



**BEFORE THE SUBCOMMITTEE ON ENERGY AND POWER**

**COMMITTEE ON ENERGY AND COMMERCE**

**HEARING ON THE AMERICAN ENERGY INITIATIVE**

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**TESTIMONY OF MARY J. HUTZLER**

**THE INSTITUTE FOR ENERGY RESEARCH**

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Energy Secretary Steven Chu and other administration officials paint a very dire picture of the U.S.-vs.-China race for clean energy, implying that China is quickly outstripping United States in that race.<sup>1</sup> However, all the facts are not on the table. In both 2008 and 2009, the United States added more non-hydroelectric renewable capacity than it added traditional capacity (natural gas, coal, oil, and nuclear).<sup>2</sup> At the end of 2010, the United States and China each had over 20 percent of the world's installed wind

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<sup>1</sup> Climate Wire, Energy policy: U.S. clean tech outpaced by China—Chu, March 9, 2010, <http://www.eenews.net/climatewire/2010/03/09/3>

<sup>2</sup> Energy Information Administration, Annual Energy Review 2009, Table 8.11a, [http://www.eia.gov/emeu/aer/pdf/pages/sec8\\_42.pdf](http://www.eia.gov/emeu/aer/pdf/pages/sec8_42.pdf)

capacity.<sup>3</sup> While it is true that China's total installed wind capacity was about 5 percent more than that of the United States in 2010, not all of China's wind capacity is connected to the electric grid. Adjusting for that difference, the United States has in essence over 30 percent more useable wind capacity than China. At the end of 2009, the United States ranked fourth in solar capacity, with only Germany, Spain, and Japan having a larger amount; China did not even make the list of the top 8 countries.<sup>4</sup> According to the Pew Environment Group, in 2010, China had about 75 percent less solar capacity installed than the United States.<sup>5</sup>

Where China is outstripping us in domestic construction is in coal-fired, nuclear, and hydroelectric generating technologies. Legal and bureaucratic red tape makes it much more difficult to build these energy technologies in the United States than in China. China is eclipsing the United States in all forms of energy, and especially the most cost-efficient energy sources. For example, their ability to quickly permit energy projects allows them to build the cleanest and most efficient coal plants.<sup>6</sup> China is building supercritical plants that produce about 15 percent less carbon dioxide emissions for \$500 to \$600 per kilowatt<sup>7</sup>, much lower than the \$2800 per kilowatt cost in the United States, exclusive of financing costs, according to the Energy Information Administration.<sup>8</sup>

China realizes that it needs affordable energy to fuel its economic growth and manufacturing productivity, and it is building all forms of generating technologies at breakneck speed. By contrast, the electric generating construction program in the United States has slowed tremendously, owing to regulatory, financial, legal and demand problems. Economic growth has slowed in the United States and with it our energy demand has grown more slowly. History shows that the United States became the world's workshop – replacing Britain – shortly after we became the world's largest consumer of energy. Since energy is literally, "the capacity to do work," the United States needed enormous amounts of energy in the 20th century to do more work than our competitors, and ended up the lone superpower in the world. Policymakers need to understand that energy availability and affordability spur economic

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<sup>3</sup> Global Wind Energy Council, <http://www.gwec.net/fileadmin/images/newsletter/Top%2010%20total%20installed%20capacity%202010.jpg>

<sup>4</sup> Solar Energy Industries Association, US Solar Industry: Year in Review 2009, April 15, 2010, <http://seia.org/galleries/default-file/2009%20Solar%20Industry%20Year%20in%20Review.pdf>

<sup>5</sup> The Pew Environment Group, <http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/G-20Report-LOWRes-FINAL.pdf>

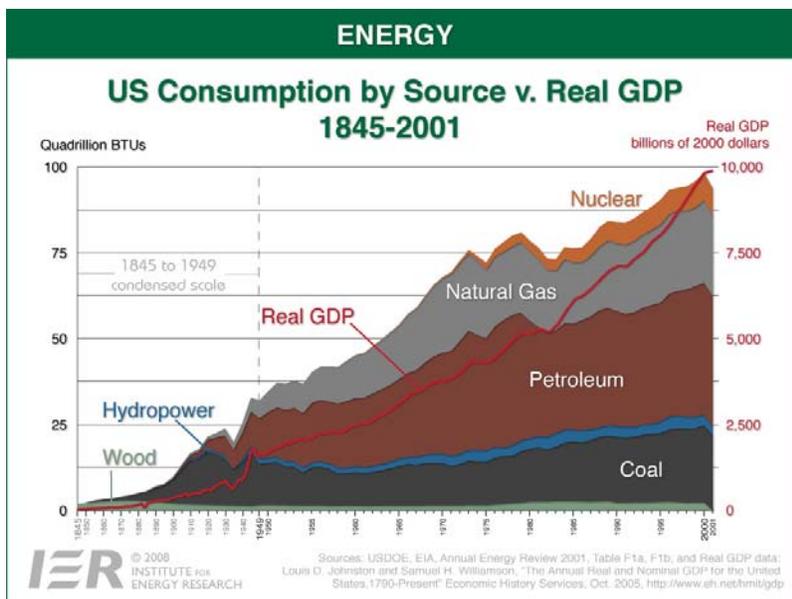
<sup>6</sup> New York Times: China Outpaces US in Cleaner Coal-Fired Plants-May 10, 2009 <http://www.nytimes.com/2009/05/11/world/asia/11coal.html>

<sup>7</sup> Reuters, Analysis: China clean energy plan hinges on coal price, August 27, 2010, <http://www.reuters.com/article/2010/08/27/us-china-clean-energy-idUSTRE67Q0Y520100827?pageNumber=2>

<sup>8</sup> Energy Information Administration, [http://www.eia.doe.gov/oiaf/beck\\_plantcosts/index.html](http://www.eia.doe.gov/oiaf/beck_plantcosts/index.html)

growth. Without reasonably priced energy, it will be difficult to achieve high levels of economic growth in the United States, and industry will move offshore where energy is more affordable, taking jobs away when we can least afford to lose them.

As the following chart illustrates, the use of energy to propel the U.S. economy and increase the capacity to do work led to unprecedented growth and opportunity. Of note is the fact that the U.S. economy once ran entirely on renewable forms of energy from well before our founding until well after the Civil War, at which time the advent of new forms of concentrated energy enabled us to surpass Britain in energy consumption and economic output. It is therefore important to understand China’s energy path today realistically. Data from the International Energy Agency indicated that China consumed more energy than the United States in 2009 – the first time since 1885 that the United States was no longer the number one user of energy.<sup>9</sup> Just 8 short years ago the United States used twice as much energy as China, according to statistics from the Energy Information Administration.<sup>10</sup>



### Comparison of Generating Capacity Data for the U.S. and China

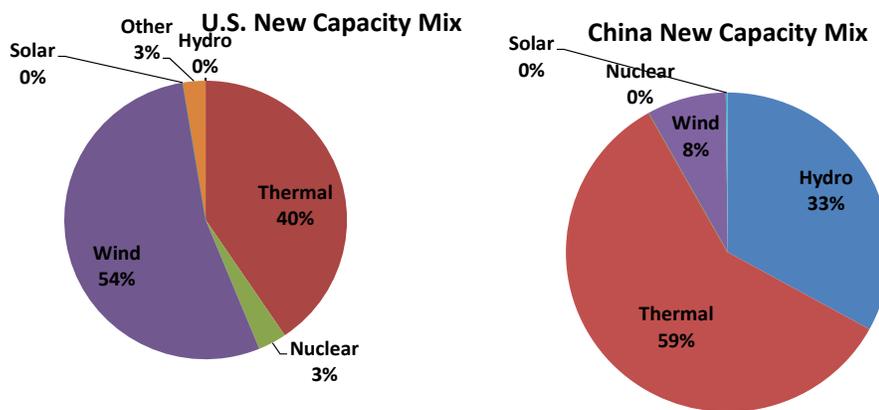
Energy Information Administration data for 2008 (the most recent year available from the Energy Information Administration) indicates that China added more than 5 times the total generating capacity that the United States did (80 gigawatts of total capacity for China, versus 15 gigawatts of capacity for

<sup>9</sup> The Wall Street Journal, China Passes US as the World’s Biggest Energy Consumer IEA, July 19, 2010, [http://online.wsj.com/article/SB10001424052748703720504575376712353150310.html?hat\\_input=China+Passes+U.S.+as+World%27s+Biggest+Energy+Consumer](http://online.wsj.com/article/SB10001424052748703720504575376712353150310.html?hat_input=China+Passes+U.S.+as+World%27s+Biggest+Energy+Consumer)

<sup>10</sup> Energy Information Administration, <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=44&pid=44&aid=2&cid=regions&syid=1996&eyid=2008&unit=QBTU>

the United States).<sup>11</sup> While that statistic is in itself interesting, the split between fuel types is even more interesting. Embedded in these capacity addition statistics is China’s 26 gigawatts of hydroelectric capacity to none for the United States. China also added 47 gigawatts of thermal capacity (primarily coal), while the U.S. added 6 gigawatts (primarily natural gas). That’s almost 8 times more thermal capacity and on a carbon dioxide-emitting basis, over 15 times more.

### Comparison of New Generating Capacity Mix for U.S. and China, 2008 (Percent)



Total New Capacity: 15 Gigawatts

Total New Capacity; 80 Gigawatts

**Note: New thermal capacity for the U.S. is natural gas-fired; new thermal capacity for China is coal-fired.**

Source: Energy Information Administration, International Energy Annual

So, based on an apples-to-apples comparison of newly built capacity in 2008, China is out stripping us in hydroelectric and coal-fired capacity, which the Administration and environmental organizations fail to mention. Not only did they build more hydroelectric and coal-fired capacity in 2008 than we did, but their total hydroelectric capacity is over twice that of the United States, and as of the end of 2008, their coal-fired capacity was almost twice that of the United States.

#### Why is China Building Wind and Solar Capacity?

China builds wind and solar partly because ratepayers in other countries pay them to do so. China has taken advantage of the Clean Development Mechanism (CDM) under the Kyoto Protocol to obtain

<sup>11</sup> Energy Information Administration, <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=7>

funding for its solar and wind power.<sup>12</sup> Under this program, administered by the United Nations, wealthy countries can contribute funds and get credit for “clean technology” built elsewhere as long as it is additional, that is, as long as that technology would not have been built otherwise. China is the world’s largest beneficiary of the program and has benefited to the point where about 30 percent of its wind capacity is not operable because it is not connected to the grid.<sup>13</sup> However, in mid 2009, the United Nations started questioning whether the Chinese CDM program was in fact “additional,” because the U.N. found that China was lowering its subsidies to qualify for the program.<sup>14</sup> That is, China was reducing its own government’s support in order to get international subsidies.

### **What are China’s Electric Construction Plans?**

Both China’s generating sector and its industrial sector rely heavily on coal, with 80 percent of its electric generation being coal-fired.<sup>15</sup> Even with China’s substantial clean energy targets, the Energy Information Administration expects fossil fuels, mostly coal, to generate 75 percent of the country’s electricity in 2035. Clean energy sources (nuclear, wind, solar, biomass, and hydroelectric power) generated 19 percent of China’s electricity in 2009, and they are expected to increase their share to 25 percent by 2035. China has the world’s largest hydroelectric capacity, generating 16 percent of its electricity from water.

### **Hydroelectric Power**

Most of China’s hydroelectric capacity is from very large dams on major rivers. China’s most famous hydroelectric project, the Three Gorges Dam that many thought was an impossible engineering feat, brought its final generator on line in October 2008, with a total capacity of 18.2 gigawatts. The Three Gorges Project Development Corporation plans to further increase the project’s total installed capacity to 22.4 gigawatts by 2012. The 12.6-gigawatt Xiluodu project on the Jinsha River is scheduled for completion in 2015 as part of a 14-facility hydropower development plan. China also has the world’s second tallest dam (at nearly 985 feet) currently under construction, as part of the 3.6-gigawatt Jinping I project on the Yalong River. It is scheduled for completion in 2014 as part of a plan by the Ertan Hydropower Development Company to construct 21 facilities with 34.6 gigawatts of hydroelectric capacity on the Yalong.

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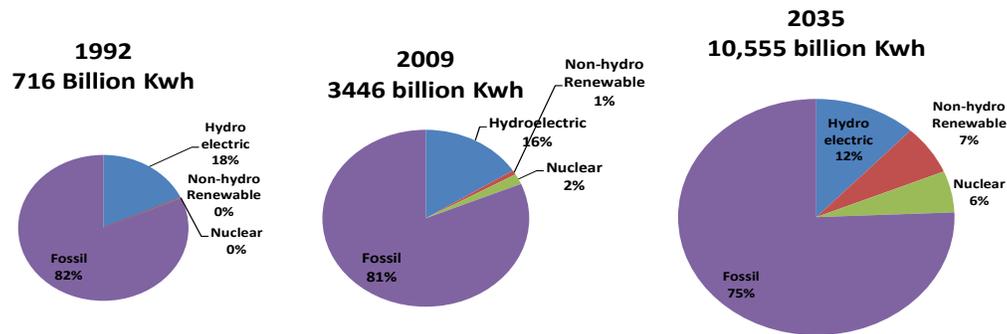
<sup>12</sup> CNN, U.N. halts funds to China wind farms, December 2, 2009, <http://edition.cnn.com/2009/BUSINESS/12/01/un.china.wind.ft/index.html>

<sup>13</sup> The Wall Street Journal, “China’s Wind Farms Come with a Catch: Coal Plants”, September 28, 2009, <http://online.wsj.com/article/SB125409730711245037.html>

<sup>14</sup> CNN, U.N. halts funds to China wind farms, December 2, 2009, <http://edition.cnn.com/2009/BUSINESS/12/01/un.china.wind.ft/index.html>

<sup>15</sup> Energy information Administration, International Energy Outlook 2010, Tables H11 and H14, <http://www.eia.doe.gov/oiaf/ieo/index.html>

## Electricity Generation Shares in China by Generator Type (Percent)



Source: Energy Information Administration

The Chinese government has set a target for 300 gigawatts of hydroelectric capacity by 2020, and according to the Energy Information Administration, the Chinese government has sufficient projects underway to meet the target.<sup>16</sup> China currently has about twice the hydroelectric capacity of the United States and its 2020 goal is almost four times more capacity than the United States is expected to have by then.

China has a goal to produce 15 percent of its primary energy from renewable energy by 2020.<sup>17</sup> According to an official from China's National Energy Administration, "Hydropower is the key to reaching that target. It will make up 9 to 10 percentage points out of the 15."<sup>18</sup> By comparison, most proposals for renewable energy mandates in the United States do not include existing hydroelectric power as a source.

<sup>16</sup> Energy Information Administration, International Energy Outlook 2010, page 88, <http://www.eia.doe.gov/oiaf/ieo/index.html>

<sup>17</sup> USA Today, "China Pushes Solar, Wind Power Development", [http://www.usatoday.com/money/industries/energy/environment/2009-11-17-chinasolar17\\_CV\\_N.htm](http://www.usatoday.com/money/industries/energy/environment/2009-11-17-chinasolar17_CV_N.htm)

<sup>18</sup> Analysis: China clean energy plan hinges on coal price, August 27, 2010, <http://www.reuters.com/article/2010/08/27/us-china-clean-energy-idUSTRE67Q0Y520100827?pageNumber=2>

## Wind

The Global Wind Energy Council reports that China had 42,287 megawatts of wind capacity at the end of 2010, 5 percent more than the U.S. total of 40,180.<sup>19</sup> China added 16,500 megawatts in 2010 to 5,115 megawatts added by the United States. Both Europe and the United States saw a slowdown in installations of wind turbines due to the financial crisis, reduced electricity demand expectations, and issues regarding the future forms of subsidies.

According to the Pew Environment Group, China has a goal to produce 150,000 megawatts of wind by 2020.<sup>20</sup> To help meet this goal, China is planning to build the world's largest wind farm in the northwest part of the country. The plan was to complete 5 gigawatts in 2010, and expand to 20 gigawatts by 2020, at a cost of \$1 million per megawatt,<sup>21</sup> or \$1,000 per kilowatt, about 40 percent of the cost of an onshore wind unit in the United States, according to the Energy Information Administration.<sup>22</sup>

Unlike the United States that can back up its wind power with several fuel types, China backs up its wind power with coal-fired plants when the wind does not blow or when the electric grid is inadequate to handle the wind capacity. According to the China Power Union, only 72 percent of the country's total wind power capacity is connected to the grid.<sup>23</sup> Adding to the problem is poor connectivity between regional transmission networks, which makes it difficult to move surplus power from one part of the country to another and thus requires each region to have sufficient reserve capacity.<sup>24</sup> For example, the wind project in Jiuquan in Gansu, although fairly large at 10 gigawatts, is located too far from the regional load-bearing center. In Inner Mongolia, less than 2 gigawatts of wind power was originally connected to the grid, with an additional 8.3 gigawatts needing to be connected. China plans to spend

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<sup>19</sup> Global Wind Energy Council, <http://www.gwec.net/fileadmin/images/newsletter/Top%2010%20total%20installed%20capacity%202010.jpg>

<sup>20</sup> The PEW Environment Group, <http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/G-20Report-LOWRes-FINAL.pdf>

<sup>21</sup> The Wall Street Journal, "Wind Power: China's Massive and Cheap Bet on Wind Farms", July 6, 2009, <http://blogs.wsj.com/environmentalcapital/2009/07/06/wind-power-chinas-massive-and-cheap-bet-on-wind-farms/>

<sup>22</sup> Energy Information Administration, [http://www.eia.doe.gov/oiaf/beck\\_plantcosts/index.html](http://www.eia.doe.gov/oiaf/beck_plantcosts/index.html)

<sup>23</sup> Asia Times, China's wind power has faulty connection, June 16, 2010, [http://www.atimes.com/atimes/China\\_Business/LF16Cb03.html](http://www.atimes.com/atimes/China_Business/LF16Cb03.html)

<sup>24</sup> The Wall Street Journal, "China's Wind Farms Come with a Catch: Coal Plants", September 28, 2009, <http://online.wsj.com/article/SB125409730711245037.html>

over \$600 billion to upgrade its power grid to accommodate all of its new electricity expansion over the next decade.<sup>25</sup>

Currently China is mainly manufacturing wind turbines for domestic use, but with saturation in China's domestic market, many wind turbine manufacturers have looked to overseas markets to meet their expanding output. With the Investigative Reporting Workshop of the American University finding that 79 percent of U.S. stimulus funds for renewable projects have gone to overseas firms, mainly for wind projects, it is no wonder that the Chinese are looking into U.S. markets.<sup>26</sup> China's wind industry tried to enter the U.S. market to build a 600-megawatt wind farm in West Texas as part of a consortium of Chinese and American companies. The original proposal had the wind turbines manufactured in China, creating thousands of jobs there, but only a few hundred temporary installation jobs in the United States.<sup>27</sup> Due to criticism from some U.S. senators, the Chinese firm agreed to build a plant in Nevada to manufacture turbine parts. However, although the Chinese are providing the financing for the project, the consortium needs \$450 million, 30 percent of the wind farm's cost, to come from a federal stimulus grant. The \$1.5 billion cost for the project is \$2.31 million per megawatt, or \$2,310 per kilowatt,<sup>28</sup> over twice the cost of wind farms in China.

Not only does China want to enter in the U.S. market by building wind farms, but U.S. manufacturers have plants in China, capitalizing on their lower labor cost. GE, a major U.S. wind turbine producer, already owns three facilities in China that produce turbine components.<sup>29</sup> And it opened a factory<sup>30</sup> in Vietnam that employs 500 local workers and will export 10,000 tons of components to GE Energy assembly plants around the world.<sup>31</sup>

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<sup>25</sup> Asia Times, China's wind power has faulty connection, June 16, 2010, [http://www.atimes.com/atimes/China\\_Business/LF16Cb03.html](http://www.atimes.com/atimes/China_Business/LF16Cb03.html)

<sup>26</sup> Investigative Reporting Workshop, Renewable energy money still going abroad, despite criticism from Congress, February 8, 2010, <http://investigativereportingworkshop.org/investigations/wind-energy-funds-going-overseas/story/renewable-energy-money-still-going-abroad/>

<sup>27</sup> [www.reuters.com/article/pressRelease/idUS200008+29-Oct-2009+BW20091029](http://www.reuters.com/article/pressRelease/idUS200008+29-Oct-2009+BW20091029)

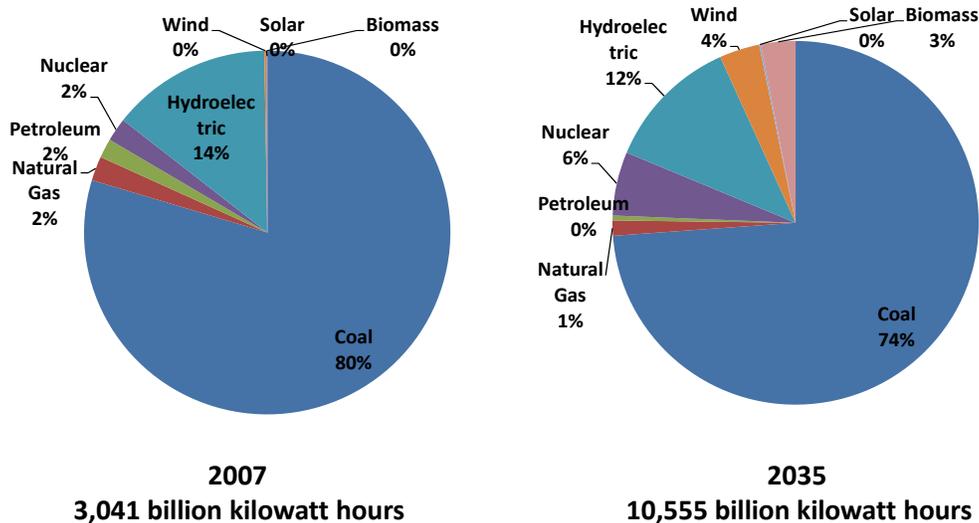
<sup>28</sup> <http://theheartofamerica.wordpress.com/2011/01/10/wind-farms-courtesy-of-china/>

<sup>29</sup> "Overseas firms collecting most green energy money", October 29, 2009, <http://investigativereportingworkshop.org/investigations/wind-energy-funds-going-overseas/>

<sup>30</sup> Viet Nam Business News, GE factory to be put into operation, October 15, 2010, <http://vietnambusiness.asia/ge-energy-factory-to-be-put-into-operation/>

<sup>31</sup> "Vietnam's first turbine component plant underway", May 13, 2009, <http://www.vietnews.vn/News/Business/Companies-Finance/6072/Vietnams-first-turbine-component-plant-underway.htm>

## Coal Dominates China's Electric Generation Even in 2035 (Percent)



Source: Energy Information Administration, International Energy Outlook 2010

### Solar

China leads the world in solar cell manufacture, but 95 percent of its production is exported.<sup>32</sup> According to the Pew Environment Group, China had 800 megawatts of solar capacity at the end of 2010 compared to 3,100 megawatts in the United States. China's target for 2020 is 20,000 megawatts of solar capacity so it has a long way to go.<sup>33</sup> In 2009, China generated only 0.01 percent of its grid-connected electricity from solar energy.<sup>34</sup> However, Arizona-based First Solar has signed a deal to build the first phase (30 megawatts) of what was to be the world's largest solar farm (2,000 megawatts) in China in cooperation with China Guangdong Nuclear Solar Energy Development Company Ltd. (CGN SEDC). CGN

<sup>32</sup> <http://www.guardian.co.uk/world/2009/may/26/china-invests-solar-power-renewable-energy-environment>

<sup>33</sup> The Pew Environment Group, <http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/G-20Report-LOWRes-FINAL.pdf>

<sup>34</sup> Energy Information Administration, International Energy Statistics, <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=2&pid=36&aid=12&cid=regions&syid=2005&eyid=2009&unit=BKWH>

SEDC will be the majority project owner and operator, providing the engineering, procurement and construction functions. First Solar will supply its thin-film solar photovoltaic modules and will support CGN SEDC with advisory services.<sup>35</sup>

Realizing that the United States may be a good market for solar, China's Suntech, the world's largest supplier of solar panels, opened a solar manufacturing plant in Arizona last year.<sup>36</sup> Suntech will be supplying solar panels to the 150-megawatt Mesquite solar plant in Arizona with construction beginning this year and completion in 2013. The company has orders for 350 megawatts of utility sales in 2011.<sup>37</sup> Suntech's factory will create finished panels from subcomponents that will be manufactured in the company's Chinese facilities. According to Suntech, locating the assembly in the U.S. will lower delivery time and costs, as well as reduce the overall carbon footprint of getting finished panels to U.S. customers.<sup>38</sup>

Due to lower operating costs in China, a U.S.-based firm, Evergreen Solar, after receiving at least \$43 million in incentives from the state of Massachusetts, moved its assembly plant to China, laying off 800 workers in the United States.<sup>39</sup> Chinese solar manufacturers have been able to lower prices because of financing from state-owned banks and lower manufacturing costs. World prices for solar panels have fallen as much as two-thirds in the last three years.

## **Nuclear**

According to the World Nuclear Association, China has 13 nuclear reactors operating and at least 25 reactors under construction, half of the units in the world's construction pipeline. Many more units are planned with construction due to start within three years. As of June 2010, official installed nuclear capacity projections were 70 to 80 gigawatts by 2020, 200 gigawatts by 2030 and 400 to 500 gigawatts by 2050.<sup>40</sup> If China meets its 2030 target, it will have twice the amount of nuclear capacity as the United

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<sup>35</sup> First Solar and China Guangdong Nuclear to co-develop Ordos project, January 7, 2011, [http://www.semiconductor-today.com/news\\_items/2011/JAN/FIRSTSOLAR3\\_070111.htm](http://www.semiconductor-today.com/news_items/2011/JAN/FIRSTSOLAR3_070111.htm)

<sup>36</sup> Suntech opens solar panel factory in Goodyear, Arizona, October 8, 2010, <http://www.brighterenergy.org/17375/news/solar/suntech-opens-solar-panel-factory-in-goodyear-arizona/>

<sup>37</sup> Suntech Solar Panels Head to Arizona Plant, February 26, 2011, <http://www.earthtechling.com/2011/02/suntech-solar-panels-head-to-arizona-plant/>

<sup>38</sup> Business Week, "China Solar Panel Maker Sets First U.S. Plant", November 15, 2009, [http://www.businessweek.com/technology/content/nov2009/tc20091115\\_970512.htm](http://www.businessweek.com/technology/content/nov2009/tc20091115_970512.htm)

<sup>39</sup> Solar Panel Maker Moves Work to China, January 14, 2011, <http://www.nytimes.com/2011/01/15/business/energy-environment/15solar.html>

<sup>40</sup> World Nuclear Association, March 10, 2011, <http://www.world-nuclear.org/info/inf63.html>

States.<sup>41</sup> China Daily reports that nuclear power should contribute up to six percentage points towards China's goal of attaining 15 percent of primary energy consumption from non-fossil energy by 2020.<sup>42</sup>

China has under construction the world's first Westinghouse AP1000 units, a demonstration high-temperature gas-cooled reactor plant. China's four AP 1000 reactors under construction at two different sites, Haiyang and Sanmen,<sup>43</sup> are the same reactors that the U.S. Nuclear Regulatory Commission (NRC) has ruled need additional analysis, testing, or design modifications of the shield building to ensure compliance with NRC requirements.<sup>44</sup> At least eight more at four sites are planned, and about 30 more are proposed to follow. For the first four units, construction is expected to take 50 months from pouring of concrete to fuel loading and an additional six months to be connected to the grid. The construction time is expected to be significantly reduced for the following units. The cost of the first four is expected to be less than \$2000 per kilowatt and \$1600 per kilowatt for future units.<sup>45</sup> The initial cost is over 2.5 times the cost projected for a plant built in the United States exclusive of financing costs, according to the Energy Information Administration.<sup>46</sup> China builds these reactors at lower cost than the United States because of less red tape, state-owned financing, and low cost labor familiar with large infrastructure projects.

The Chinese are aiming to enter into the global nuclear marketplace by 2013—just a few short years. With Western know-how being transferred and low-cost manpower, China can become a formidable competitor, as they have become to wind and solar markets. The World Nuclear Association indicates that the Chinese are very quickly becoming self-sufficient in reactor design. That is not surprising, when western nuclear companies provide technical training and related documents to the Chinese. Westinghouse, for example, as part of their contractual agreement with its Chinese customers, turned over more than 75,000 technical documents.

The United States is not the only country working with the Chinese to construct nuclear plants. France, for example, is honchoing a project of third-generation reactors in the Guangdong province, where construction on two European pressurized reactors is underway based on a contract signed in

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<sup>41</sup> Energy Information Administration, Annual Energy Review, Table 8.11a

<sup>42</sup> China Daily, China's nuclear power set to increase sevenfold by '20, August 27, 2010, [http://www.chinadaily.com.cn/business/2010-08/27/content\\_11217181.htm](http://www.chinadaily.com.cn/business/2010-08/27/content_11217181.htm)

<sup>43</sup> Westinghouse News Releases, Westinghouse and the Shaw Group Celebrate First Concrete Pour at Haiyang Nuclear Site in China, September 29, 2009, <http://westinghousenuclear.mediaroom.com/index.php?s=43&item=200>

<sup>44</sup> Westinghouse Statement Regarding NRC News Release on AP1000 Shield Building, <http://westinghousenuclear.mediaroom.com/index.php?s=43&item=203>

<sup>45</sup> World Nuclear Association, March 10, 2011, <http://www.world-nuclear.org/info/inf63.html>

<sup>46</sup> Energy Information Administration, [http://www.eia.doe.gov/oiaf/beck\\_plantcosts/index.html](http://www.eia.doe.gov/oiaf/beck_plantcosts/index.html)

November 2007 with France's Areva. In fact, work is progressing much better than the company's other projects due to the experience Areva gained on them and to the 9,000 Chinese laborers on-site, who work 7 days a week at 10-hour shifts. The first reactor should be on-line at the end of 2013 and the second in the fall of 2014. Two more may follow in the future.<sup>47</sup> Clearly, western nuclear companies are hoping for a long-term partnership with the Chinese, but, in reality, they may only be gaining near term profits, instead.

Public concern over Japan's nuclear accident has led China to review the safety of its operating and proposed nuclear units. The country temporarily suspended approvals for new nuclear units to revise its safety standards and has asked for safety checks at their six operating nuclear plants.<sup>48</sup> One of the problems at the Japanese nuclear units affected by the earthquake and the tsunami has been fixed in the design of advance nuclear reactors. Instead of using diesel generators to pump cooling water into the reactors, Westinghouse's AP1000 uses a passive cooling system where water circulates by natural convection instead of needing electricity to pump the cooling water.<sup>49</sup>

## Coal

China gets over 70 percent of its energy from coal,<sup>50</sup> and 80 percent of its electricity. According to the Department of Energy's National Energy Technology Laboratory (NETL), from 2006 through 2009, China has been building 55 to 80 gigawatts of coal-fired power a year, and has over 70 gigawatts more under construction. NETL reports that China has plans to build over 200 gigawatts of coal-fired plants in the near future.<sup>51</sup> (See figure below.)

According to Australia, China is planning to build 500 coal-fired plants over the next ten years.<sup>52</sup> That means every week or so, for the next decade, China will open another large coal-fired power plant. The Energy Information Administration forecasts that coal will still generate about 75 percent of China's electricity in 2035, even with its massive building programs in other generating technologies. According

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<sup>47</sup> Guardian, Construction schedule on Chinese third-generation nuclear plants races ahead of European models, December 28, 2010, <http://www.guardian.co.uk/environment/2010/dec/28/china-areva-taishan-nuclear-thibault>

<sup>48</sup> China freezes nuclear plant approvals, March 16, 2011, <http://edition.cnn.com/2011/WORLD/asiapcf/03/16/china.nuclear/?hpt=T2>

<sup>49</sup> The Wall Street Journal, Japan Does Not Face Another Chernobyl, March 14, 2011, <http://online.wsj.com/article/SB10001424052748704893604576198421680697248.html>

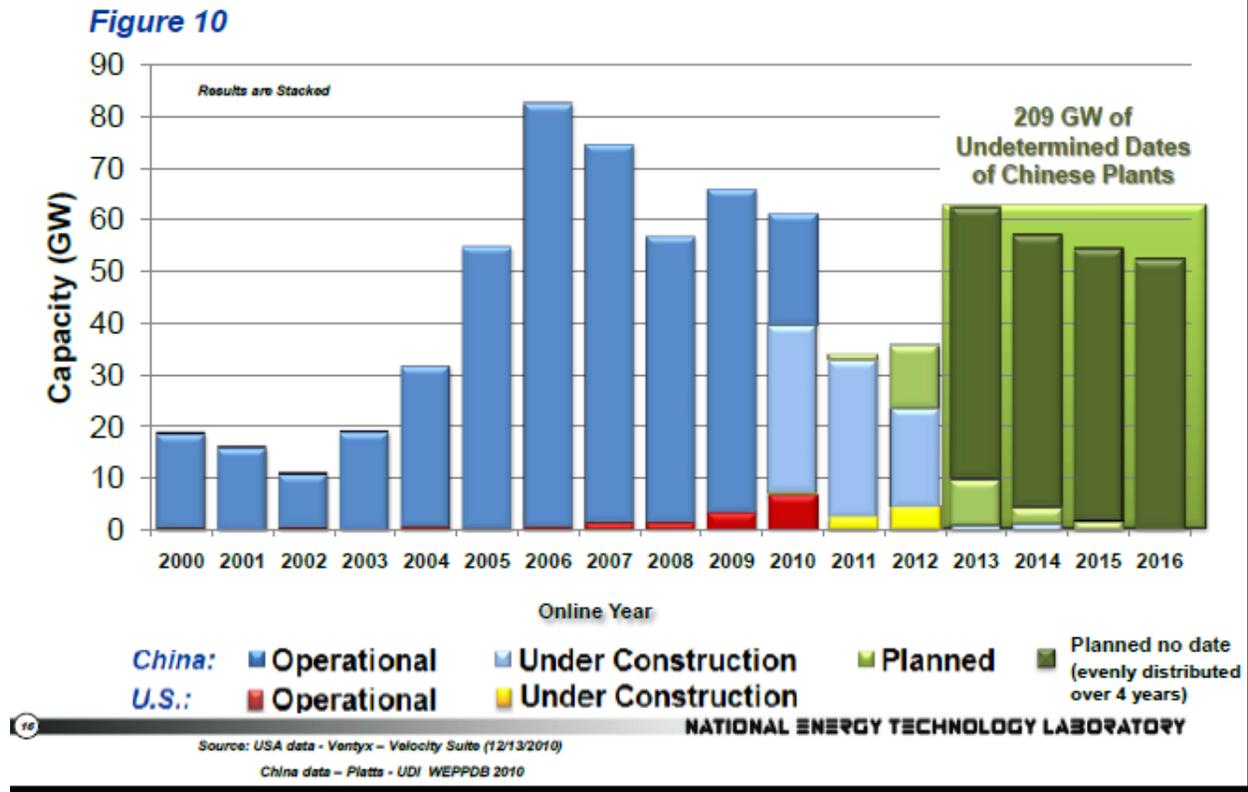
<sup>50</sup> Energy Information Administration, <http://www.eia.doe.gov/countries/cab.cfm?fips=CH>

<sup>51</sup> National Energy Technology Laboratory, Tracking New Coal-fired Power Plants, January 14, 2011, <http://www.netl.doe.gov/coal/refshelf/ncp.pdf>

<sup>52</sup> <http://windfarms.wordpress.com/2009/01/29/china-building-500-coal-plants/>

to Ashok Bhargava, a China energy expert at the Asian development bank, “No matter how much renewable or nuclear is in the mix, coal will remain the dominant power source.”<sup>53</sup>

## Coal-Fired Build Rate China and United States



### Prospects for Electric Capacity in the United States

The United States has made it difficult to build generating plants in this country, particularly coal-fired and nuclear power plants. According to NETL, only eleven coal-fired plants totaling 6,682 megawatts became operational in the United States in 2010, but this was the largest increase in coal-fired capacity additions in one year since 1985.<sup>54</sup> Prospects of cap-and-trade legislation, reviews and re-reviews by the Environmental Protection Agency, direct action protests, petition drives, renewable portfolio mandates

<sup>53</sup> New York Times, China Outpaces U.S. in Cleaner Coal-Fired Plants, May 10, 2009, <http://www.nytimes.com/2009/05/11/world/asia/11coal.html>

<sup>54</sup> National Energy Technology Laboratory, Tracking New Coal-fired Power Plants, January 14, 2011, <http://www.netl.doe.gov/coal/refshelf/ncp.pdf>

in many states, competition from subsidized and mandated wind power, and lawsuits have slowed the construction of new coal-fired plants.<sup>55</sup> According to the Sierra Club, plans for over 150 coal plants have been shelved due to their activities.<sup>56</sup> The graph above compares the coal-plant additions in the United States to that of China, showing only a handful of coal plants under construction in the United States. Because the capital cost of most of our existing coal-fired plants has been paid, that fleet produces 45 percent of our electricity at very little cost. Average production costs for coal-fired generators in 2009 were only 2.97 cents per kilowatt hour, slightly higher than our nuclear plants at 2.03 cents per kilowatt hour.<sup>57</sup>

No nuclear plant has started up in the United States since 1996, and no construction permits have been issued since 1979. NRC requirements, financing difficulties, and slow fulfillment of the nuclear provisions of the Energy Policy Act of 2005 have slowed the construction of new nuclear power reactors. However, as part of the 2005 Energy Policy Act, President Obama announced that his administration is offering conditional commitments for \$8.33 billion in loan guarantees for nuclear power construction and operation. Two new 1,100 megawatt Westinghouse AP1000 nuclear reactors were to be constructed at the Alvin W. Vogtle Electric Generating Plant in Burke, Georgia, supplementing the two reactors already at the site. Before the nuclear accident in Japan, the two new nuclear generating units were expected to begin commercial operation in 2016 and 2017 at a cost of \$14 billion. As part of the conditional loan guarantee deal, the U.S. Nuclear Regulatory Commission must determine if the AP1000 fulfills the regulatory requirements for a construction and operating license. (These are the same units permitted, licensed, and being constructed in China right now.) But, as a recent Wall Street Journal energy conference noted, loan guarantees are “meaningless in the absence of regulatory certainty.”<sup>58</sup>

Natural gas and wind power are the technologies that seem best able to surmount the financial, regulatory, and legal hurdles of getting plants permitted and operational in the United States. However, organized local opposition has halted even some renewable energy projects by using “not in my back yard” (NIMBY) arguments, changing zoning laws, opposing permits, filing lawsuits, and bleeding projects

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<sup>55</sup> A messy but practical strategy for phasing out the U.S. coal fleet, <http://www.grist.org/article/death-of-a-thousand-cuts/>

<sup>56</sup> Sierra Club, <http://www.sierraclub.org/coal/contact.aspx>

<sup>57</sup> Nuclear Energy Institute, <http://www.nei.org/resourcesandstats/documentlibrary/reliableandaffordableenergy/graphicsandcharts/uselectritycityproductioncosts>

<sup>58</sup> The Wall Street Journal, An Energy Head Fake, March 11, 2010, [http://online.wsj.com/article/SB10001424052748704784904575112144130306052.html?mod=WSJ\\_Opinion\\_AboveLEFTTop](http://online.wsj.com/article/SB10001424052748704784904575112144130306052.html?mod=WSJ_Opinion_AboveLEFTTop)

of their financing.<sup>59</sup> Delay in capital intensive energy projects many times equates to denial, because of the economic exposure.

### **Generating Costs of New Technologies**

According to the Energy Information Administration (EIA), the annualized cost of solar photovoltaic technology is 21.07 cents per kilowatt hour (in 2009 dollars), and solar thermal is 31.18 cents per kilowatt hour. Offshore wind is expected to cost 24.32 cents per kilowatt hour, and onshore wind is less at 9.7 cents per kilowatt hour. These costs are levelized costs, which is the present value of the total cost of building and operating a generating plant over its financial life, converted to equal annual payments and amortized over expected annual generation. The EIA estimates these costs for the year 2016, which is the first future year that generating technologies can be compared because of the different lead times for building the plants. Some plants, such as photovoltaic plants, require 1 or 2 years to build, while others (such as nuclear plants) require 6 or more years.<sup>60</sup>

The costs for new solar and wind technologies are generally higher than the costs of competing technologies. For 2016, natural gas combined-cycle technologies have costs estimated at 6.31 to 6.61 cents per kilowatt hour, and pulverized coal and coal-fired integrated gasification combined-cycle technologies have costs of 9.48 and 10.94 cents per kilowatt hour, respectively. EIA includes a 3-percentage point increase in the cost of capital when evaluating investments in greenhouse gas intensive technologies to represent the difficulties in obtaining financing, which is equivalent to a \$15 per ton carbon dioxide emission fee.<sup>61</sup> (See figure below.)

If one considers just the capital cost of building these plants, without finance charges, the EIA estimates those at \$4,755 per kilowatt (in 2009 dollars) for photovoltaic technology, \$4,692 per kilowatt for solar thermal technology, and \$5,975 for offshore wind.<sup>62</sup> Of course, plant costs can vary depending on site locations, terrain, labor costs, and other factors. For a solar photovoltaic plant that came on line last October in southern Florida, Florida Power and Light spent \$152 million building a 25-megawatt plant, which is equivalent to \$6,080 per kilowatt.<sup>63</sup>

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<sup>59</sup> For a repository of stalled and stopped energy projects, see U.S. Chamber of Commerce, “Project No Project Energy-Back On Track”, <http://pnp.uschamber.com/>

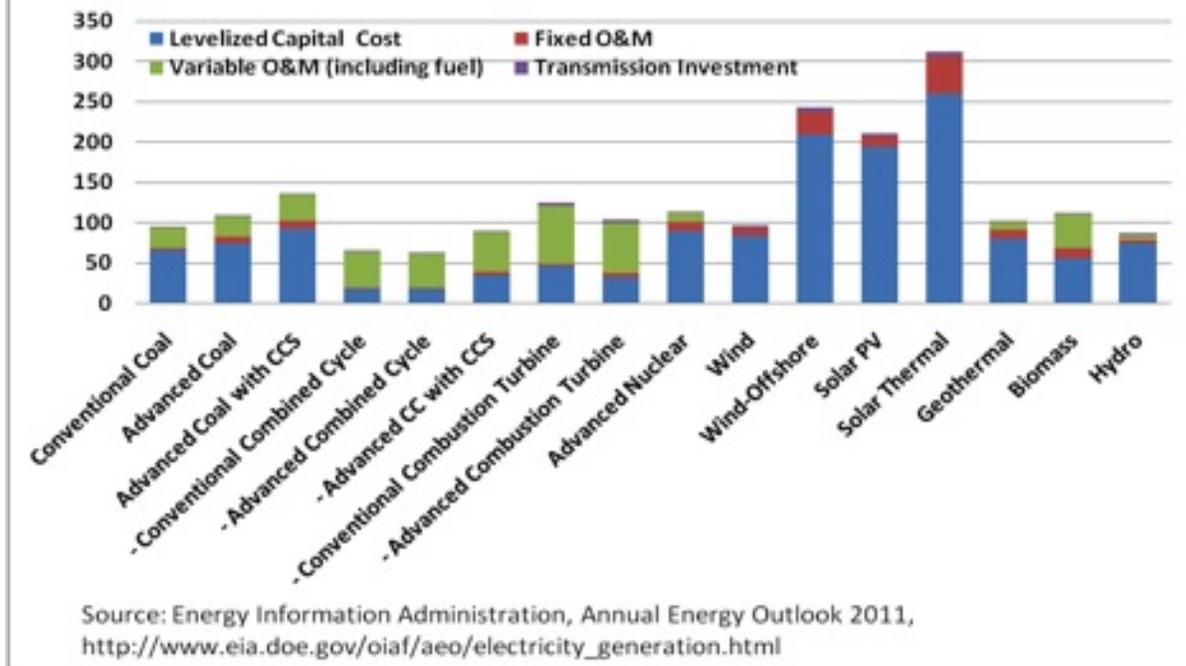
<sup>60</sup> Energy Information Administration, 2016 Levelized Cost of New Generation Resources from the Annual Energy Outlook 2011, [http://www.eia.doe.gov/oiaf/aeo/electricity\\_generation.html](http://www.eia.doe.gov/oiaf/aeo/electricity_generation.html) .

<sup>61</sup> Ibid.

<sup>62</sup> Energy Information Administration, [http://www.eia.doe.gov/oiaf/beck\\_plantcosts/index.html](http://www.eia.doe.gov/oiaf/beck_plantcosts/index.html)

<sup>63</sup> “Solar plant set to open, even as shadows loom”, Herald Tribune, Zac Anderson, Oct. 14, 2009, <http://www.heraldtribune.com/article/20091014/ARTICLE/910141033/2055/NEWS?Title=Solar-plant-set-to-open-even-as-shadows-loom>

## Estimated Levelized Cost of New Electricity Generating Technologies in 2016 (2009\$/megawatt hour)



The Cape Wind project, off the coast of Cape Cod in Massachusetts, is expected to be the first offshore wind farm in the United States. The 130-turbine wind farm is estimated to cost at least \$2 billion and was approved last year by Interior Secretary Ken Salazar after more than eight years of federal review. National Grid, the state’s largest utility, is to buy half of Cape Wind’s power, starting at 18.7 cents per kilowatt hour,<sup>64</sup> less than EIA’s estimate of 24.32 cents per kilowatt hour, but increasing annually at 3.5 percent in a 15 year deal. But that’s still about twice what the utility pays for power from conventional sources, and almost twice the average U.S. cost of electricity—9.9 cents per kilowatt in 2010.<sup>65</sup> As one

<sup>64</sup> The Associated Press, Mass. court rejects challenge to Cape Wind permit, August 31, 2010, <http://www.google.com/hostednews/ap/article/ALeqM5gz8VVwo2TgZdHn9MmdvajdSGq2QD9HUN0TO3>

<sup>65</sup> Energy Information Administration, [http://www.eia.doe.gov/totalenergy/data/monthly/pdf/sec9\\_14.pdf](http://www.eia.doe.gov/totalenergy/data/monthly/pdf/sec9_14.pdf)

might expect, the project is having trouble getting buyers for the other half of the project's output due to its high cost.<sup>66</sup>

## Summary

China is on a fast track to bring online new generating units using coal, nuclear, hydroelectric, solar, and wind power, which will allow its economy to continue to grow. Because China is endowed with a sizable amount of coal resources and because coal is the cheapest energy source in China, coal-fired generating additions will far outpace those of other technologies. By continuing to rely heavily on currently available coal technology, China will remain the number one emitter of carbon dioxide. According to the Energy Information Administration, China's carbon dioxide emissions are already 5 percent higher than those of the United States, and by 2035, they are expected to be over twice that of the United States.<sup>67</sup>

The United States, on the other hand, has made it difficult to build generating plants in this country. Prospects of cap-and-trade legislation and reviews and re-reviews as well as changing emissions requirements by the Environmental Protection Agency have slowed the construction of new coal-fired plants. NRC requirements, financing difficulties, and slow fulfillment of the nuclear provisions of the Energy Policy Act of 2005 have slowed the construction of new nuclear power reactors. Even renewable energy projects have been halted by "not in my back yard" (NIMBY) protesters. They have blocked energy projects by organizing local opposition, changing zoning laws, opposing permits, filing lawsuits, and bleeding projects dry of their financing. Without reasonably priced energy, it will be difficult to achieve high levels of economic growth, and U.S. industry will just move offshore where energy is more affordable.

Our President has a goal to reduce oil imports by one-third by 2025 to improve our energy security. However, we may be just trading one energy source for another since Chinese manufacturers can easily produce solar and wind generating technologies for far less than manufacturers in the United States. After many years of relying on unstable governments in the Middle East and elsewhere for oil, the United States may now turn to China for renewable energy technologies.

The United States became the world's most productive economy by using its energy resources to increase output and make life better for its citizens. Contrary to the claims of some, the Chinese are not fixated on "green technology" solely, and in fact, are growing other parts of their energy mix much more extensively. The Chinese are building all generating technologies much more quickly than the United States, and are using energy to build an economy for the future.

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<sup>66</sup> Associated Press, Wanted: Buyer for controversial Cape Wind energy, December 19, 2010, <http://www.sfgate.com/cgi-bin/article.cgi?f=/n/a/2010/12/19/national/a081715S27.DTL> and <http://www.instituteforenergyresearch.org/2010/12/29/expensive-offshore-wind-in-need-of-customers/>

<sup>67</sup> Energy Information Administration, International Energy Outlook 2010, Table A10, <http://www.eia.doe.gov/oiaf/ieo/index.html>

At IER, we urge Members of the Committee to look at this matter comprehensively, since history tells us energy consumption is directly linked with economic growth. Should the United States choose to concentrate solely on a path of expensive energy sources for our future “capacity to do work,” our nation will do less work. That is a stark departure from the path that led and sustained our position in the world, and has implications far beyond those related to energy security.

Thank you for the opportunity to supply this testimony for the Committee’s use.

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