

Industrial Policy and Renewable Energy: Trade Conflicts

Bob Carbaugh and Max St. Brown*

Central Washington University and Washington State University

Abstract Governments use industrial policy to promote the development of new industries and the creation and adoption of new technologies. Such policy involves subsidies granted to producers and consumers, usually for the purpose of correcting a market failure. Concerning renewable energies such as wind energy and solar energy, China, the United States, and the European Union provide extensive support to producers and consumers. This support has resulted in trade frictions among these nations. This paper discusses the relationship between industrial policy and trade disputes in renewable energy.

Keywords: Industrial policy, energy

JEL classification: A1, F1, L5

1. Introduction

Renewable energies including solar, wind, geothermal, and biomass energy are used in about 2 percent of total U.S. electricity generation. The use of renewable energy and forecasts of its growth are low because the cost of renewable energy-fired electricity is greater than that of its main competitor, combined-cycle natural gas (natural gas or synthesis natural gas made from coal), as seen in Table 1. Few analysts believe that this will change any time soon. Also, renewable energy sources are capital intensive compared with combined-cycle natural gas. In deregulated electricity markets, investors lack any guarantee that capital costs will be recovered from customers. Therefore, investors tend to desire technologies that have higher marginal but lower capital costs, such as combined-cycle natural gas. However, advocates of renewable energy argue that the demand for renewables would increase if conventionally generated electricity were priced to reflect its pollution cost.

Governments use “industrial policy” to promote the development of new industries, such as renewable energy, and the creation and adoption of new technologies. Such policy involves government subsidies granted to producers and consumers, usually for the goal of correcting a market failure. For example, renewable energy is heavily subsidized in China, the United States, the European Union, and elsewhere. Among the main motivations for subsidizing renewable energy are to decrease carbon emissions and dependence on foreign oil, to diversify sources of energy and foster entrepreneurial ingenuity and the positive spillover effects on innovation, to promote new innovations that will drive down the cost of using the new technology, and to create jobs. These subsidies artificially decrease the price of energy paid by consumers, increase

the price received by producers, or reduce the cost of production.

However, large-scale industrial policies can promote trade conflicts among competing nations, as seen in renewable energy. The U.S.-China renewable-energy trade dispute and the dispute involving Brazil and the United States are examples of such conflicts. This paper examines the use of industrial policies to promote wind energy and solar power production in light of trade frictions that have surfaced between the United States and China. These frictions are likely to become more frequent as countries continue to enact policies to promote their renewable energy industries.

2. Dynamic Comparative Advantage and Industrial Policy

David Ricardo's theory of comparative advantage has influenced international trade theory and policy for almost 200 years. It implies that nations are better off by promoting free trade and allowing competitive markets to determine what should be produced and how. Ricardian theory emphasizes specialization and reallocation of existing resources found domestically. It is essentially a static theory that does not allow for a dynamic change in industries' comparative advantage or disadvantage over the course of several decades. The theory overlooks the fact that additional resources can be made available to the trading nation because they can be created or imported. (Ricardo, 1817)

The remarkable postwar economic growth of the East Asian countries appears to be based on a modification of the static concept of comparative advantage. The Japanese were among the first to recognize that comparative advantage in a particular industry can be created through the mobilization of skilled labor, technology, and capital. They also realized that, in addition to the business sector, government can establish policies to promote opportunities for change through time. Such a process is known as dynamic comparative advantage. When government is actively involved in creating comparative advantage, the term industrial policy applies.

In its simplest form, industrial policy is a strategy to revitalize, improve, and develop an industry. Proponents maintain that government should enact policies that encourage the development of emerging, "sunrise" industries, such as high-technology. This strategy requires that resources be directed to industries in which productivity is highest, linkages to the rest of the economy are strong, and future competitiveness is important. Presumably, the domestic economy will enjoy a higher average level of productivity and will be more competitive in world markets as a result of such policies.

A variety of government policies can be used to foster the development and revitalization of industries; examples are antitrust immunity, tax incentives, R&D subsidies, loan guarantees, low-interest-rate loans, and trade protection. Creating comparative advantage requires government to identify the "winners" and encourage resources to move into industries with the highest growth prospects.

To better understand the significance of dynamic comparative advantage, we might think of it in terms of the classic example of Ricardo's theory of comparative advantage. (Carbaugh, 2011) His example showed that, in the eighteenth century, Portugal and England would each have gained by specializing respectively in the production of wine and cloth, even though Portugal might produce both cloth and wine more cheaply than England. According to static comparative-advantage theory, both nations would be better off by specializing in the product in which they had an existing comparative advantage.

However, by adhering to this prescription, Portugal would sacrifice long-run growth for short-run gains. If Portugal adopted a dynamic theory of comparative advantage instead, it would specialize in the growth industry of that time (cloth). The Portuguese government (or Portuguese textile manufacturers) would thus initiate policies to foster the development of its cloth industry. This strategy would require Portugal to think in terms of acquiring or creating strength in a "sunrise" sector instead of simply accepting the existing supply of resources and using that endowment as productively as possible.

Countries have used industrial policies to develop or revitalize basic industries, including steel, autos, chemicals, transportation, and other important manufactures. Each of these industrial policies differs in character and approach; common to all is an active role for government in the economy. Usually, industrial policy is a strategy developed collectively by government, business, and labor through some sort of tripartite consultation process. However, many people are dubious of the merits of industrial policy, because they are skeptical about the ability of governments to correctly identify and then to correct market failures. (Rodrik, 2009)

Advocates of industrial policy typically cite Japan as a nation that has been highly successful in penetrating foreign markets and achieving rapid economic growth. Following World War II, the Japanese were the high-cost producers in many basic industries (such as steel). In this situation, a static notion of comparative advantage would require the Japanese to look to areas of lesser disadvantage that were more labor-intensive (such as textiles). Such a strategy would have forced Japan into low-productivity industries that would eventually compete with other East Asian nations having abundant labor and modest living standards.

Instead, the Japanese invested in basic industries (steel, autos, and later electronics, including computers) that required intensive employment of capital and labor. From a short-run, static perspective, Japan appeared to pick the wrong industries. But from a long-run perspective, those were the industries in which technological progress was rapid, labor productivity rose quickly, and unit costs decreased with the expansion of output. They were also industries in which one would expect rapid growth in demand as national income increased.

These industries combined the potential to expand rapidly, thus adding new capacity, with the opportunity to use the latest technology and thus promote a strategy of cost reduction founded on increasing productivity. Japan, placed in a position similar to that of Portugal in Ricardo's

famous example, refused to specialize in "wine" and chose "cloth" instead. Within three decades, Japan became the world's premier low-cost producer of many of the products for which it initially started in a high-cost position.

However, critics of industrial policy contend that the causal factor in Japanese industrial success is unclear. They admit that some of the Japanese government's targeted industries--such as semiconductors, steel, shipbuilding, and machine tools--are probably more competitive than they would have been in the absence of government assistance. But they assert that Japan also targeted some losers, such as petrochemicals and aluminum, for which the returns on investment were disappointing and capacity had to be reduced. Moreover, several successful Japanese industries did not receive government assistance--motorcycles, bicycles, paper, glass, and cement.

Industrial-policy critics contend that if all trading nations took the route of using a combination of trade restrictions on imports and subsidies on exports, a "beggar-thy-neighbor" process of trade-inhibiting protectionism would result. They also point out that the implementation of industrial policies can result in pork-barrel politics, in which politically powerful industries receive government assistance. Also, it is argued that in a free market, profit-maximizing businesses have the incentive to develop new resources and technologies that change a country's comparative advantage. This incentive raises the question of whether the government does a better job than the private sector in creating comparative advantage. (Harrison and Rodriguez-Clare, 2010)

3. China's Renewable Energy Program and Industrial Policy

China is the world's most populous country with over 1.3 billion people. During the last three decades, it has experienced tremendous economic growth, with an annual average increase in gross domestic product of 9.8 percent during that period. This has resulted in an increasing demand for energy, causing China to add an average of 53 gigawatts of electric capacity each year over the last ten years to its power generation capabilities. China is also the world's largest producer and consumer of coal, with about half of its coal being used for electricity generation. In fact, coal provides over 70 percent of China's current electricity needs and fuels much of the new power generation capacity being built. (Howell, et. al, 2010)

However, the burning of coal contributes to air pollution and greenhouse gas emissions. Also, the growth potential for hydropower, China's main source of renewable energy, is increasingly limited by environmental and social problems associated with the construction of large dams. Because China cannot meet its increasing electric power demand by relying on conventional sources--including coal, oil, natural gas, nuclear power, and hydropower--the Chinese government is subsidizing renewable energy. Although governments in the United States, Europe, Canada, and Japan have enacted policies to promote their renewable energy industries, China's effort is striking given its ambitious scale and the speed with which it is being enacted.

(Campbell, 2010)

China largely operates as a command and control economy in which the national government assumes a dominant role. Many of China's industries, including much of the energy sector, consist of state-owned enterprises (SOEs) which must conform to the laws and regulations governing the economy and also government directives regarding investments, purchasing practices, prices, mergers, research and development, and market entry and exit. Since the economic reforms of 1978, China's economy has become somewhat less centralized and the government has made greater use of market incentives instead of commands to influence enterprise behavior, but the government's impact on the market remains strong.

China's government has enacted ambitious targets for developing its non-hydropower renewable energy resources in the last few years. China recognizes that given the increasing demand for energy at home, developing its domestic renewable energy industry and building manufacturing capacity can result in advantages in future export markets. Although the Chinese government's goal is to turn its wind energy and solar panel industries into global leaders, energy efficiency and conservation are officially China's top energy priority.

To encourage the development of renewable energy industries, China's government provides preferential financing, value-added-tax rebates, tax incentives, local content laws, procurement preferences for Chinese-owned and controlled companies, and research and development (R&D) subsidies for renewable energy equipment producers. Direct subsidies are granted earlier in the time line of R&D projects for renewable energy, while tax incentives are applied later in the cycle to assist manufacturing ventures or to encourage consumers to adopt the technologies and help to increase demand for renewable energy. Such support has resulted in a rapid increase in investment in the production of renewable energy equipment. To finance the subsidization of the development of renewable energy, China charges a fee to all electricity users of about 0.029 cents per kilowatt-hour. In justifying its subsidies, some of which appear to be in violation of the rules of the World Trade Organization (WTO), China maintains that as a developing country it should be judged less strictly than an economically advanced country such as the United States. (Karp and Stevenson, 2012)

Moreover, China maintains a comprehensive set of rules governing government procurement of goods and services. These laws require government departments to purchase only domestic goods and services except where these items are not available within the borders of China or cannot be purchased at reasonable commercial terms (defined as 20 percent more expensive than foreign products) or where the items to be procured are for use abroad. Although China became a member of the WTO in 2001, it has not yet signed the WTO's Government Procurement Agreement that enforces open access to domestic procurement markets. A number of European producers of electricity generating equipment have protested China's policy, claiming that it makes it burdensome for them to participate in China's energy market. However, China defends its buy national program as being consistent with similar programs in other WTO countries. (Matechak and Gerson, 2010)

The United States also uses industrial policy to promote the use of renewable energies as desirable substitutes for conventional fossil fuels. Governmental subsidies have included subsidized loans, tax breaks, cash grants, and regulations such as California's mandate that its utilities buy 33 percent of their power from clean-energy sources by 2020. Such subsidies mask the true cost of generating electricity from those sources. According to the companies involved, some solar and wind power projects would have been built even without the assistance of government subsidies, but others such as a \$229 million wind farm in New Hampshire might not have happened without government assistance. (Lipton and Krauss, 2011)

4. Local-Content Subsidies Assist China's Wind Turbine Producers

The wind power industry provides an example of China's industrial policy. Judging by the hum of its wind turbine factory in Tianjin, China in 2010, the Spanish firm Gamesa appeared to be a successful player in the energy industry it helped create. Gamesa is the world's third largest wind turbine producer, after Vestas of Denmark and General Electric of the United States. But as Gamesa found out, doing business in China required it to adhere to strict rules set by the Chinese government. (Bradsher, 2010)

For example, almost all the components that Gamesa assembles into million-dollar turbines in Tianjin are produced by local companies that Gamesa helped develop to fulfill local content requirements. And these are the same companies that lower Gamesa's market share in wind turbines by selling parts to other Chinese producers that compete against Gamesa in the turbine market. During 2005-2010, the upstarts captured more than 85 percent of the wind turbine market, aided by low-interest loans, export credits from China's Export-Import Bank, and a variety of other subsidies. As a result, Gamesa's market share fell from about 33 percent of the Chinese market to only 3 percent during this period. However, Gamesa did not complain. Although the company's market share tumbled, the country's wind turbine market grew so big that Gamesa was able to sell more than twice as many turbines in China in 2010 as it did when it was the market leader in 2005. So as Gamesa's executives see it, they made the right bet by coming to China.

With its relatively low Spanish labor costs, Gamesa became an early favorite at the turn of the century when China began buying significant numbers of imported wind turbines. However, besides ordering imported turbines, Beijing began slipping new provisions into the bidding requirements for some state-run wind farms, requiring more and more of the content of turbines to be equipment produced within China, not imported. Those piecemeal requirements soon led to a blanket local content requirement in which China's wind farms had to buy equipment in which at least 70 percent of the value was domestically manufactured. Wind farms not meeting the requirement of the local content law were not allowed to be built.

Although trade lawyers maintained that enacting a local content requirement was a violation of the rules of the WTO, which China joined in 2001, China ignored such warning and bet correctly that Gamesa and other multinationals would not risk losing a piece of China's booming wind

farm business by complaining to trade officials in their home countries. It was not until 2009, when President Barack Obama began looking at barriers to American renewable energy exports, that the United States began to press China about its local content regulation (the United States does not have local content laws). The story of Gamesa in China follows an industrial arc traced in other businesses, like solar panels and desktop computers. Chinese companies acquire the latest Western technology by various means and then take advantage of government subsidies to become low-cost suppliers.

The U.S. challenge to China's industrial policy was in response to a petition filed by the United Steelworkers in 2010. (United Steelworkers, 2010) The petition sought action against a wide range of allegedly WTO-inconsistent Chinese policies on wind and solar energy products, advanced batteries, energy-efficient vehicles, and other products.. However, the U.S. government only challenged China's wind power equipment subsidies, claiming that the Chinese government subsidizes its wind turbine manufacturers that use parts and components produced in China, instead of imports. Subsidy grants to individual manufacturers ranged from \$6.7 million to \$22.5 million. These subsidies allowed Chinese manufacturers to sell turbines and related equipment on international markets at cheaper prices than their competitors. The "local content" nature of these subsidies also operated as a barrier to U.S. parts and component exports to China and are prohibited under WTO rules, according to U.S. officials. Following the U.S. challenge, the Chinese government revoked its local-content subsidy program. As a result, American manufacturers could produce wind turbine parts and components here in the United States and sell them to China. However, the program was no longer needed at that point since the objectives of local content were largely fulfilled—some of Gamesa's wind turbines exceeded 95 percent Chinese content.

With the help of China's industrial policies, Chinese companies have grown to control about half of the global market for wind turbines. China's biggest turbine makers, Sinovel Wind Group and Xinjian Goldwind Science and Technology, are now taking aim at foreign markets, particularly the United States, where General Electric has long been the leader.

5. WTO Rules Against China's Hoarding of Rare Earth Metals

Dozens of key green technologies, including solar panels and wind turbines, depend on critical raw materials derived from rare earth elements and other minerals, such as zinc. Frequently, there are no substitutes for these minerals in green technology applications, due to their unique physical and chemical properties. China produces more than 90 percent of the world's supply of these essential minerals. The United States currently produces no rare earth raw materials at all. To restrict exports of rare earth minerals to users in the United States and other countries, China uses export quotas, taxes, and licensing procedures. Such a policy benefits China's producers of wind farm equipment and solar panels at the expense of foreign competitors.

Why would China restrict the export of raw materials and thus decrease the world supply? By

restricting export sales, the supply of raw materials in the domestic market will increase, reducing the price faced by domestic buyers. Also, by limiting the export of a good and thus decreasing world supply, the world price of the export good may be driven upward, improving the exporting country's terms of trade. Moreover, the exporting country may want to conserve a scarce resource. Finally, export limitations on raw materials would increase the domestic manufacturers' access to raw materials needed in production, and also hold down the cost of these inputs, giving them a competitive advantage in global markets.

Figure 1 illustrates the effects of Chinese export tariffs applied to zinc, a rare-earth metal. Assume that China produces a large share of total world output of zinc. In the figure, S_C denotes China's domestic supply curve, D_C its domestic demand curve, and D_{C+W} the total world demand curve for zinc. The distance between D_C and D_{C+W} at each price denotes the rest of the world's demand for zinc. Equilibrium occurs where supply curve S_C intersects demand curve D_{C+W} . At this point, China would produce 9 million pounds, of which 4 million pounds are sold domestically and 5 million pounds are exported. A price of \$1.05 would apply to both domestic sales and exports.

Now assume that China imposes a tax of \$0.30 on each pound of zinc that is exported. A tax on foreign buyers decreases the amount they are willing to pay Chinese sellers, so the demand curve shifts downward, from D_{C+W} to $D_{C+W (Tax)}$. Equilibrium occurs where the new demand curve intersects the supply curve at a quantity of 7 million pounds, with 5 million pounds sold in China and 2 million pounds exported abroad. Foreign consumers pay \$1.20 per pound; this includes the lower price of \$0.90 going to Chinese producers and \$0.30 going to the Chinese government as tax revenue. However, Chinese consumers pay only \$0.90 per pound because the export tax does not apply to them. Simply put, China's export tax on zinc results in a combination of a lower domestic price and a higher world price. An alternative scheme for restricting exports is the implementation of an export quota, which can yield the same effects on prices and volume.

Concerning the environment, China does not impose stringent regulations on mining rare earths like many other countries do. For example, in China, the waste from rare earth mining is pumped into artificial ponds with earthen dams where the seepage and waste has caused health-related issues. The lack of stringent environmental regulations gives China's producers a cost advantage compared to their foreign competitors.

In defending its trade policy, China contended that its export restrictions are essential to protect its environment and scarce resources. WTO rules allow export controls for environmental reasons, as long as such measures are made effective in conjunction with restrictions on domestic production or consumption. However, such restrictions cannot be used to discriminate against users and refiners of materials in other nations.

The United States and other complainants in the natural resource case maintained that China's export restrictions were a discriminatory protectionist policy. The effect of these restrictions was to reduce the supply of key resources abroad and drive up world prices higher than China's

domestic prices. This disadvantaged foreign producers that used these resources as inputs and that competed against the Chinese. Also, steps to limit sales of raw materials abroad were seen as a bid by China to attract more manufacturing to its shores.

In 2011, the World Trade Organization ruled that China had no legal right to impose export restrictions on nine rare earth metals. The ruling was a setback to China's policy of hoarding rare-earth metals. In response to the ruling, China said that it would make modifications to its export controls to avoid penalties. At the writing of this paper, it remains to be seen how these modifications will play out.

6. U.S. Solar Industry Dims as China's Industrial Policy Lights Up

Solar energy has been harnessed by humans since ancient times using a range of ever-evolving technologies. Although there is no denying solar energy's promise and potential, debate remains about how the industry should develop. Should the market be relied on to determine winners and losers or should industrial policy carry out the task?

The bankruptcy of three American solar power companies in 2011 left China's industry with a dominant sales position, about two thirds of the market. Another major producer of solar energy equipment, Germany, was also retrenching in that year. Although some American, Japanese, and European solar equipment companies had a technological edge over their Chinese rivals, they maintained that they could not beat the Chinese when it came to cost. They noted that the Chinese government has been particularly effective in developing an industrial policy that provides its manufacturers with a number of advantages in the global solar industry, including access to lower cost capital, subsidized electricity rates, free access to land, and much a shortened permitting process for factories. Also, China's solar energy producers have realized huge economies of scale that result in decreasing production cost and increased competitiveness.

At the heart of the solar industry's problems in 2011 were sharply decreasing prices for solar panels and their components—wafers, cells, polysilicon, and the modules themselves. The reason was obvious: There were simply too many manufacturers trying to sell their products. The glut of manufacturers was due to factors including efforts by the U.S. government to promote clean technology, venture capitalists pouring into the sector, investors purchasing stock issues of solar companies during an upswing in oil prices, and an increased sense of urgency for climate change. Also, European governments offered substantial subsidies for solar installation, stimulating demand in the market. The abundant production of solar panels resulted in cutthroat price competition. In 2010, solar panels sold for \$1.60 per watt, on average. By 2011, the going price was between 90 cents per watt and \$1.05 per watt. Despite a buyers' market, customers were not purchasing solar panels fast enough to match the increase in supply. The result was the bankruptcy of numerous producers.

The bankruptcy of Solyndra, Inc. in 2011, a California company making solar panels, received much publicity. In 2010, President Obama visited Solyndra and touted it as a leading company in a growing industry. However, the company found that it could not compete with cheaper Chinese-manufactured solar panels, so it defaulted on its government-guaranteed loan of \$535 million. This resulted in attacks by critics of Obama who tried to make the failed solar panel

company both a symbol of the failure of industrial policy in solar energy and a club with which to beat alternative renewable energy of all kinds.

7. U.S. Files AntiSubsidy/AntiDumping Case Against China's Solar Panel Makers

In October 2011, seven American makers of solar panels filed a broad trade case in Washington D.C. against the Chinese solar panel industry, accusing it of using billions of dollars in government subsidies to help gain sales in the American market. The companies also accused China of dumping solar panels in the United States for less than it costs to manufacture and ship them. The trade case seeks tariffs of more than 100 percent on the wholesale price of solar panels from China, which shipped \$1.6 billion of the panels to the United States in the first eight months of 2011. (Bradsher 2011)

The coalition of solar panel makers is led by SolarWorld Industries America, the largest maker of conventional solar panels in the United States. The coalition maintains that American solar operations should be rapidly expanding to keep pace with the strong demand for these products. However, in August 2011, Solyndra and two other American solar companies filed for bankruptcy protection, citing the plunging prices of solar technology from China. Many of the surviving companies, meanwhile, were laying off workers and closing factories, or setting up shop in China. According to the coalition, there is one primary explanation for this: Without any production cost advantage, dumping by Chinese solar manufacturers and massive subsidies by the Chinese government are enabling Chinese producers to drive out U.S. competition, a violation of WTO rules.

In December 2011, the U.S. International Trade Commission voted to continue investigating U.S. solar firms' allegations of dumping by Chinese solar-panel makers, saying there were indications of injury or threat of injury to U.S. industry. (U.S. International Trade Commission, 2011) This decision clears the way for the U.S. Department of Commerce, which is also investigating the accusations, to continue its probe. If the Commerce Department concludes that Chinese solar-panel makers dumped their products and/or received unfair subsidies, then the International Trade Commission would determine if the U.S. solar industry was injured or threatened with injury. An affirmative decision by the International Trade Commission would allow the Commerce Department to impose antidumping or countervailing tariffs on such products.

In response to increased trade tensions with the Obama administration, in December 2011 the Chinese government imposed higher tariffs on imports of sports utility vehicles and midsize and large cars from the United States. The new tariffs included antidumping duties of 8.9 percent for G.M. vehicles, 8.8 percent for Chrysler, 2.7 percent for Daimler, and 2 percent for BMW. The Chinese government also imposed additional antisubsidy duties of 12.9 percent for G.M. and 6.2 percent for Chrysler. All of the new duties are calculated on vehicle prices that include China's existing 25 percent import tariff for all family vehicles. The duties will be in place for two years, through December, 2013. China's import duties exceed those of other big auto producing countries. The United States, for example, imposes a tariff of 2.5 percent on imported cars, minivans, and S.U.V.'s.

Basically, there are four steps in making a solar panel. (1) Molten polysilicon is used to grow crystals or cast blocks of polycrystalline silicon; (2) the material is cut and polished into thin,

smooth wafers; (3) the wafer is chemically treated and combined with electrical contacts to turn it into a solar cell; and (4) 62 or 70 solar cells are connected, covered with glass, enclosed in an aluminum frame and combined with a electrical junction box. The U.S. trade case has been filed against solar panels for which either of the final two steps—turning the wafer into a cell or assembling cells into a panel—was done in China. Although Chinese manufacturers want to keep wafer production in China, they have reportedly been making plans to ship wafers to Taiwan or South Korea for conversion into cells, as one way to potentially avoid any new tariffs the U.S. government might decide to impose. That step is the costliest, most high-tech and most highly automated task in producing solar panels, representing about a third of the total cost. Chinese manufacturers have studied moving solar cell factories directly to the United States but have largely rejected it in favor of other countries because it takes so long to comply with the many American regulations for opening new factories that use a lot of chemicals. Any cells made in Taiwan or South Korea from Chinese wafers could be shipped to the United States for final assembly, a step that typically accounts for a little less than a fifth of the total cost of making a solar panel. (Bradsher, 2011)

However, SolarWorld's petition for antidumping duties and countervailing duties has met strong opposition from much of the American solar industry which has formed the Coalition for Affordable Solar Energy (CASE); its members include solar project developers and installers, companies that manufacture solar equipment and polysilicon, and the like. CASE maintains that import duties on solar panels and cells would raise prices and slow the growth in domestic demand for photovoltaic systems (which convert sunlight to electricity) by homeowners, businesses, and power producers, resulting in lost jobs. A study commissioned by CASE, and conducted by The Brattle Group, estimates that a 100 percent tariff on imported solar cells and panels from China would eliminate between 16,900 and 49,600 American jobs over a three-year period following the implementation of the tariff, minus any jobs created in cell or solar panel manufacturing. The study concludes that, even under the most conservative assumptions, the imposition of a tariff would eliminate far more jobs than it creates. And all this is about protecting one troubled company, SolarWorld, which creates only 2-3 percent of U.S. solar industry jobs. (The Brattle Group, 2012) In December, 2011 CASE sent a letter to SolarWorld urging it to withdraw its trade petition. However, the request was rejected.

CASE also fears that the Chinese solar industry will retaliate by filing an anti-dumping and anti-subsidy trade case of its own with China's Commerce Ministry. The most likely target would be American exports of polysilicon, the main material used in making conventional solar panels. The manufacture of polysilicon requires enormous amounts of electricity in the production process. It turns out that the United States is one of the world's largest producers of polysilicon, in states like Washington and Tennessee, because it has access to a lot of inexpensive hydroelectric power. And most of that polysilicon is exported. A retaliatory tariff placed on U.S. exports of polysilicon to China would threaten 11,000 American jobs, according to The Brattle Group. At the writing of this paper, the outcome of this trade dispute remains in question.

8. Conclusion

This paper examined the affects of industrial policy on the renewable energy industry and its potential to cause trade conflicts between competing nations. Indeed, many nations have used a variety of subsidies to foster the competitiveness of their clean energy producers. Countries from the United States and Germany to Brazil and China are trying to boost power derived from crops, the wind, and the sun in order to lower emissions of greenhouse gases while increasing the security of energy supplies. Other motivations for subsidizing renewable energy are to decrease dependence on foreign oil, promote entrepreneurial ingenuity and the positive spillover effects on innovation, encourage new innovations that will drive down the cost of using the new technology, and to create jobs. However, many people are dubious of the merits of industrial policy because they are skeptical about the ability of governments to pick winners.

The command and control economy of China has resulted in its government owning or controlling many of the country's enterprises and setting goals for economic development. China has emphasized the development of new industries, such as wind turbines and solar panels, which can feed into the future growth of its economy. China has made good use of its renewable energy subsidies in that it has become the leading producer of wind and solar technology. Also, it is producing green technology at a scale that could dramatically bring down the price of goods like solar panels and wind turbines, making them affordable for both the developed and developing world.

Because of China's lack of transparency, it has taken significant investigatory efforts by the U.S. government, working with industry and workers, to uncover the subsidies that have been successfully challenged at the WTO. Under WTO rules, China is obligated to submit information about all of its subsidy programs on a regular basis, as must all other WTO members. Despite this obligation, China never notified the WTO of its subsidies to its producers of wind power equipment and solar panels that have been the focus of recent WTO disputes. This lack of transparency hinders efforts of WTO members to collectively ensure that each government is playing by the rules and it threatens to progress into retaliatory tariffs. Therefore, transparency and international cooperation are of ultimate importance to avoid a process of trade inhibiting protectionism.

One of the few goods that this statement may not hold true is rare earth, because China has a near monopoly on its extraction. China may be able to attain greater surplus for its citizens by withholding some of its rare earth reserves. Realizing this, the United States must be willing to work with China and consider making compromises--such as, if China will decrease its export taxes on rare earth, the United States will be less strict about proposals to place import duties on solar panels and cells. To place pressure on China, in March 2012 President Obama lodged a formal request for consultations with China at the WTO, the first step toward filing a legal case against the Chinese government over its hoarding of rare earth metals. The United States was joined in its request by the European Union and Japan. However, given China's robust defense of its trade policies, this legal challenge may drag on for several years.

The use of industrial policy for developing key industries will likely continue for China, despite complaints of the United States and other European countries. However, China is in a tight spot because if it invests in clean technology, U.S. industries will claim that China is engaging in unfair trade practices. But if it does not, the U.S. government threatens to impose a high carbon

tariff on Chinese imports. This is a no win situation, according to the Chinese. Simply put, the trade disputes between the United States and China regarding energy will likely take years to simmer down. Instead, these disputes may intensify as the two countries continue to promote the development of the energy industry.

Endnote

*Department of Economics, Central Washington University, Ellensburg WA. Email: carbaugh@cwu.edu. Also, School of Economic Sciences, Washington State University, Pullman WA. Email: mstbrown@wsu.edu.

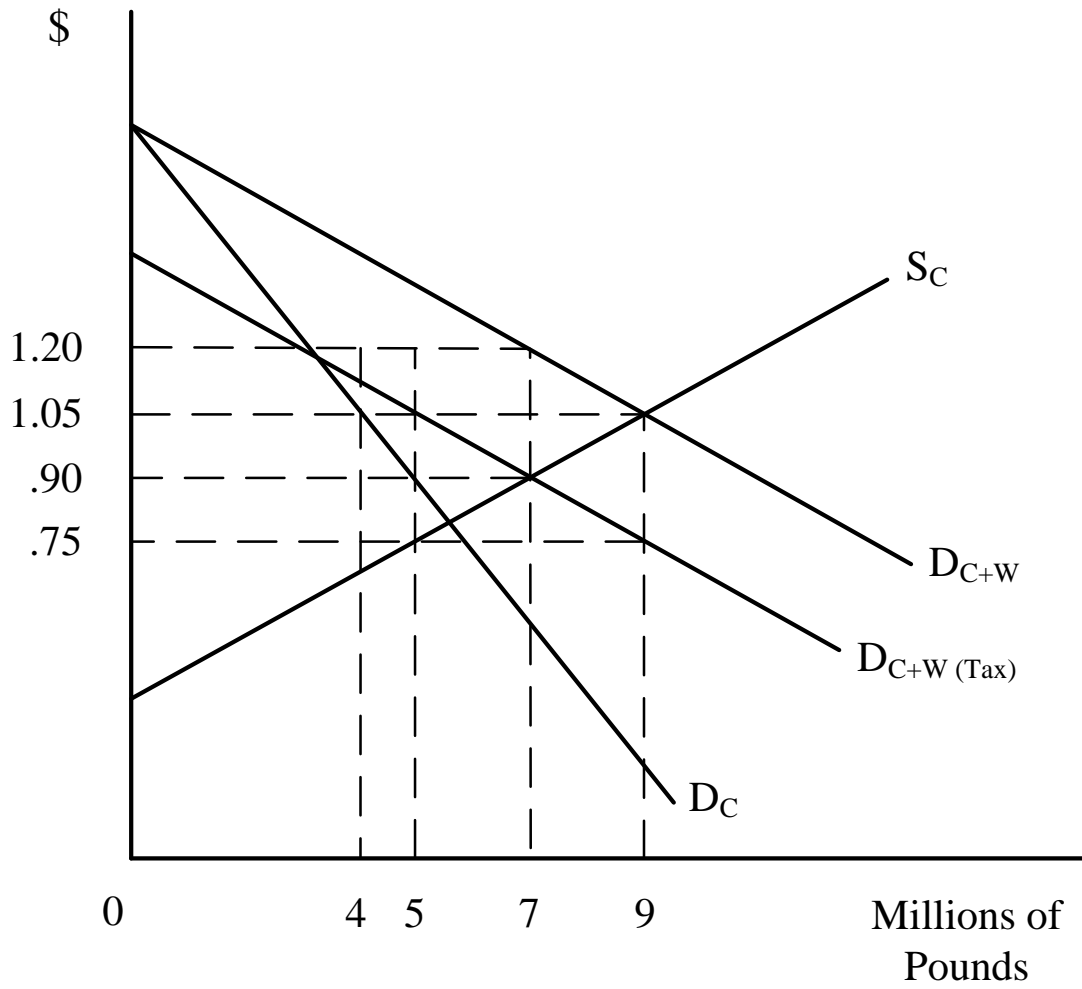
Table 1. Levelized Cost of Electricity-Generating Technologies: Brought in Line in 2016*

Plant Type	Cost Per Kilowatt Hour (Cents)	
Coal		
Conventional Coal	11.1	
Advanced Coal		12.2
Natural Gas Fired		
Conventional Combined Cycle		7.4
Conventional Combustion Turbine	14.4	
Advanced Combustion Turbine		11.8
Advanced Nuclear		12.1
Wind		11.5
Wind, Offshore		34.9
Solar Photovoltaic (PV)		32.4
Solar Thermal		64.2
Geothermal		11.6
Biomass		13.3
Hydro		12.1

*Levelized cost represents the present value of the total cost of building and operating a generating plant over an assumed financial life and duty cycle, converted to equal annualized payments and expressed in terms of real dollars to remove the impact of inflation. This calculation does not include wider system costs associated with each type of plant, such as long distance connections to grids, and does not include externalities such as health damage by coal plants or decommissioning costs of a nuclear plant. Also, government subsidies are not included in the calculations of levelized cost.

Source: U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2011*, December 2010, DOE/EIA-0383 (2010)

Figure 1. China's Export Tariff Applied to Rare Earth Metals



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