the use of clean energy and improved efficiency will reduce China's foreign energy dependence and help improve reliability of its domestic supply. There are also co-benefits from this approach. Clean energy technologies "promise to create new, incremental supplies to respond to their growing fears over their basic ability to provide enough energy to meet booming energy demand while also reducing air pollution from China's heavily coal-based economy," according to Herberg.¹¹²

Driver 4: Climate Change

Compounding the previous three drivers are the threats posed by climate change. Chinese scientists are documenting and projecting the current and future impacts of climate change. Many of China's leaders are increasingly acknowledging that climate change is real, that it is being driven in part by anthropogenic emissions of greenhouse gases, and that it poses a significant threat to the country's long-term prosperity in terms of already observable droughts, declining crop yields, damage from rising sea levels, floods, and increased extreme weather events.^{113,114,115}

China's leaders have been concerned about the potential impact of climate change on agricultural production for many years. The first national report on climate change in 2006 projected that yields of rice, corn and wheat could fall as much as 37% within a few decades as a result of climate change.¹¹⁷ The IPCC's 4th Assessment Report issued in 2007 was also important in convincing China's leaders of the extent of the risk of climate change; at least 10% of the report's co-authors were Chinese, some of whom held senior positions in both the IPCC and the Chinese government. The report found an increase in the frequency of heat waves, extreme rains, and floods, and a decrease in the ice mass in the Himalayas, and severe degradation of wetlands and other ecosystems in most river delta regions from warmer climate, less precipitation, and droughts.¹¹⁸ Other studies since then have found that a third of China's 18,000 km coastline is "highly vulnerable" or "very highly vulnerable" to sea level rise as a result of climate change, and 90% is "moderately vulnerable" or worse. China's coastal zone hosts 42% of the country's total population and produces 51% of GDP.119

Since 2008, the NDRC has issued an annual white paper, "China's Policies and Actions for Addressing Climate Change,"

outlining the latest scope of the climate problem, current measures being taken, and recent progress on adaptation in the areas of agriculture, forestry, water, and public health, among others. These documents note that climate change has caused increasing instability in China's agricultural production, and shifted boundaries of forestry resources, which has been accompanied by rising frequency of plant and animal diseases and destructive insect outbreaks, and recession of glaciers that will eventually intensify water scarcity. Water resources have also shifted as a result of changing climate, with reduced flow in northern rivers, and increased frequency of flooding and droughts.¹²⁰

To address some of these risks, China is undertaking both mitigation and adaptation efforts. Many of the mitigation efforts such as economic rebalancing and targets for improving efficiency and promoting renewable energy have already been discussed. On adaptation, China is developing large-scale irrigation infrastructure, watersaving technologies, and improved crop strains to support agriculture. Governments at all levels are expanding nature reserves and programs for forest and wetland management, fire, and pest control. The Ministry of Public Health has also implemented improved drinking water quality monitoring programs and improved systems for reporting, prevention, and control of infectious diseases, particularly those closely related to climate change.¹²¹

By its own official estimates, China ascribed \$50 billion in direct economic losses to natural disasters in 2011. One independent study that focuses on climate impacts estimates that the negative effects of climate change cost China over \$71 billion in 2010, and that figure could increase over tenfold to nearly \$748 billion per year by 2030 if no action is taken. In addition to direct savings of \$65 billion per year in 2030 from measures to reduce the use of fossil fuels— such as deploying energy-efficient lighting and improving vehicle engine and building efficiency— China could avoid \$20 billion per year in health-related costs associated with the avoided pollution.

The same energy system that is contributing to climate change is also aggravating water stress. Coal-fired power accounts for 60% of industrial water demand in China, yet the country faces a water shortage of 40 billion m³ per year,¹25 and has seen its fresh water reserves decline by 35 billion m³ each year for the past decade.¹26 If these threats are allowed to escalate, rising incidence of tropical diseases and environmental refugees are expected to contribute to declines in livelihoods and increased

unrest.¹²⁷ Conflicts over transnational water resources originating in the Tibetan Plateau and the potential for related unrest in the region could affect political stability, and shifting water resources could impact international markets for agricultural commodities (i.e. lower crop yields causing global food prices to rise) and energy (i.e. reduced hydroelectric production leading to increased reliance on and international competition for fossil fuels).¹²⁸

Driver 5: International Challenges and Opportunities

It is evident from China's growing participation in a wide array of multilateral institutions and fora in recent years that it would like to be viewed internationally as a responsible leader, and allay fears that its development poses a threat to international order.¹²⁹ In the near term, experts expect China's leaders to focus on pressing domestic issues such as its economic rebalancing effort,¹³⁰ and to seek to avoid international conflicts that could divert resources from delivering on their promise of continued economic development and growing prosperity for Chinese citizens.

The UNFCCC international climate change negotiations may be one such example where China might feel some motivation to act on clean energy and climate goals. In a speech before the United Nations delivered before the start of the 2009 Copenhagen climate negotiations, President Hu Jintao stated, "out of a sense of responsibility to its own people and people across the world, China has taken and will continue to take determined and practical steps to tackle this challenge."¹³¹ On the other hand, perceived difficulties in getting the Chinese to sign on to certain aspects of an international climate agreement such as legally binding emissions reduction targets may result from its reticence to agree to targets that it feels it may be unable to meet, putting itself at risk for economic or diplomatic sanctions.¹³²

China also desires to be seen as a leader among developing nations, and an upholder of multilateralism in general. It has shown support for "South-South" alliances through the G77 and in the UNFCCC, but has walked a delicate line on supporting policies that may not serve its own direct interests.¹³³ At the climate negotiations in Durban in 2011, for example, China was careful to express its support for South-South cooperation outside of the official climate negotiations. One reason for this was that it was reluctant to be a donor to the Green Climate Fund, as is expected of

OPPORTUNITIES AND CHALLENGES FOR CO-OPERATION BETWEEN THE U.S. AND CHINA

In addition to its own action on clean energy, China has engaged in cooperation with the U.S. The U.S. and China have enjoyed a long history of cooperation on science and technology, dating back to China reopening to the world economy in the early 1980s. More recently, several joint initiatives on low-carbon energy established in 2009 are beginning to bear fruit. For example, The U.S.-China Clean Energy Research Center (CERC) collaborations on advanced coal, electric vehicles, and energy efficient buildings have resulted in technological advancements and a framework agreement for intellectual property protection. The U.S.-China Renewable Energy Partnership (USCREP) is a ten-year package of cooperative clean energy research programs on wind and solar energy, biofuels, renewable grid integration, standards and testing, and policy and planning. One example of success paired a U.S. wind speed monitoring equipment manufacturer with Chinese wind farm researchers to test new equipment and gain valuable data. Through the U.S.-China Energy Cooperation Program (ECP) environmental engineering company LP Amina partnered with Chinese utilities to demonstrate a new technology that improves efficiency and reduces pollution at coal-fired power plants. The component is being manufactured in Michigan, Ohio, and West Virginia for buyers in the U.S., China and around the globe.¹³⁹ But more such initiatives could be implemented to sow even greater benefits.140

Kenneth Lieberthal of the Brookings Institution cautions that as China's new leaders devote more attention to domestic issues, collaboration rather than provocation from the U.S. could be the more productive course: "climate change efforts could conceivably become a positive bridge between the new Chinese leadership and the new American administration," he says, "but this area could also play the other way." The good news is that China's leaders are open to cooperation. "Our two countries have areas where interests intersect and these areas can expand continuously," according to China's Premier Li Keqiang, who says he believes "there is unlimited room for expanding these areas." China is also eager to invest in foreign clean tech markets, including in the U.S., and clearer policy would encourage such investment and the accompanying jobs benefitting the U.S. economy.

Challenges involving U.S.-China trade in renewable energy technology exist. Trade complaints have been raised on all sides over subsidies, dumping, tariffs, standards, local content requirements, and policies for public procurement. There is a

OPPORTUNITIES AND CHALLENGES (CONTINUED)

complex debate over whether and to what extent various practices promote or hinder cleaner, cheaper energy in both countries.¹⁴⁴ It is beyond the scope of this paper to provide an analysis of each case, but some of these issues are being addressed through trade laws, institutions, and bilateral consultations. Some have resulted in tariffs being imposed, while others have been settled before reaching that point.¹⁴⁵ There is hope that some of these issues can be resolved and mutually-beneficial agreements facilitating trade in environmental goods and services can be reached. For example, in late 2011, members of the Asia-Pacific Economic Cooperation (APEC) forum agreed to cap tariffs on a list of green goods at 5 percent or less by 2015.¹⁴⁶ In another example, in 2011 China agreed to end subsidies to Chinese wind turbine manufacturers that favored locally produced components over foreign suppliers after the U.S. brought a complaint to the WTO.¹⁴⁷

Also, protection of intellectual property (IP) is an important issue affecting collaboration. Protecting IP remains a priority for the U.S. Trade Representative's enforcement efforts. Many U.S. companies see value in investing in China's clean energy market and are engaging, 149 but hesitancy over IP concerns has put a damper on realizing the full economic potential of the market, and the potential for clean technologies to improve environmental quality and climate protection. This is not only a problem for foreign companies; as Chinese clean energy firms devote more resources to R&D and overseas investment, a growing number of them are also calling for stronger IP protection at home, which could provide impetus for improvement in the handling of these issues through China's domestic legal process. 150 Progress has been made in some areas, such as the CERC framework agreement to begin to address the IP concerns of corporate partners.¹⁵¹ Much work remains to be done to resolve the issue, however. 152

With respect to both of these important concerns over IP protection and trade disputes, it is also worth noting that in the realm of low-carbon, many of the tools and technologies necessary to reduce emissions and adapt to a changing climate are low-cost and not protected by patents, meaning there is opportunity for climate progress not dependent on cutting-edge technology.¹⁵³ Barriers to trade and investment are not unique to China. Chinese firms are also eager to invest in foreign clean tech markets, including in the U.S., but uncertainty over national security reviews, availability of financing options due to political reasons, and a playing field made uneven by fossil fuel subsidies give these firms pause. A clearer policy framework in the U.S. encouraging such investment could bring capital and jobs benefitting the U.S. economy.¹⁵⁴

developed countries. Nevertheless, NDRC Vice-Minister Xie Zhenhua also announced four major areas of Chinese investment in South-South collaboration and highlighted other collaborative efforts with developing nations under the 11th and 12th Five Year Plans. 134

China has undeniably benefited from its clean tech and climate policies. It has attracted high levels of investment due to its clear long-term policy environment, and has grown employment in clean tech industries as a result. It has also made advances on its climate and energy goals. Based on energy consumption data from 2011, China has made swifter progress toward its energy intensity reduction target in the first year of the 12th Five Year Plan than it did in the first year of the previous Plan. Renewables and nuclear power accounted for almost all growth in electricity generation in 2012, while the share of all electricity generated by renewables rose to 19.4%. As mentioned above, peaks in emissions and use of fossil fuels may be in sight.

While challenges persist, there are some promising signs for future progress. The once-a-decade leadership transition that occurred from November 2012 to March 2013 saw Xi Jinping and Li Keqiang assume leadership of China's government. Li has been working to support the appointment of key officials to positions to guide China through the remainder of its 12th Five-Year Plan and reportedly to take long-term, low-carbon growth seriously. 137

II. BEYOND CHINA— THE BENEFITS OF AND NEED FOR CLEAN ENERGY AND CLIMATE STRATEGY

China can be expected to continue to pursue its clean energy and climate goals and policies because, as discussed in the preceding section, it serves its own economic, environmental, security, political, and developmental interests to do so. Circumstances differ from country to country, but countries like Germany, India, and Australia are also pursuing sustainability goals and policies out of similar self-interest. We use these three countries as examples because they are all taking significant steps, and illustrate a variety of circumstances from a very advanced industrial economy like Germany, to a developing country like India facing serious economic challenges such as overcoming significant poverty, and Australia, a country with large fossil fuel resources that is nevertheless promoting clean energy by placing a price on carbon.

A review of China's experience and highlights from other countries shows the need for and value of stronger action on clean energy and climate. These countries, including the U.S., can learn from each other in this regard and work individually and collectively to achieve the benefits. The aim of this section is not to provide a detailed discussion of climate and energy policies in the U.S. and other countries. Rather, it is to show that the U.S. has interests similar to those of China and other countries with respect to economic competitiveness, energy security, and environmental improvement that call for a shift to low carbon energy, and that the U.S. could be doing more to capture these benefits.

There are many benefits from pursuing clean energy and climate protection. Replacing fossil-fuels with renewable energy sources, and capturing and sequestering carbon from combustion has the potential to dramatically reduce emissions of environmental pollutants, improving air quality and human and environmental health, and mitigating the threats of climate change. Development, production and deployment of clean power technologies can generate profits for corporations and jobs for individuals. Relying on domestic sources of energy instead of foreign imports also benefits energy security. Countries around the world, developed and developing, understand these benefits, and they are acting accordingly.

International Examples

Like China, Germany has set clear targets for renewable energy deployment and instituted supportive policies that have led it to achieve much success over the past two decades.¹⁵⁵ This effort, called the "Energiewende" or "energy transformation," was intensified in the wake of the 2011 Fukushima nuclear disaster, as the nation seeks to transition away from nuclear and fossil fuels to renewables. The goals of the transition are familiar: to fight climate change, reduce energy imports and strengthen energy security, stimulate technology innovation and the green economy, and strengthen local economies.¹⁵⁶ Germany relies on its strengths of innovation and world-class academic institutions, and it has also provided long-term policy stability supporting renewable electricity. In the view of the German government, their policies have "sparked considerable innovation in the renewable energy industry. Longterm investment security made the creation of in-house research and development departments possible for many companies, enabling important technological progress, which has made renewable electricity generation more efficient and more cost-effective."157 As a result, in 2011, Germany generated more than 20% of its electricity from renewables,158 and had 372,000 jobs in renewable energy.159 Germany also realizes the benefits of cooperation with China in cleantech, signing more than a dozen cooperative research agreements in energy, biotech, environment, and ocean research in 2012,160 and as a market opportunity for its companies that are experiencing slowdowns in western markets.¹⁶¹

In Australia, a nation with abundant fossil fuel resources, wind energy is now cheaper than electricity produced from burning coal or gas, due to a combination of the country's carbon pricing policy and falling costs for new wind installations.162 As a result, the country expects to generate half its electricity from renewables by 2050.163 Australia's Renewable Energy Target (RET) policy has delivered USD \$19.2 billion in investment while lowering wholesale electricity prices by as much as USD \$10.4/MWh between 2001 and 2012, and is expected to deliver roughly that amount of benefit again by 2030. By mandating that utilities purchase new renewable energy generation, the RET has encouraged greater deployment of renewables (primarily wind generation and small-scale solar water heating and PV systems) over a wider area of the country, while reducing overall demand for electricity and gas and

improving transmission efficiency.164

Pursuit of renewables outside China is not confined to developed countries. India, even though 400 million of its citizens still lack electricity, has pledged to reduce the energy intensity of its economy and has instituted a National Action Plan on Climate Change with a goal of 15% electricity consumption coming from renewables by 2020. It has taken these steps because it wants to use clean energy as a solution to support economic growth, build its position as a leader on the global stage, and avoid the damaging impacts of climate change. 165 Some of India's policies encouraging renewables include feed-in tariffs, capital subsidies, renewable portfolio standards, and generation based incentives. The country is the birthplace of Suzlon, one of the world's largest wind power companies with 8.4% of global market share in 2012.167

Implications for the United States

Economic Benefits

The U.S. could be foregoing many of the economic benefits of stronger steps on clean energy and climate goals in terms of jobs, sustainable energy security, improvements in public health, and avoidance of damaging climate impacts. Some studies show that it could miss out on cumulative investments totaling \$97 billion by maintaining the status quo instead of pursuing more aggressive clean energy policies between 2010 and 2020.¹⁷¹ According to a study by the Pew Charitable Trusts, policy uncertainty is keeping lowcarbon capital sidelined or even sending it abroad. 172 The U.S. is also already experiencing what the negative consequences and costs of inaction on climate will be like. Evidence is mounting linking human-induced warming to increasing frequency and/or intensity of devastating severe weather events such as 2012's Hurricane Sandy and Midwestern drought, which together caused \$100 billion in damages.273

A major concern regarding current U.S. policy is failure to attain full U.S. competitive potential. In 2010, the President's Council of Advisors on Science and Technology gave "economic competitiveness" as the top reason for developing an integrated Federal energy policy to help accelerate the pace of energy technology innovation. The U.S. has several key strengths that, if properly leveraged, could enable it to succeed in global

clean energy markets.¹⁷⁵ For example, the U.S. is home to some of the world's best institutions for technological innovation- top universities, a robust national laboratory system, and clusters of private innovation such as Silicon Valley. It also attracts the largest share of venture capital in the world,¹⁷⁶ but the lack of a clear and comprehensive long-term energy policy capitalizing on these strengths sends mixed signals to potential investors, and limits progress.¹⁷⁷

Other nations are acting, and the U.S. risks being left behind. According to Joanna Lewis, a professor at Georgetown University's Edmund A. Walsh School of Foreign Service "the United States is falling behind other countries like China in terms of the scale to which it's deploying renewable energy in the last few years."178 Analysts have consistently ranked China as the most attractive location for investment in renewable energy for the past few years, after unseating the U.S. in 2010.¹⁷⁹ Although the U.S. had a \$1.6 billion trade surplus with China in solar, wind and energysmart technologies (i.e. equipment for LEDs, Electric Vehicles, batteries, etc.) in 2011,180 whether that surplus will be maintained in 2012 and in the future is less clear. Foreign investors are already stepping into U.S. renewable energy markets while U.S. companies struggle to find the necessary capital, with Chinese investment growing 130% in 2011.181 This foreign investment can be beneficial because it creates jobs¹⁸² and tax revenues in the U.S., but it may also threaten U.S. leadership in these industries. 183 In order to maintain its competitiveness in clean technology, the U.S. must both reduce policy uncertainty for investors and increase its domestic demand for clean tech. 184 Even U.S. companies investing abroad can be a positive in terms of bringing benefits back home. According to a 2008 study, companies increasing investment abroad also invest more and hire more domestically.185

Energy Security and National Security

It is sometimes said that the U.S., with the world's largest coal reserves and newly-accessible large unconventional oil and gas reserves, could choose to be fully self-sufficient in energy from those resources alone. However, as in China, serious problems of pollution and climate change come with this approach. In addition, transportation accounts for a large portion of U.S. energy consumption (28%) and is primarily fueled by oil. Because the market for oil is global, disruptions

in supply on the other side of the world can still cause large price fluctuations in the U.S. ¹⁸⁸ While shale gas has reshaped the U.S. energy picture in recent years, reducing demand for dirtier coal and contributing to the country's declining carbon emissions, ¹⁸⁹ it still produces CO2, meaning it is not the answer to long term energy and climate problems. ¹⁹⁰ Utilizing shale gas also raises concerns of fugitive emissions, on-the-ground impacts to water and air quality, land use, communities, and ecosystems, in addition to broader implications for energy and global warming. ¹⁹¹

Shifting away from fossil fuels toward renewable energy and electric vehicles can improve energy security. The U.S. has some of the world's best wind power resources throughout the country, in addition to excellent solar potential in the Southwest. By developing even a small fraction of its estimated 117,000 GW of solar and 10,000 GW of wind resources, the U.S. could go a long way to replacing the 318 GW of coal and 415 GW of natural gas generation capacity it had online in 2011.192 "With its exceptional renewable resources,"193 writes Kelly Sims Gallagher, professor of environment and energy policy at Tufts University, "the United States has a natural potential to become a leader in renewable energy despite its large fossil resources." Improvements in energy efficiency practices and technology deployment can also help improve energy security by lowering energy demand. Congress has held hearings to explore innovation in energy efficiency as a means to improve national security, 194 and the Administration has proposed an "energy security trust" that would use oil and gas royalties to fund renewable energy and energy efficiency research.195

Climate change is also increasingly acknowledged as a national security threat for the U.S. The Department of Defense has explored scenarios in which climate change contributes to de-stabilizing the geo-political environment, leading to increased conflict over constrained food, water and energy resources.¹⁹⁶ Taking action to mitigate the severity of climate change would therefore mitigate security threats in the future. The U.S. military also realizes that use of alternative energy has strategic benefits of for its operations and effectiveness, and it is well situated to drive innovation as an early developer and adopter of technologies.¹⁹⁷ A bipartisan group of former U.S. Cabinet officials and lawmakers led by former Senators Richard Lugar and Joseph Lieberman have pointed out that while poorer

countries may be the most directly vulnerable, the U.S. would be called on to respond to increasing global natural disasters and political turmoil as the impacts of climate change intensify. 198

Environmental Concerns

The U.S. has come a long way since the 1960s and 1970s when environmental pollution reached crisis levels. Bipartisan efforts like the Clean Air and Clean Water Acts and bipartisan Senate ratification of the Montreal Protocol demonstrate that the country can solve difficult problems at home, and be part of the solution in international agreements.

But problems remain. Many areas of the country still fail to meet EPA standards for clean air¹⁹⁹ and water,²⁰⁰ and are at severe risk for climate-related drought, floods, storm damage, coastal inundation, and resource depletion.201 The U.S. is currently not on course to meet its goals for greenhouse gas emissions reductions,202 and a global failure to adequately reduce emissions before 2017 would lock in a future with a greater than 2 degree increase in global average temperature, with dire consequences for people and the environment.²⁰³ One study estimates that the negative effects of climate change (including weather-related disasters, habitat change, and stress on industry) and the carbon economy (pollution-related impacts) cost the U.S. nearly \$150 billion in 2010, and that figure would increase to nearly \$400 billion per year by 2030 if no action is taken.²⁰⁴ To achieve the climate goal of limiting global temperature increase to 2 degrees C, all countries need to continue to shift away from fossil fuels. This means strong global action would need to be taken to reduce the share of fossil fuels in the world's primary energy supply from 83% in 2011 to 63% in 2035. Less than one third of the world's current fossil fuel reserves could be utilized before 2050.205

Prospects for Stronger U.S. Action

The U.S. is not on track to meet its international commitment of reducing greenhouse gas emissions by 17 percent below 2005 levels by 2020 unless it implements strong new measures under existing legal authorities, which the executive branch can do without new Congressional action.²⁰⁶ The measures with the greatest potential for reductions are directing the EPA to immediately pursue ambitious emissions reductions from existing power plants and natural gas systems

using its authority under the Clean Air Act, directing the Department of Energy to set new efficiency standards for consumer appliances and other equipment, and pursuing hydrofluorcarbon reductions through both the Clean Air Act and the Montreal Protocol process.²⁰⁷ States can also pursue independent actions to help meet this target, such as establishing requirements for lower carbon fuels, reducing vehicle miles traveled, and implementing energy efficiency programs. While these actions under existing authorities would be an important step toward addressing global warming, it is likely that new federal legislation will eventually be needed to meet the longer-term aspiration of staying on track to cut emissions by 83% below 2005 levels by 2050.²⁰⁸

If the U.S. is to achieve the many benefits of a cleaner energy supply, it will need to be more strategic and farsighted in its approach. Piecemeal policies such as state renewable portfolio standards, and federal incentives like the wind production tax credit are helpful, but do not fully satisfy this need. Developing a comprehensive, long-term national climate and energy policy would send a strong signal to stakeholders and encourage competition-driven innovation.209 The experiences of other countries have demonstrated that these kinds of strategies can help drive renewable energy. Many industries prefer regulatory certainty at the federal level to a patchwork of state policies, and having a clear and stable energy policy is widely acknowledged to benefit clean energy industries by allowing investors to more efficiently navigate regulations and to better understand and manage risks.210,211 China, Germany and other countries currently have a national energy policy, while the U.S. does not.212

The U.S. Administration recognizes this need for a better strategy in order to remain competitive in the global energy industry, and to address the dangers of climate change. President Obama said in his 2013 State of the Union address that his administration will take executive action "now and in the future, to reduce pollution, prepare our communities for the consequences of climate change, and speed the transition to more sustainable sources of energy," and he called for Congress to pursue a market-based solution. Acknowledging that other countries see the opportunity, the President said, "as long as countries like China keep going all in on clean energy, so must we." Similarly, Secretary of State John Kerry said at

his confirmation hearing that cooperation on climate change is one mutual interest that can strengthen the U.S.-China relationship by working toward common goals (see box above on U.S.-China cooperation), and that "the solution to climate change is energy policy... The opportunities of energy policy so vastly outweigh the downsides... If you want to do business and do it well in America, we've gotta get into the energy race."²¹⁴

President Obama stated in his 2013 State of the Union Address that he will direct his Administration to take executive action, and the President's Council of Economic Advisers has released a report that for the first time since 2010 includes a chapter on climate change.²¹⁵ It calls for Congress to address the market failure of carbon pollution with market-based mechanisms, the direct regulation of emissions, and by promoting energy efficiency, in addition to taking action to prepare for unavoidable impacts already occurring.216 There has also been renewed discussion of putting a price on carbon emissions in Congress²¹⁷ and elsewhere. 218 Although it may be unlikely that a carbon price will be passed in the short-term, this is a very important discussion, and a 2012 poll showed 70% of Americans favor such a policy.219

The U.S. has the potential to succeed in capturing the benefits of a more sustainable energy economy. It possesses exceptional renewable resources, more so than other countries like Germany which have taken more aggressive action. ^{220,221} Although the U.S. is among those taking action, it could do more, and it needs to do more. The benefits of action are significant and the costs of inaction will be devastating.

CONCLUSION

China has demonstrated that it is serious in its pursuit of clean energy and climate goals, both in the policies it has developed to promote deployment of renewables and curtail emissions, and in the actions it has taken to shut down inefficient equipment and build new, cleaner infrastructure. In many ways, China's efforts resemble those of other nations that have had success pursuing cleaner economic growth, such as Germany, Australia, India, and in some respects the U.S. However, the U.S., like all countries, has more untapped potential for progress, and as the world's second largest source of emissions, increased actions it takes are important to confront climate change and can

have a real impact. Policies in various countries may differ, but countries share similar interests in promoting economic growth, strengthening energy security, preserving the environment, and exercising leadership in strengthening the shift to low-carbon energy needed to confront the threat of climate change.

The misperception that China is not acting should no longer be seen as a reason for inaction by the U.S. or any other country. In fact, as this issue brief has shown, countries can learn from each other how to address the challenges and reap the benefits of taking the action that is imperative to address climate change and maintain sustainable development.

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