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# Boosting U.S.-Mexico Clean Energy Cooperation

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By Joel Martinez

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# Introduction and summary

The United States and its southern neighbor enjoy deep levels of interconnectivity, including economic, political, security, and cultural ties. These are the results of countless policy, business, and personal choices that fundamentally differentiate the United States' relationship with Mexico from its relationship with all other countries in the world except Canada. Among these connections are complex, cross-border supply chains that have become the norm in a growing number of industries. This integration creates clear opportunities to benefit both the United States and Mexico across a broad set of public interests. One such area of opportunity is deepening cross-border renewable energy production and distribution.

By using existing North American trade and production systems, where goods cross the border multiple times during the production process, the United States has an opportunity to enhance its manufacturing of solar photovoltaics (PV) in the United States and install them along the Northern deserts of Mexico to engage in cross-border solar energy generation and transmission. Such development of price-reduction and deployment strategies would not only benefit U.S. solar PV manufacturing, it would also boost exports and U.S. clean energy production. In addition, it would benefit producers and consumers on both sides of the border who would gain access to affordable and more environmentally friendly forms of electricity. Constructive cooperation in the renewable energy sector could also help shore up the United States' most important binational relationship at a time of heightened stress created by the current U.S. administration's negative rhetoric and policies affecting Mexico.

As in any effort to deepen cross-border economic engagement, such cooperation must address the legitimate concerns—in both countries—about the implications of U.S.-Mexico integration and associated economic dislocations. Although it is critical that fundamental U.S. orientation toward the world must be to stay

engaged—particularly with Mexico—policymakers must address public policy failures, especially important shortcomings in U.S. domestic economic policies that have not done nearly enough to create opportunities for important sectors of American workers adversely affected by globalization. In short, policymakers must ensure that cross-border economic activity contribute to and take place in a context of broader public policies that support a vibrant, inclusive, middle-class democracy in the United States.

# The importance of the U.S.-Mexico bilateral relationship

Contrary to the nativist rhetoric from some sectors in the United States, Mexico is the southern neighbor that the United States wants to have. For example, Mexico has been a key ally toward strengthening the region's security and defense in regard to counternarcotic efforts and helping address the Central American refugee and migration crisis.<sup>1</sup> Mexico also plays a critical role in joint efforts against international terrorism.<sup>2</sup> Economically, Mexico plays a larger role that may surprise many observers. In 2015, the largest share of all business travelers and tourists to the United States were Mexicans—around 27 percent—at 20.4 million people; Canadians were second with 13.4 million visitors.<sup>3</sup> Mexicans made up a large share of a tourist industry that accounts for 1.2 million jobs and \$32.4 billion in wages in the United States.<sup>4</sup>

In addition, hundreds of thousands of people legally cross the U.S.-Mexico border in both directions on any given day—those who live a binational life and commute for work, school, shopping, entertainment, and to visit friends and family. Likewise, Mexico hosts the largest community of U.S. expatriates—approximately 1 million American citizens—in places such as San Miguel de Allende, Guanajuato.<sup>5</sup>

Many policymakers, politicians, and business leaders misrepresent the U.S.-Mexico relationship as zero-sum exchange, with Mexico portrayed as taking advantage of its economic relationship with the United States. Although both the United States and Mexico need to assure that economic cooperation works to support middle-class jobs—such misconception misses the importance of the binational relationship across a wide range of fronts, as already mentioned.<sup>6</sup>

Even as the debate continues about how to make trade work better to further support a middle-class in both the United States and Mexico—a key priority in both countries and something that public policy on both sides of the border inadequately addresses—the United States has policy options currently available that would take meaningful steps toward such a goal. If fully realized, these policy options—specifically in terms of greater cooperation in the renewable energy sector—would create jobs in the United States and foster a beneficial relationship with Mexico.

# Advantages of North American renewable energy production

Throughout the globe, renewable energy represents the majority of new electricity generation capacity, and in the United States, solar plants have demonstrated their efficiency and effectiveness to supply renewable energy.<sup>7</sup> Globally, the levelized cost of electricity generation from solar PV has been on a downward trend since 2009 and is expected to further decline while new capacity installations have increased.<sup>8</sup> In 2014, the U.S. solar industry employed 175,000 workers, by 2017 it was approximately 373,807 jobs in equipment manufacturing, construction and installation, and operation and maintenance.<sup>9</sup>

The U.S. Southwest has more than 300 days of sunshine per year, and the Northern deserts of Mexico benefit from even more intense sunlight. Working together to harness those favorable conditions—through cross-border energy cooperation—can provide substantial opportunities for both the United States and Mexico.<sup>10</sup>

Currently, Mexico accounts for one-fifth of all energy use in Latin America and the Caribbean, and its domestic energy demand is growing. Likewise, Mexico has pledged to increase carbon-free sources of electricity while promoting economic growth through job creation in its renewable energy industry.<sup>11</sup>

Mexico's ambitious energy policies have brought up concerns about the environmental impacts of energy resource development, the expansion of energy infrastructure, effects on domestic energy prices, and other market issues.<sup>12</sup> However, increasing clean energy cooperation with the United States can help Mexico modernize its distribution grid in a sustainable manner, address its technical and nontechnical losses, enforce industry regulations that promote best workplace practices, ensure timely and thorough social and environmental impact assessments, and encourage further consultation processes with indigenous communities near renewable energy projects.<sup>13</sup>

Likewise, under President Barack Obama's leadership, the United States made great progress building out strong, clean energy manufacturing and deployment. However, the United States also encountered trade challenges from China, as that nation used nonmarket subsidies to give its companies an edge and flood the energy market with low-cost alternatives. Such challenges led to U.S. trade enforcement measures to reduce the influx of dumped solar panels, among others.<sup>14</sup> With China's price advantages, as well as cheaper financing, it is difficult for U.S. solar PV manufacturers to directly compete in global exports.<sup>15</sup>

Due to a combination of factors, 6 of the 10 largest global solar PV manufacturers are Chinese companies; only one is American.<sup>16</sup> Yet, there are manufacturing opportunities and the United States has certain competitive advantages over China. For example, local market size; innovative capacity, such as PV patents, resource and development expenditures, and high education and skilled labor; and North American market demand combine to allow the United States to rank high in measures of competitiveness and attractiveness for solar PV manufacturing.<sup>17</sup>

In terms of attractive market opportunities for increased deployment of U.S. solar PV manufacturing, the United States need look no further than its southern neighbor. Mexico's 2013 energy reforms created a favorable investment environment—through tax incentives and financing mechanisms—for U.S. companies seeking to get into the Mexican electricity market.<sup>18</sup> Mexico, for example, reduced investors' federal tax liability. Renewable energy producers are also eligible for a 100 percent up-front federal tax deduction for the cost of investments in equipment. Moreover, in its first long-term contract auction in March 2016, Mexico awarded 74 percent of its electricity contracts to solar projects.<sup>19</sup>

In addition, the Border Environment Cooperation Commission (BECC) and the North American Development Bank (NADB)—binational institutions created by the U.S. and Mexican governments—develop, finance, and build self-sustaining projects along the U.S.-Mexico border.<sup>20</sup> Both organizations help to alleviate the hassle associated with investing in U.S.-Mexico cross-border projects by working with municipal, state, and federal governments, as well as the private sector. BECC and NADB also provide technical assistance grants, project certification, loans for infrastructure projects, and grant financing for projects in all environmental sectors.<sup>21</sup> Moreover, reforming NADB, and recapitalizing the institution, would more effectively promote cross-border renewable energy cooperation.<sup>22</sup>

Such cross-border investment should also, over time, open the way for U.S. companies to participate in the expansion and modernization of Mexico's power grid—to the benefit of the United States and Mexico as joint technology, policy, and regulatory solutions toward renewable energy reliability and security challenges are developed.<sup>23</sup> Under the current energy reform, Mexico's Comisión Federal de Electricidad (CFE), allows public-private partnerships.<sup>24</sup> These investment opportunities can help address the current lack of cross-border integration and improve Mexico's technical and nontechnical challenges.<sup>25</sup>

If done properly—with special respect for labor standards, environmental protections, and domestic regulatory concerns—U.S. companies have an opportunity to build part or all of solar panels in the United States and install them in the Northern deserts of Mexico using existing North American trade and production systems. Specifically, this means tapping into the robust methods of cross-border manufacturing where some parts of the value chain are produced in the United States and some in Mexico. Although some policymakers, politicians, and business leaders have criticized such cross-border manufacturing as simply reducing American jobs,<sup>26</sup> particularly in the industrial Midwest, for some sectors and firms a strong manufacturing partnership between the U.S. and Mexico may support good jobs in both countries.<sup>27</sup> Preventing the creation of cross-border supply chains is not an adequate policy response to the challenges facing American workers. Far more comprehensive policies are needed.<sup>28</sup>

The U.S. solar PV industry can increase and keep manufacturing jobs in the United States, and more effectively compete with Chinese manufacturers, by employing a price-reduction strategy through North American supply chains. In addition, U.S. solar PV manufacturers can expand markets by deploying and installing their technologies throughout Northern Mexico. In short, such cross-border solar energy development can strengthen U.S. solar PV manufacturing and produce immediate benefits—cheaper, cleaner, reliable energy—for cities on both sides of the shared border, such as San Diego, Tucson, Phoenix, San Antonio, El Paso, Tijuana, Mexicali, Ciudad Juarez, and Monterrey.<sup>29</sup>

Lastly, Mexico's pledge to meet its clean energy target of 35 percent by 2024 and 50 percent by 2050 can be significantly assisted through an increase in solar energy production and usage.<sup>30</sup> A U.S.-Mexico solar energy production supply chain can decrease carbon pollution in both countries and can be a positive step toward sustainable cross-border infrastructure investment.<sup>31</sup>

# Potential of cross-border solar energy production

China is currently the largest employer in renewable energy. In 2014, it employed 44 percent of the 7.7 million workers in the global renewable energy sector; the United States, meanwhile, employed almost 10 percent of this sector, representing approximately 724,000 U.S. jobs.<sup>32</sup> Globally, solar PV has been the largest renewable energy employer in recent years—in equipment manufacturing, construction and installation, and operation and maintenance—due to lower costs of solar panel production accelerating growth in installations.

Although the United States has PV-specific characteristics that provide opportunities to exploit the global industry,<sup>33</sup> U.S. PV manufacturers face a cost disadvantage because of higher crystalline silicon PV production costs. Even without unfair trade practices, this factors-of-production challenge makes PV production difficult for the United States compared with competing nations, such as China.

For example, after Suniva, a Georgia-based solar PV manufacturer, was forced out of the market, it filed a trade petition, along with SolarWorld, on April, 2017 with the U.S. International Trade Commission (ITC), seeking to limit imports of solar cells and modules from foreign countries by raising tariffs and setting a floor price under Section 201 of the Trade Act of 1974.<sup>34</sup> The petition by Suniva and SolarWorld claimed that the U.S. PV cell industry suffered from a flood of foreign imports. The ITC ruled in favor of Suniva and SolarWorld on September 22, 2017, and will recommend raising tariffs and setting a floor price to the Trump administration, which will have to make a final ruling by or before January 2018.

The Solar Energy Industries Association (SEIA) which opposes tariffs and price floors, estimates that if the remedies are imposed, more than 80,000 American jobs will be lost.<sup>35</sup> These tariffs and price floors

would raise the cost of PV manufacturing in the United States and thereby advantage Chinese competitors. It is also worth noting the irony that Suniva, which brought the complaint to the ITC, has majority Chinese ownership.<sup>36</sup>

As the Trump administration decides on implementation of the ITC's recommendations, it should do so in a way that does not penalize U.S. manufacturers already engaged in U.S.-Mexico solar PV supply chains. Although the ITC is required to make additional investigative findings for countries under any Free Trade Agreement (FTA) with the United States, Canadian and Mexican imports are allowed differentiated treatment given the separate assessment rules under Section 302 of the NAFTA Implementation Act.<sup>37</sup>

Yet, U.S. solar PV manufacturing can compete with China—creating, increasing, and ensuring employment opportunities in the U.S. renewable energy sector—through price-reduction strategies available in North American trade and production systems, particularly with Mexico. Likewise, along with the recent energy reforms that have made Mexico’s energy sector more attractive to new players, investment, and technology, installing U.S.-made solar panels in Mexico can also produce joint benefits that would help address pressing issues in the binational relationship. These benefits include strengthening U.S. manufacturing; being a boon to producers and consumers both in the United States and Mexico; improving security in the border region; and encouraging sustainable border infrastructure.

In regard to Mexico, the potential of its growing domestic supply chain is reflected in its high levels of indirect value added for clean energy technologies.<sup>38</sup> To better understand the factors that can make U.S.-Mexico solar PV supply chains competitive, it is important to examine manufacturing costs and minimum sustainable prices. Yet, given Mexico’s developing solar technologies industry, manufacturing costs for other technologies, such as lithium-ion batteries (LIBs), can be used as a proxy to model for competitiveness of solar PV manufacturing costs.<sup>39</sup>

LIBs power many consumer electronics and are now more frequently used to power electric vehicles. In an April 2016 report on automotive lithium-ion cell manufacturing, the Clean Energy Manufacturing Analysis Center (CEMAC), developed country specific scenarios to model regional competitiveness on LIB manufacturing costs.<sup>40</sup> The report demonstrated a scenario of a Mexican manufacturing facility owned by a Japanese parent company with automotive and consumer electronics LIB experience. The model concluded that Mexico has equivalent labor rates to China; lower general material prices, given the Mexican facility’s purchasing and high-volume manufacturing capacity; an advantage of geographical proximity to U.S. markets; and the lowest sustainable pricing achievable for LIBs material costs.

Overall, Mexico demonstrated its North American supply chain competitiveness against its Asian counterparts. While recognizing that poor environmental standards play a key role in lower manufacturing costs, increasing clean energy cooperation with the United States can help Mexico enforce clean energy technologies regulations that promote and raise environmental and labor standards.

If U.S. solar PV manufacturers engage in North American supply chains as a price-reduction strategy such an approach can foster competitive solar energy costs in U.S. manufacturing and can be complemented through solar PV deployment along Northern Mexico. Through such U.S. solar PV deployment, electrical interconnectivity between the United States and Mexico can be enhanced—a key to cross-border solar energy production.

Again, if done properly—with special respect for labor standards, environmental protections, and domestic regulatory concerns—the management of cross-border solar energy production between the United States and Mexico will allow a competitive edge against other competitors in a globalized and diversified renewable energy sector. Moreover, cross-border solar energy production would help enforce fair trade rules vis-à-vis China. Not to mention the substantial incentives for investment in cross-border energy cooperation given the rapid growth of the renewable energy industry on both sides of the border.<sup>41</sup> For example, California’s renewables portfolio standard, enacted in 2002, requires California’s electric utilities to have 50 percent of their retail sales derived from eligible renewable energy resources by 2030 and all subsequent years.<sup>42</sup> California residents can receive a personal tax credit of 30 percent if at least half the energy used to heat a residence’s water is from solar.<sup>43</sup> Arizona<sup>44</sup> and New Mexico<sup>45</sup> have similar renewable portfolio standards and incentives. Texas, however, has a different perspective. Due to several factors—cheap Texas wind being one—Texas has maintained a more isolated strategy in regard to renewable energy.<sup>46</sup>

California and Texas regulate cross-border energy cooperation along the U.S.-Mexico border through the Western Electricity Coordinating Council (WECC) and the Electric Reliability Council of Texas (ERCOT). Currently, there are 13 electric transmission lines connecting the two countries—five permanently operating and eight for emergency use only; most emergency connections are in Texas.<sup>47</sup> California and the Mexican state of Baja California are the most integrated states in the border region as Baja California is not connected to the rest of the Mexican national power grid. The nascent regulatory framework in Mexico and the differing legal instruments for open-access transmission agreements and reliability coordination between the United States and Mexico are current barriers toward deepening cross-border integration.

To enhance cross-border renewable energy cooperation, state authorities in the United States and Mexico need to collaborate and align legal instruments to ensure consumer and taxpayer protections in developing new infrastructure.<sup>48</sup> For

example, Texas could benefit from greater integration with Mexico through access to enhanced imports, or as a business opportunity for power exporters.<sup>49</sup> From January to June of 2016, ERCOT's wholesale electricity price in Texas was \$22 per megawatt-hour (MWh), in Mexico the average wholesale electric price was between \$48/MWh to \$60/MWh.<sup>50</sup>

While cross-border energy cooperation can maximize efficiencies for commercial opportunities for U.S. generators to sell into a higher-priced market and at the same time lower the cost of electricity for industrial and residential consumers in Mexico,<sup>51</sup> it is important to acknowledge and hedge against the risks involved in cross-border transmission and operations between the United States and Mexico. To avoid any Enron-like risks, where the flow of electricity across borders pulls energy toward the highest-cost market, ERCOT and WECC, along with CFE, need to design a system to prevent such an outcome. WECC and ERCOT can supplement such a system by establishing a high-voltage, direct current (HVDC) grid network with CFE. This framework would amplify cross-border energy cooperation by building upon WECC's current operation, under agreement with CFE, of the electrical grid in the northern portion of Baja California.<sup>52</sup>

As the United States and Mexico continue to define the binational economic relationship, the California Independent System Operator, WECC and ERCOT—under guidance of the Federal Energy Regulatory Commission—along with CFE must be part of the conversation as well. Ultimately, the focus of the cross-border relationship must be on the energy, climate, and economic benefits that can flow to both countries from enhanced binational, clean energy cooperation.

HVDC technologies—line commutated converters (LCC) or voltage source converters (VSC)—are among the most efficient, economical, and feasible solutions for connecting and transmitting renewable energy production, such as solar.<sup>53</sup> Although high-voltage alternating current (HVAC) transmission towers are the common electric power transmission system, HVDC technologies deliver power at a lower cost and with less power loss over long distances—benefitting both producers and consumers, specifically throughout the geographically complex border region.<sup>54</sup>

The development of HVDC would also have important ancillary benefits for the border region by increasing economic opportunity. This cross-border infrastructure project would service a border region—consisting of four states in the United States and six states in Mexico—that together has a combined population

of nearly 100 million people, and if considered as a stand-alone entity would be the world's fourth largest economy.<sup>55</sup> In addition, border areas in Mexico affected by crime and violence generated by transnational criminal organizations, would benefit from an increase in state presence as solar PV systems would attract more civilian and government oversight in both the United States and Mexico.<sup>56</sup>

Likewise, increased, cross-border energy cooperation would build upon Mexico's status as the technology center of Latin America with the states of Guadalajara and Monterrey being among the leading technological manufacturers and service centers in the world.<sup>57</sup> This would result in high-tech employment for both high- and low-skilled workers in Mexico. For the United States, improved access to lower-cost and reliable power would be good for U.S. manufacturing. For example, Mexico's medical device industry in Tijuana relies heavily on inputs and capital machinery from American suppliers. American hospitals import approximately 30 percent of medical devices and supplies from the global market, with Mexico being its leading supplier.<sup>58</sup>

Moreover, such economic development can also absorb significant numbers of would-be migrant workers who might otherwise seek economic opportunities in the United States—further contributing to decreasing migration rates from Mexico to the United States, which have plummeted precipitously in recent years.<sup>59</sup> In fact, since 2009, more Mexicans have left the United States to return to Mexico than have migrated to the United States.

Expanding cooperation and interconnectivity across the U.S.-Mexico border to increase renewable energy trade with Mexico can help address pressing issues in the economic relationship. Work in this area, in fact, has already begun in both the public and private sphere and should not be disrupted by tensions President Trump can and has injected into the binational relationship. In January 2017, for example, before ending his term, Ernest Moniz, then U.S. Energy Secretary, and Mexico's Energy Minister signed bilateral principles that promote electricity reliability of interconnected power systems—setting the stage for increased connectivity between U.S. and Mexican electricity systems.<sup>60</sup> At the same time, San Diego's Sempra Energy, the largest natural gas utility in the United States, has a controlling interest in IEnova—the first energy firm to be listed on the Mexican stock exchange—and has rights to property in Mexico with wind and solar electric generation potential.<sup>61</sup>

In addition, Flextronics, a global electronics manufacturer, has its largest Latin American and the Caribbean solar panel production facility located in Ciudad Juarez, Mexico.<sup>62</sup> Among others, Flextronics currently produces solar modules for U.S. manufacturers SunPower, SunEdison, and Enphase Energy.<sup>63</sup> Likewise, SunPower has a facility in Mexicali, Mexico,<sup>64</sup> which already employs price-reduction strategies that have caught the interest of First Solar—the largest U.S. solar PV manufacturer—which is looking to expand its operations in Mexico and other Latin American and Caribbean countries.<sup>65</sup>

The manufacture of solar PV has become a global enterprise, the Trump administration should maximize America's comparative advantage in North American competitiveness.<sup>66</sup> Among the 12 primary manufacturing hub economies for solar PV, LIBs, wind turbine components, and light emitting diode (LED) packages, the greater share of direct manufacturing production revenue of these four clean energy technologies is retained as value added in the United States, United Kingdom, and Canada. The economic ripple effect, or indirect value added for such clean energy manufacturing is greatest in China, Mexico, India, and Brazil—with Mexico's PV module manufacturers achieving an 81 percent average utilization rate, well above the 55 percent global average rate.<sup>67</sup> In other words, high direct and indirect value added for U.S. and Mexican clean energy manufacturing underlines the competitiveness of cross-border supply chains.

## Conclusion

By engaging in U.S.-Mexico solar photovoltaics supply chains, U.S. solar PV manufacturers can employ a price-reduction strategy, which will allow U.S. solar PV to compete on the global market. In addition, U.S. solar PV manufacturing can be complemented through solar PV deployment along Northern Mexico. Through such U.S. solar PV deployment, electrical interconnectivity between the United States and Mexico can be enhanced—fostering cross-border solar energy production. Strengthening cross-border solar energy cooperation would benefit both the United States and Mexico as increasing convergence of electricity and information technology infrastructures will improve technology, policy, and regulatory solutions to reliability and security challenges on both sides of the border.<sup>68</sup>

Likewise, expanding cooperation and interconnectivity across the U.S.-Mexico border to increase renewable energy trade with Mexico provides other positive outcomes. It can help reverse the recent negative trajectory of U.S.-Mexico relations; strengthen American manufacturing; benefit producers and consumers—on both sides of the border; improve border security; and encourage sustainable border infrastructure—all while competing with China's growing presence in the global solar industry.

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## About the author

**Joel Martinez** is the Mexico research associate on the National Security and International Policy team at the Center.

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