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HEARING BEFORE THE U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION: "CHINA'S GLOBAL QUEST FOR RESOURCES AND IMPLICATIONS FOR THE UNITED STATES; CHINA'S PROSPECTS FOR SHALE GAS AND IMPLICATIONS FOR THE U.S."

January 26, 2012

Good morning and thank you for the opportunity to contribute to the deliberations of this Commission. My name is Sarah Forbes, and I am a Senior Associate for the Climate and Energy Program at the World Resources Institute. I am also manager of the World Resources Institute's Shale Gas Initiative. The World Resources Institute is a non-profit, non-partisan environmental think tank that goes beyond research to provide practical solutions to the world's most urgent environmental and development challenges. We work in partnership with scientists, businesses, governments, and non-governmental organizations in more than seventy countries to provide information, tools, and analysis to provide for human well-being.

I am delighted to speak with you today about China's prospects for shale gas and the implications for the United States. The United States and China share an interest in the domestic and international development of shale gas resources. In this testimony I will describe the state of China's shale gas industry as well as the governmental policies that will drive its future development in China. I will discuss the implications of U.S.-China business-to-business partnerships as well as government-to-government cooperation—including the risks and opportunities such cooperation could yield. I will also describe how shale gas development in China and the United States changes the global dynamics of energy security. In conclusion, I will provide recommendations for future actions Congress and this Commission can take. In the interest of time, I have limited the scope of my testimony to a discussion of the implications of shale gas development in China on the U.S. and China.

Considering the speed with which shale gas has shifted the U.S. energy outlook[1], this is an important moment to consider the implications of the development of China's shale gas resources. Development of shale gas in China will shift future global energy dynamics. How it is done will affect the environment and global climate picture. As I describe in this testimony, shale gas can help improve international energy security by providing an abundant domestic energy resource and reducing the need for natural gas imports. What role it plays in addressing climate change will depend in large part on the degree to which shale gas displaces inefficient coal plants and supplements continued improvements in energy efficiency and renewable energy.

[1] For example, see natural gas production as described in Annual Energy Outlook 2009 compared with Annual Energy Outlook 2011. http://www.eia.gov/oiaf/aeo/pdf/0383(2009).pdf ; http://www.eia.gov/forecasts/aeo/pdf/0383(2011).pdf

As I start, I would like to emphasize the following key points, which I will describe in detail in the sections that follow.

1. **Current state and future direction of China's shale gas industry:** The shale gas industry in China is in early development, but the topic has already garnered significant interest from the national government. The Chinese government is implementing new policies that support the future development of China's gas industry broadly, as well as supporting shale gas research. State-owned and provincial-owned enterprises are conducting exploration and pilot demonstrations on shale gas in China. Through its state-owned enterprises, China[2] is also investing in shale gas development in the United States.

2. **U.S.-China cooperation on shale gas:** The global oil and gas industry operates joint ventures (JVs) to sustain growth and defuse financial risk. The emerging international shale gas industry will rely on the same tactics, particularly given the current state of the global economy. In recent years, major investments or partnerships between U.S. and Chinese companies in the shale gas sector have been used to the near-term economic benefit of both countries and provide potential for U.S. companies to benefit domestically and abroad.

3. **Impacts on the energy situation in China:** Shale gas development in China will reduce natural gas imports, thus improving China's energy security. Because total natural gas demand will continue to far outstrip all domestic production for the foreseeable future, any natural gas from shale in China is expected to be consumed domestically. From an environmental perspective, the more China can develop energy alternatives to imported oil and domestic coal, the less pressure it exerts on global energy markets and the global environment. China's domestic use of its own natural gas resources would be unlikely to have an effect on net U.S. energy imports, as the U.S. is projected to domestically produce sufficient quantities of natural gas to meet its own demand for at least the next 25 years[3,4].

Throughout my testimony, I will also emphasize a fourth point that cross-cuts these three themes.

4. **Ensuring responsible operations and creating a "level playing field"**: Shale gas development should proceed in China (or any country) with environmentally and socially responsible operations which are (1) enforced by appropriate laws, regulations, and standards, (2) realized through implementation of international best practices, and (3) based on an understanding of the real risks and benefits of responsible deployment (both to industry and the public). Such approaches drive demand for U.S. products and ensure a "level playing field" between companies operating in the United States and those in China. More importantly, they help ensure that any negative environmental impacts associated with shale gas development in the United States are not repeated elsewhere.

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[2] Large investments made by the enterprises are overseen by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) http://www.sasac.gov.cn/n2963340/n2963393/2965120.html

[3] According to the U.S. EIA Annual Energy Outlook 2011, from 2012 to 2035 net imports of liquefied natural gas are projected to never exceed 2% of total supply: http://www.eia.gov/forecasts/aeo/source_natural_gas.cfm

[4] Andrei Korzhubaev and Alexander Khurshudov, *Shale Gas: Great Expectations, Modest Plans*, Oil & Gas Eurasia, 2011; Olivia Chung, *China Joins Shale Gas Hunt*, Asia Times, 2011.

1. Current state and future direction of China's shale gas industry

Estimated reserves

Although there are a wide range of forecasts, China appears to have significant reserves of natural gas trapped in shale. According to a 2011 EIA study, China overlays eight basins containing 1,275 trillion cubic feet (Tcf) of technically recoverable resources (See Figure 1), which is larger than the study's estimate for the U.S. (862 Tcf)[5]. However, Chinese oil experts point out that these estimates are not based on any studies of what the recovery rate would be for China's shale gas and recognize an urgent need to evaluate the extent and scale of the resource. Even if the estimates are overstated, shale gas could be a game changer in China's energy future in the same way that it changed the future energy context here in the United States.

Policies drive future supply and demand

The potential of China's shale gas reserves is of great interest to the Chinese government for both energy security and environmental reasons. While China has made real advancements in renewable energy and energy efficiency, it still depends on fossil fuels such as coal to sustain its current pace of development. For example, in 2008 coal accounted for 66% of China's primary energy consumption[6].

The growing energy demand places stress on China's energy security – as prices from chief import partners, such as Russia, continue to fluctuate. In the context of emissions goals for traditional air pollutants and greenhouse gases, natural gas is generally more favorable compared with more carbon-intensive fuels like coal or oil[7]. Increasing the share of natural gas in the energy mix both improves energy security and helps in meeting climate goals, and China has been expanding its production and use of natural gas. Natural gas production has been growing at an annual rate of 15-20% for more than a decade and the 12th Five Year Plan set a target for natural gas to become 8.3% of total primary energy in 2015 (compared to 3.8% in 2008 and a goal in the 11th Five Year Plan of 5.3%)[8].

China's current domestic supply of conventional natural gas cannot keep pace with the projected increases in demand, without turning to imported liquefied natural gas (LNG). The promise of greater energy security and the need to meet environmental goals have sparked a strong interest in domestic unconventional gas development in China[9]. The 12th Five Year Plan targets the production of 6.5 billion cubic meters (0.23 Tcf) of shale-sourced gas per year by 2015 and 80 billion cubic meters (2.8 Tcf) by 2020[10,11]. Comparatively, U.S. projections are 7.20 Tcf, and 8.21 Tcf for the same years[12,13]. According to Chinese energy experts, China's plans include an

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[5] World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States
http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf

[6] IEA. 2011. World Energy Outlook Special report: *The Golden Age of Gas*.
National Energy Technology Laboratory (NETL), *Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production*, NETL, 2011. http://www.netl.doe.gov/energy-analyses/pubs/NG-GHG-LCI.pdf

[8] IEA. 2011. World Energy Outlook Special report: *The Golden Age of Gas*.

[9] Philip Andrews-Speed and Roland Dannreuther, *China, Oil and Global Politics*, Routledge 2011, p. 24.

[10] Reuters, *China sets ambitious shale gas output targets-paper*, Reuters, 2011.
http://af.reuters.com/article/energyOilNews/idAFL3E7LC0DM20111012

[11] Bloomberg, *China to Set Shale-Gas Output Targets, Securities Journal Says*, 2011.
http://www.bloomberg.com/news/2011-10-11/china-to-set-shale-gas-output-targets-securities-journal-says.html

[12] USEIA, Annual Energy Outlook 2011.

[13] SinoCast, *China Shale Gas Planning Coming Soon*, MENAFN News, 2011; Energy Information Administration (EIA), *Annual Energy Outlook: 2011*, EIA, 2011; Conversion rate: 1 Bcm = 0.03531Tcf.

effort to drill 990 shale gas horizontal wells by 2015[14]. The Ministry of Land and Resources also recently approved shale gas as an independent mining resource, which is a legal status that may allow firms other than State-owned enterprises to begin developing the unconventional sources[15]. The announcement of the new approved status came shortly after a government decision to free well-head prices for unconventional gas, including shale and coal bed methane. The press release is linked to the launch of pilot reforms on natural gas pricing in Guangdong Province and Guangxi Zhuang autonomous region, an effort to steer toward a market-guided pricing mechanism that includes costs associated with transportation and consumer demand, as well as production costs[16].

Shale gas activities

Currently, China is assessing and exploring potential shale gas resources through geologic basin evaluations conducted by State-Owned and Province-Owned Enterprises. PetroChina has successfully drilled several pilot shale wells in the Sichuan Basin and plans to produce 1.5 billion cubic meters (0.53 Tcf) of gas from shale in 2015, 1 billion cubic meters from Sichuan alone[17]. PetroChina's activities include two vertical wells, operated as part of a JV with Shell[18]. Results from these wells presented in December 2011, show that the primary production has been "very good[19]." PetroChina has also successfully drilled two horizontal shale gas wells in the Weiyuan gas field in the Sichuan basin. As of December 2011, this well had produced over 2 million cubic meters (70.6 million cubic feet) of shale gas[20]. China Petroleum and Chemical Corporation (also known as Sinopec Corporation) has partnered with BP on shale gas exploration and deployment in Guizhou and Jiangsu, and has also drilled a horizontal well in Hubei province[21,22]. In January 2012 Sinopec announced that it is drilling its first shale gas well in Anhui province[23]. The provincial oil and gas companies are also actively developing shale gas in areas like Hunan and there is government-supported research underway in government and research institutions and by provincial governments and enterprises[24].

2. United States and China cooperation on shale gas

Government-to-Government

The United States and China are working together in both a governmental and private sector capacity. In 2009, Presidents Barack Obama and Hu Jintao announced the launch of the U.S. – China Shale Gas Resource Initiative, with the goal of sharing information about shale gas exploration and technology to reduce greenhouse gas emissions, promote energy security, and create commercial opportunities[25]. Activities conducted under the initiative include forums, workshops, and a Chinese delegation's visit to a U.S. shale gas development operation.

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[14] Interfax China. *China's first horizontal shale well outputs 2 MMcm to date*. December 7, 2011.
[15] Reuters, *China Approves Shale Gas as an Independent Resource,* Reuters, 2011
[16] Reuters, *Government to liberate wellhead prices*, Global Times, 2011
[17] Chen Aizhu and Coco Li, *China: PetroChina aims to produce 1 bcm of shale gas in Sichuan in 2015*, Reuters, 2011. - http://www.reuters.com/article/2011/09/25/petrochina-shale-output-idUSL5E7KP0VX20110925
[18] Shell, *Our business in China*, Shell, 2012.
[19] Tom Bergin, *Exclusive: Shell strikes shale gas in China*, Reuters, 2011.
[20] Interfax China. *China's first horizontal shale well outputs 2 MMcm to date*. December 7, 2011.
[21] Interfax China. *China's first horizontal shale well outputs 2 MMcm to date*. December 7, 2011.
[22] Olivia Chung, *China Joins Shale Gas Hunt*, Asia Times, 2011.
[23] Interfax China. CNPC takes the lead in shale gas production. January 19, 2012.
[24] Peng Suping, China University of Mining and Technology, January 2012.
[25] Office of the Press Secretary, *Fact Sheet: U.S.-China Shale Gas Resource Initiative*, White House Press Release. 2009.

Business-to-Business

Over the past two years, two of China's State-Owned Enterprises (Sinopec Corporation, and China National Offshore Oil Cooperation, or CNOOC) have formed JVs with U.S. shale gas operators. These JVs are not investments in the companies themselves but financial stakes in portions of the company's assets. The global oil and gas industry operates JVs to sustain growth and defuse financial risk, and these deals are evidence that the shale gas industry is following that same model. Figure 2 describes the geographic distribution of foreign company investment in the U.S. shale gas industry. Key investments are also described below.

November 2010: CNOOC paid $1B for a 33% stake of Chesapeake Energy's 600,000 acre oil and gas leasehold in Texas (Eagle Ford). CNOOC paid $1.08 billion in cash, plus an additional $40 million at closing. CNOOC will also fund 75% of Chesapeake's share of the drilling and completion costs up to $1.08 billion, which Chesapeake expects to occur by year-end 2012[26].

January 2011: CNOOC and Chesapeake came to agreement on a $1.3B deal for 2011-2014 which gives CNOOC a 33.3% stake in Chesapeake's 800,000 acre holdings in the Denver-Jules and Powder River Basins. The deal included CNOOC funding 66.7% of Chesapeake's share of drilling and completion costs until an additional $697M is paid[27].

December 2011: CNOOC and Sinopec Corporation are jointly competing to buy a 30% stake in FTS International, an oil-field services company specializing in hydraulic fracturing, or fracing. Saudi Arabian Oil Company, known as Saudi Aramco, is also bidding[28].

January 2012: Sinopec Corporation and Devon Energy signed a multibillion-dollar deal which gives Sinopec Corporation a one-third stake in five U.S. shale oil and gas fields. The stake includes 1.2 million acres in Devon's lease holding in the Tuscaloosa Marine Shale in Alabama and Mississippi, the Niobrara in Colorado, the Mississippian, the Utica Shale in Ohio, and the Michigan Basin. The deal included a $900 million payment at closing, $300 million of which went toward reimbursements for acreage and drilling acquisitions. In addition, by the end of 2014 Sinopec will pay $1.6 billion to Devon to cover the costs of drilling[29].

Opportunities in the U.S. market

It is worth noting that although these investments total more than $5B, they represent only about five percent of overall Chinese investment in foreign energy between 2010 and 2012[30]. In the United States, Chinese financial interests between 2008 and early 2012 accounted for eight percent of all foreign investment in shale gas basins. Other major foreign investment came from Norway's Statoil, France's Total, BHP Billiton, and international majors like Shell and BP[31].

From a short-term economic standpoint, JVs are advantageous to both parties. In the case of the United States and China, both countries stand to benefit from additional business-to-business

[26] Oil & Gas Financial Journal, *CNOOC, Chesapeake close Eagle Ford shale deal*, Oil & Gas Financial Journal. 2010.
[27] Reuters, *UPDATE 2 – Chesapeake, CNOOC strike second shale deal for $1.3 bln*, Reuters, 2011.
[28] https://secure.marketwatch.com/story/devon-reaches-shale-deal-with-sinopec-2012-01-03[28] Ryan Dezember, *Devon reaches shale deal with Sinopec*, Market Watch. 2012.
[29] Angel Gonzalez and Ryan Dezember, *Sinopec Enters U.S. Shale*, Wall Street Journal, 2012.
[30] The Heritage Foundation, *Chinese Outward Investment data*, The Heritage Foundation, 2011.
[31] Angel Gonzalez and Ryan Dezember, *Sinopec Enters U.S. Shale*, Wall Street Journal, 2012; Joanne Liou, *PwC: International investment in US shale plays surge, drive M&A activity*, Drilling Contractor Magazine, 2011.; James Regan and Caroline Jacobs, *France's Total in $2.3 billion U.S. shale gas deal*, Reuters, 2012. Final figure for international shale gas investment in U.S. shale was derived by using PwC's calculation of $60B in shale gas deals from 2008 – 2011 and adding the two deals finalized in 2012, with Total and Sinopec.

deals. Shale gas extraction is costly and requires significant up-front capital investment by well operators with a lag in returned profits. The high capital costs coupled with the low price of natural gas in the United States, currently around an average of $4.00 with recent prices below $3.00[32], creates a strong need for investment that offsets the capital requirements and reduces financial risk for U.S. companies[33]. Chinese investment is driven both by the opportunity of participating in what can be a lucrative U.S. market opportunity, as well as the potential to learn more about the operational aspects of shale gas development along a fully integrated supply chain and apply those lessons to its own shale gas resources[34]. The result is that the U.S. shale gas industry benefits by receiving the capital it needs to continue operating and the Chinese companies profit in dollars and in knowledge on shale gas technology and operational management of shale gas. Such knowledge transfer could increase the speed and efficiency of China's shale gas resource development.

Opportunities in China's shale gas market

Domestic Chinese shale gas production could open new markets for U.S. companies producing goods and services to support activities throughout the shale gas supply chain. For example, Halliburton and Baker Hughes are international leaders in oilfield services, including fracing fluid production and well-completion management[35]. Even if only China's state and provincial enterprises gain access to the country's shale gas reserves, they will likely require goods and services from the sector's top-performing companies, most of which are based in the United States.

Water treatment technology could especially be in demand. Each well drilled and fractured in the Marcellus shale of the northeast United States requires 2.4 to 7.8 million gallons of water[36]. Twenty to 80 percent of injected water returns to the surface, which leads to a net loss of water and generates wastewater at each drilled well. In the relatively water-abundant northeast United States, water demands from fracing are small compared to uses such as municipal water supply and power generation[37]. In China, however, any additional water demands for fracing pose significant challenges because most major shale plays underlie water-scarce regions (Figure 3). Further straining demand on water resources, residents in 400 of 657 major Chinese cities rely on groundwater[38]. For these reasons, Chinese shale gas operations should reuse reclaimed water, treat wastewater before discharging it to receiving surface waters, and prevent the intrusion of wastewater from well casings into groundwater. U.S. companies are at the forefront of water treatment technologies for all three purposes because of experience complying with the Clean Water Act and other environmental laws as well as adoption of voluntary industry best-practices.

[32] U.S. Energy Information Administration (EIA), *Natural Gas Data*, EIA, 2011.
[33] *UPDATE 2 – Chesapeake, CNOOC strike second shale deal for $1.3 bln*, Reuters, 2011.
[34] Julie Jiang and Jonathan Sinton, *Overseas Investments by Chinese National Oil Companies: Assessing the drivers and impacts, International Energy Agency (IEA), 2011*
[35] Trefis Team, *Fracking Good New from China for Halliburton, Schluberger and Baker Hughes*, Forbes, 2011.
[36] New York Department of Environmental Conservation. 2009. *Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program: Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and other Low-Permeability Gas Reservoirs*.
[37] Susquehanna River Basin Commission as reported in Penn State Cooperative Extension. 2009. "Marcellus Education Fact Sheet: Water Withdrawals for Development of Marcellus Shale Gas in Pennsylvania."
[38] Statistic cited in the National Groundwater Pollution Prevention Plan, signed by the State Council in August 2012 http://www.gov.cn/ldhd/2011-08/24/content_1932010.htm

Are there risks as well as opportunities for U.S. companies?

From a global perspective, the oil and gas industry is integrated; companies work together on projects all over the world, owning shares in projects and hiring service providers as required for operations. Because of the variation in geology, most of what is needed to develop any oil or gas play is local "know-how," not technology that is subject to patents. These unique features of the globalized industry result in less dependency on intellectual property protection and the risks of sharing technologies abroad as compared with other industries. For example, while the basic drilling and fracturing technologies needed for shale gas development are relatively uniform, the extraction methodologies depend most heavily on the site-specific geological features of the shale play being developed. Horizontal drilling first occurred in the United States in 1929 and fracing has been performed since 1949[39]. Geological factors that are unique to each well site (e.g., natural gas content, natural fractures of the rock, fracturing ability of the source rock) impact the staging of the fractures, the pressure of the hydraulic fracturing, and the fracturing fluid mixture. It is the experience gained from working many drill sites, in different basins and plays, which is the driving force behind U.S. shale gas development.

Chinese companies currently possess the ability to drill wells horizontally and have some experience with fracing[40], but operators and service providers in the United States currently have a clear global advantage based on the substantial experience with drilling and fracing shales to produce gas and the know-how to use these techniques effectively to maximize output[41]. This being said, the oil industry in China is a very domestic business (especially onshore) and has historically provided international companies with very limited access to onshore resources. Any international involvement typically comes from the creation of partnerships between Chinese companies and foreign companies, which is already happening with shale plays in China, as demonstrated by the PetroChina-Shell and CNOOC-BP JVs. A key question is whether the future shale gas industry in China will be modeled after the offshore oil industry (which includes more JVs) or the onshore oil and gas industry.

Future cooperation between governments and businesses should not be limited to financial investments or knowledge sharing on operational practices. Although the United States currently stands as the only country with domestic experience in large-scale shale gas development, the experiences have not been all positive. U.S. regulatory structures, information flow, and enforcement capacities have generally not kept pace with the speed of development in shale formations. Stakeholders affected by U.S. shale gas development have not reached agreement on the risks associated with fracing, although experts agree that practices and regulations should be improved in order for the United States to develop its shale gas resources in an environmentally and socially responsible manner[42]. The growing understanding within state governments of both the level of environmental risks and how to manage them are valuable experiences for Chinese regulators and industrial entities to be aware of and take into account while pursuing and designing Chinese domestic development.

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[39] http://www.kgs.ku.edu/Class2/horz05092001a/index.htm; http://www.spe.org/jpt/print/archives/2010/12/10Hydraulic.pdf

[40] Oilfield Technology. *Revolution of Evolution?* March 2011. http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_consulting_RevolutionorEvolution_Oilfield_Technology052511.pdf

[41] Tim Carr, January 6, 2012

[42] U.S. DOE. Secretary of Energy Advisory Board (SEAB) Natural Gas Subcommittee *Improving the Safety & Environmental Performance of Hydraulic Fracturing*, Final Report. November 2011. http://www.shalegas.energy.gov/

3. How will the growth of the shale gas industry in China impact the energy situation in China and the U.S.?

China's current domestic supply of conventional natural gas cannot keep pace with the projected increases in demand[43]. Shale gas development in China is expected to reach considerable production levels between 2015 and 2020[44], and this additional gas could both increase China's energy security and also impact the global market by reducing the need for imports from Russia as well the Middle East. Some imports of natural gas are projected for China, even if significant shale gas is produced[45]. These imports include gas from the Myanmar and Kazakhstan pipelines as well as LNG imports (140 bcf in 2009), among other sources[46]. The timing and scale of the development of China's shale gas industry should be viewed as uncertain, however, as there are a number of challenges to China's development of a fully integrated shale gas industry (pipeline infrastructure and access, drilling rig availability, regulations, market disincentives, existing contracts, etc.).

China's shale gas resources are located in areas that are "energy short" (Hunan, Hubei, Sichuan, and Chongqing), and it is likely that shale gas produced in China would be needed and used locally rather than exported, even to other areas within China. There is, therefore, very little risk of exported Chinese gas competing with U.S. suppliers within the United States.

The implications of shale gas in China and the United States extend beyond the gas market alone. Shale gas has the potential to remake the world energy picture – potentially undercutting markets for existing and new coal-fired power generation in the near-term and clean zero-emission technologies for the foreseeable future. It is essential that as Congress considers new energy policies, priority is given to provisions that help ensure that the environmental impacts of shale gas are managed and that it contributes to, rather than detracts from, a sustainable, low-carbon energy future. The rapid pace at which shale resources are being tapped means that time is short to ensure responsible development that avoids negative consequences for people, ecosystems, and the global climate.

Concluding recommendations:

1. To avoid environmental risks associated with shale gas development it will be critical for public and private sector stakeholders in China to receive technical guidance from qualified experts. As Congress considers future programs and government-to-government collaboration, it should support programs – including government-to-government collaboration – that include information sharing on regulatory capacity as well as operational best practices. Specifically, the U.S. could assist China in developing environmental regulations for shale gas and in establishing and implementing best practices and international standards for shale gas development. The U.S.-China Shale Gas Resource Initiative, led by the State Department, could provide a platform for such exchanges.
2. The social, environmental, and market implications of shale gas in China remain largely unknown due to the nascent status of China's shale gas industry. In particular,

[43] Philip Andrews-Speed and Roland Dannreuther, *China, Oil and Global Politics*, Routledge 2011, p. 24.
[44] Gavin Thompson and Wood Mackenzie, *Challenges Hamper China's Near-Term Unconventional Development*, Hart Energy, 2011.
[45] Kenneth Medlock et al.. *Shale Gas and U.S. National Security*, James A. Baker III Institute for Public Policy, 2011.
[46] EIA, 2012 China Energy Data, Statistics and Analysis - Oil, Gas, Electricity, Coal. Country Analysis Briefs.

uncertainties remain regarding estimates of its technically recoverable reserves and the pending implementation of new policies and targets outlined in the 12th Five Year Plan. Congress should support ongoing analysis by government and independent researchers who are tracking the global economic and environmental impacts of emerging global shale gas developments. In the near term, Congress could request a report that explores these issues, delivered to Congress by the Department of Energy's Advisory Board Subcommittee on Shale Gas Production with input from the DOE National labs as well as U.S. Departments of State and Commerce, Environmental Protection Agency, Geologic Survey, Trade and Development Association, and other relevant agencies.

3. Congress should help maximize the opportunities a potential Chinese shale gas market provides for U.S. companies. Specifically, with Congressional support, the U.S.-China Shale Gas Resource Initiative should be charged to work with other U.S. Government agencies, the private sector, and civil society to transfer knowledge on well completion including drilling and fracing, best practices for mitigating environmental and social impacts, and necessary regulations to China. Such efforts should stimulate demand for U.S. products and services, maximize production at Chinese wells, and realize benefits of natural gas production for Chinese citizens (i.e., develop jobs, generate tax revenue, raise standard of living).

4. Here in the United States, Congress must work toward reaching bipartisan agreement on national energy policies that encourage more efficient energy consumption, increase the diversity of domestic energy production, maximize deployment of low-carbon energy technologies, and minimize environmental impacts throughout our energy systems. In this context, measures will be needed to ensure that natural gas complements rather than competes with energy efficiency and the development of renewable energy sources in the U.S. market. In the near-term, it is critical for Congress to provide funding and incentives for low-carbon and clean energy technology. Congress should also move forward on comprehensive energy and climate legislation—but that is a topic for another day.

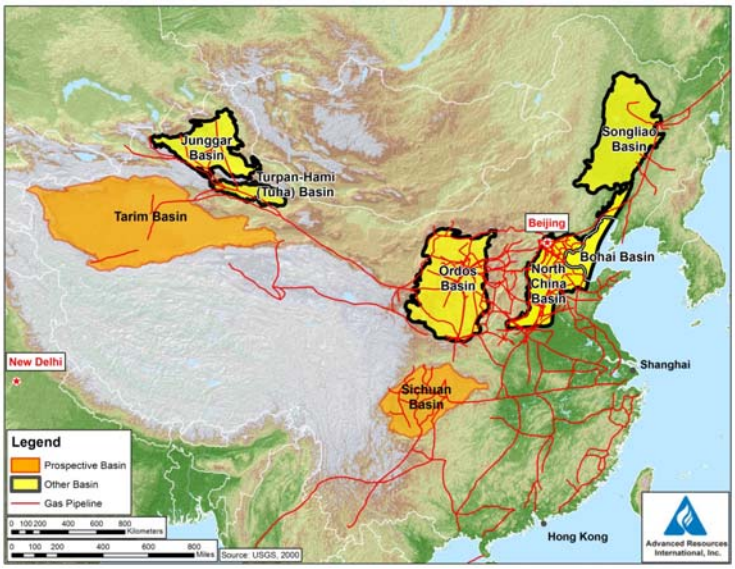

Figure 1. Major Shale Gas Basins in China (Figure Courtesy of Advanced Resources International)

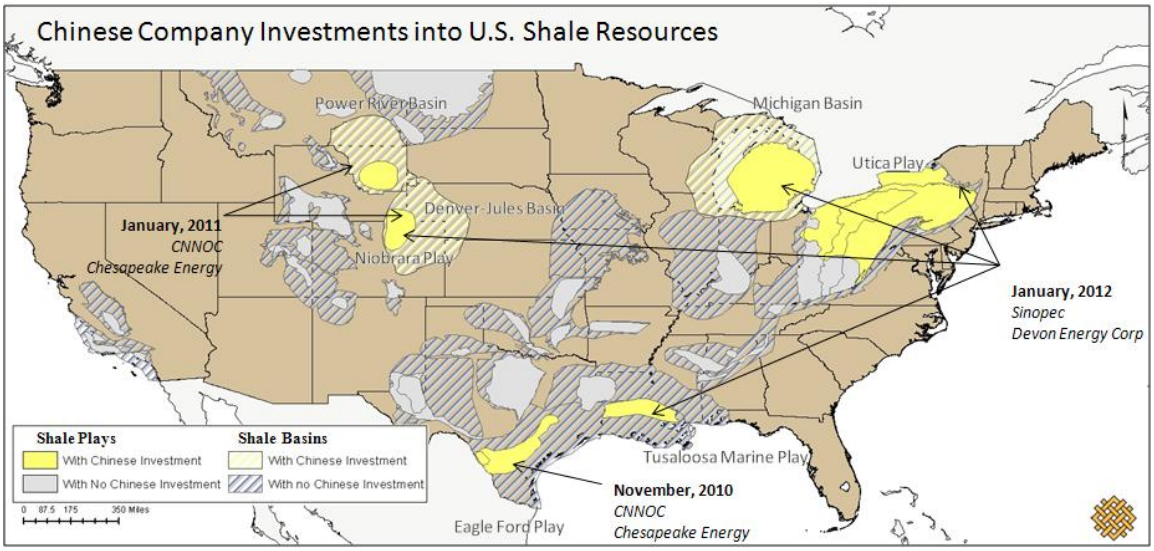

Figure 2. China's shale gas investments in U.S. Shale Gas Resources (Source: WRI analysis)

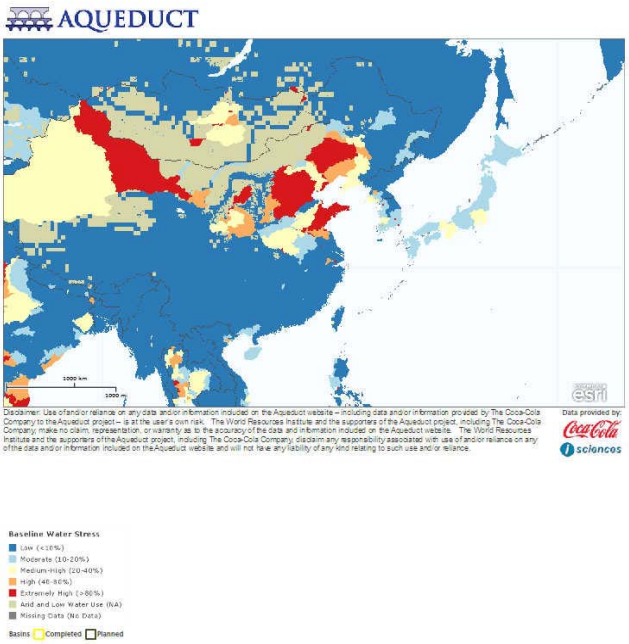

Figure 3. Shale gas production could occur in arid regions of China (Source WRI Aqueduct tool[47])

[47] http://insights.wri.org/aqueduct/welcome