Anatomy of a Partnership:
Benefits of U.S.-China Private Sector Cooperation in the Power Sector

Accounting for 42% of global energy demand, together the United States and China can lead the world in addressing energy and the deployment of new power generation technologies. Both countries face a similar set of challenges including the need for trillions of dollars in power infrastructure investment over the next two decades while reducing their CO_2 emissions and diminishing their dependence on coal-based power generation.

Collaboration in the power sector, unlike other sectors, offers potential for mutual economic benefit and job creation through the development of clean energy technologies. Power generation, after all, is a domestically developed good. However, little work has been done to date to quantify this potential. In order to better understand how this relationship would impact the United States and China and the range of potential benefits, Garten Rothkopf conducted a study, *Anatomy of a Partnership: Benefits of U.S.-China Private Sector Cooperation in the Power Sector*. In this groundbreaking report, Garten Rothkopf mapped the supply chain of four model clean energy projects, using employment projections based on actual budgeted estimates and supply chain dynamics based on current perspectives and purchasing decisions.

However, and it is vital to note this, all of these potential benefits depend on a level playing field between the two countries, a fair and balanced currency and trade regime, and a set of rules that are clear and do not inappropriately disadvantage any actors on either side. Also, this particular study does not focus on or draw conclusions about the broad U.S.-China relationship overall, but rather focuses very narrowly on specific prospects for cooperation in the power sector.

The report focused on four power technologies identified as having potential for advancement through U.S.-China technical cooperation: IGCC and carbon capture, solar PV manufacturing and installation, supercritical coal, and smart grid development. Across all four, Garten Rothkopf found potential for shared benefits. From R&D, to manufacturing, construction and installation and operations and maintenance, there is the potential for tens of thousands of direct and in-direct jobs, with 66%-95% created in the project's home market, even in those cases where the capital equipment was imported.

SHARED CHALLENGES

Though China recently passed the United States in total CO_2 emissions, the United States still leads the world in per capita emissions, with the average individual responsible for 19 tons of CO_2 each year—a full 7 tons more than the next largest emitter, Russia. The two countries face enormous power infrastructure investment challenges as well. In order to account for growing demand, China is projected to spend $3.1 trillion cumulatively on electricity to 2030. The United States, faced with the need to update its aging infrastructure, is expected to spend $2.1 trillion. Further, the United States and China still largely rely on coal as a cheap and reliable source of energy. It is estimated that coal will account for 48% of U.S. power generation by 2030. In China, coal use is expected to grow an average of 3.5% per year for the next twenty years, making that country 82% dependent on the fossil fuel for power generation in 2030.

Pressure from both national and state governments is also creating a similar investment environment within the two economies. In China, the national government has committed to producing 15% of its electricity from renewable sources by 2020. It also announced the goal of reducing its carbon intensity by 45% from 2005 levels in that same period, and is expected to embrace further renewable energy developments in its next five-year plan. U.S. states have taken the lead in crafting renewable energy mandates and tax incentives to attract renewable investments. The U.S. House of Representatives has passed a renewable energy standard and it remains possible, though not likely, that the U.S. Senate will take it up before the end of the year.

SHARED OPPORTUNITIES

In the midst of these challenges, the two countries share unrealized economic potential. As mentioned, this report focused on four key prospective areas of collaboration; IGCC and carbon capture, solar PV manufacturing and installation, clean coal technologies, and smart grid development. Across all four, the report found opportunities for both countries, including access to growing markets, accelerated development of technologies, and tens of thousands of new jobs. It also found U.S. and Chinese energy firms that are already taking advantage of opportunities in solar PV, wind, and battery production. These companies are benefiting from U.S. and Chinese incentives to expand their operations, create new jobs, and establish global supply chains to reduce costs, illustrating the tangible benefits of collaboration.

PROJECT MODELS

To understand the benefits of collaboration across four different power generating sources, Garten Rothkopf conducted over 30 interviews with leading power and technology industry executives and academics, with a view to acquiring employment projections based on actual budgeted estimates and an understanding of the supply chain based on existing projects and purchasing decisions. Though each technology offers unique opportunities, there are broad trends that run throughout each study model. The advantages include acceleration of energy technologies, expanded access to new markets, and rapid growth of emerging industries. However, the most common feature is that regardless of project location, these collaborations create jobs in both markets, with the majority created in the country where the power generation is taking place. Further, across all the projects, if we think of job creation in terms of wage creation, the United States economy greatly benefits from a positive "balance of wages," with quality jobs created that cannot be exported. Below is a summary of findings in each of the technology areas.

IGCC with Carbon Capture – Collaboration in this area would produce 3.25 GW of additional capacity through an agreement to construct five 650 MW IGCC plants with carbon capture in China. The project would lead to $5 billion in total investment between participants and government incentives. China would acquire critical technology transfer and know-how, while the United States would gain the opportunity to scale the learning curve, applying knowledge to the U.S. market. This serves a major need in the United States, as there is the potential for 56 new IGCC plants in the country to 2030, driven by large increases in power generation capacity and a need for cleaner and more efficient generation. The analysis considered both direct and indirect jobs created, for a final number of total jobs combining both figures.
Direct Jobs Created: *US*: 19,715 jobs at $23 - $40/hour / *China:* 35, 053 jobs at $2.70 - $3.05/hr.
Total Jobs Created: *US:* 40, 950 jobs at $23 - $40/hour / *China:* 136,636 jobs at $2.70 - $3.05/hr.

Utility-Scale Solar PV – U.S.-China cooperation with this technology has the potential to lead to 400 MWs of additional capacity through an agreement to construct utility-scale solar power plants in the United States. A total of $1 billion in investment would be required between participants and government incentives. Under our projections, annual U.S. solar PV installations are to increase to 1515MW by 2013, creating a large market for solar PV cells (assumed to be from China for the purposes of this study) and installation and maintenance services in the United States.
Direct Jobs Created: *US:* 9,880 jobs at $15 - $41/hour / *China:* 4,820 jobs at $1.50 - $ 3.00/hr.
Total Jobs Created: *US:* 18,772 jobs at $15 - $41/hr / *China:* 18,798 jobs at $1.50 - $ 3.00/hr.

Clean Coal Technologies – Collaboration between the two countries on clean coal would lead to $5 billion in total investment between participants and government incentives, and six 1,000 MW ultra super critical plants (potentially with carbon capture). China would benefit by gaining heat resistant materials technology, while US-based firms expand exports and flatten the learning curve, reducing costs of constructing new plants. There is a huge market potential for clean coal technology given additional electrical capacity; as many as 377 clean coal plants in China and 36 in the United States to 2030 may be needed.
Direct Jobs Created: *US:* 23,430 jobs at $23 – 51/ hour / *China:* 78,810 jobs $1.50 - $3.05/hour.
Total Jobs Created: *US:* 44,517 jobs at $23 – 51/hour / *China:* 307,360 jobs at $1.50 - $3.05/hour.

Smart Grid – Between the United States and China there would be two million meters deployed, leading to $1.4 billion total investment between participants and government incentives. The United States provides technology and expertise, while China provides meter manufacturing and access to a burgeoning U.S. market; as much as $63 billion is needed to implement smart meters nationally in the U.S. over the next 15 years.
Direct Jobs Created: *US:* 3,374 jobs at $20 - $45/hour / *China:* 172 jobs at $1.52 - $2.70 /hour.
Total Jobs Created: *US:* 6,410 jobs at $20 - $45/hour / *China:* 671 jobs at $1.52 - $2.70 /hour.

CONCLUSION

Through access to expanding markets and technology transfers, US-China partnerships in the power sector speed technology development, promote economic growth, and drive local job creation. The generation options and private partnerships profiled in this study indicate that there can be mutual benefits gained from collaborative efforts in power generation and distribution. While economic competition and employment remain very active concerns in the U.S.-China relationship, this study demonstrates that collaboration in clean energy technologies has the potential to not only directly generates jobs for both countries, but provides a foundation for sustained economic growth and further opportunities.

Methodology for the *Anatomy of a Partnership Study*

Launched in the beginning of 2010, the study *Anatomy of a Partnership: U.S.-China Collaboration in the Power Sector*, commissioned by Duke Energy, sought to assess the job creation consequences and related economic effects of collaboration between U.S. and Chinese energy partners in specific potential project areas associated with cleaner and more efficient generation of power.

Recognizing the scarcity of meaningful data associated with projects of the nature proposed, this analysis used accepted modeling techniques to consider four specific types of energy projects with a special focus on the full supply chains associated with those projects. It should be noted that while

the study focuses on employment and other economic benefits of the bilateral cooperation, it does not attempt to address the complex trade and competitiveness issues associated with U.S.-China economic relations more broadly. The study reflects in-depth research conducted over many months and in more than 30 on the ground interviews with power and technology company executives, project developers, industry and academic experts in both the United States and China.

The primary research conducted by Garten Rothkopf yielded specific employment projections based on actual budgeted estimates and supply chain costs based off of existing projects and purchasing decisions. The employment was categorized by type (labor-intensive or technical) and country, including jobs associated with power plant construction and operation. In cases of technology suppliers, Garten Rothkopf conducted the economic impact analysis, taking into consideration the origin of parts and the geographic location of associated manufacturing jobs, keeping in mind that if some foreign technology is used, there is a high probability that manufacturing jobs for that technology will be located in the country of origin.

Across all four supply chains, the economic analysis found opportunities for both countries, including access to markets, accelerated development of technologies, and tens of thousands of new jobs. It also found U.S. and Chinese energy firms which are already taking advantage of opportunities in solar PV, wind, and battery production. These companies are benefiting from U.S. and Chinese incentives to grow their operations, create new jobs, and establish global supply chains to reduce costs. They represent just a percentage of the potential between U.S. and Chinese firms; but they illustrate the tangible benefits of collaboration.

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