

# Chile's Renewable Energy and Energy Efficiency Market: Opportunities for U.S. Exporters

From its vast wind, hydropower, and biomass resources in the South to its robust solar resources in the North and overall geothermal potential throughout the country, Chile offers a clean energy potential few countries can match. In addition, high energy prices, strong economic growth, and rising energy demand make Chile an attractive market for future renewable energy development. This MAS Market Intelligence Brief describes the Chilean market in detail, emphasizing areas of opportunity for U.S.-based renewable energy and energy efficiency (RE&EE) exporters.

The Chilean economy grew at a rate of 5.4% between 1986 and 2010.<sup>1</sup> Growth has cascaded across sectors and, according to some analysts, has positioned Chile to be the first Latin American country to achieve “developed” country status – a possibility in the near future. In fact, gross domestic product (GDP) rose to \$299.6 billion in 2011 – up 6.3% from the previous year, representing one of the fastest growth rates in Latin America.<sup>2</sup>

1 Government of Chile, “National Energy Strategy 2012-2030: Energy for the Future,” pp. 6 (February 2012)

2 Bloomberg New Energy Finance, “Climate Scope 2012: Assessing the Climate for Climate

The country’s continued economic expansion, however, has placed considerable strain on Chile’s energy grid, spread unevenly throughout the country’s harsh geography, which runs north-south along a 2,600 mile tract of land between the Andes Mountains to the East and the Pacific Ocean to the West. According to Chile’s National Energy Strategy, the country must add over 8 GW of new electricity generation by 2020 in order to meet expected energy demand increases.<sup>3</sup> Historically, a lack of policy incentives has slowed development of a transmission infrastructure capable of supporting this type of renewable energy deployment.

This situation is likely to change, as the Chilean Government has planned a vast expansion of its renewable energy capacity over the coming decade to address potential energy shortfalls and to reduce the country’s reliance on imported energy sources. If a strong renewable energy market develops in Chile, U.S. companies across the RE&EE

Investing in Latin America and the Caribbean,” pp. 46; and Government of Chile, “National Energy Strategy 2012-2030: Energy for the Future,” pp. 6 (February 2012)

3 Government of Chile, “National Energy Strategy 2012-2030: Energy for the Future,” pp.7 (February 2012)

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March 2013

## Country Quick Facts

**Size:** 756,102 sq. km

**Population:** 17,067,369 (July 2012)

**Type of government:** Republic

**Head of state:** President Sebastian Pinera

**Capital:** Santiago

**Language:** Spanish



Source: CIA World Factbook



INTERNATIONAL  
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supply chain – from manufacturers to services providers in almost every subsector – should find considerable export opportunities, particularly in the medium-to-long-term, as much of the new capacity installations are expected to utilize renewable energy resources.

### ***Market Overview***

Chile began privatizing its electricity sector 30 years ago and the effort is now complete. Today, competition between firms drives the generation and sale of electricity across the country, as well as prices paid by Chilean energy consumers. Since privatization efforts began, Chile has quadrupled its installed capacity,<sup>4</sup> which in 2011 reached 16,970 MW.<sup>5</sup>

### ***Market Structure***

Chile's electricity infrastructure is divided into four separate transmission grids, each one providing power to a specific geographic location.

- The Central Interconnected System (SIC) provides power to the vast majority of Chile's citizens, including the capital city of Santiago. In 2011, the SIC generated 73.9% of Chile's energy, producing 46,095 GWh, an increase of 6.8% over 2010.<sup>6</sup>
- The Norte Grande Interconnected System, (SING) provides electricity to Chile's largest energy consumer – the mining industry – is located in the North of the country. In 2011, the SING, produced over one-fourth of the country's electricity, generating 15,872 GWh of electricity – up 5.2% from the previous year.<sup>7</sup>
- A combination of two electricity systems provides electricity to Chile's sparsely populated southern districts in Aysen and Magallanes. Together these grids only accounted for 0.8% of the nation's electricity production.<sup>8</sup>

While southern Chile produces very little electricity, it is the location of many high-potential renewable energy sites, particularly for hydropower and wind development. In fact, future RE&EE deployment may depend in part on

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4 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 32 (February 2012)

5 Presentation by Chilean Embassy in Washington, DC entitled "Energy Policy in Chile" (received in person on 19 December 2012)

6 Ibid

7 Ibid

8 Ibid

the southern grid's ability to handle an influx of renewable power.

### ***Creation of New Regulatory Bodies and Organizations***

Chile's energy industry has been regulated by the National Energy Commission (CNE) since 2008. The CNE is charged with proposing policies and strategies to support the energy market, regulating electricity tariffs, developing and implementing technology standards, and supervising electricity dispatch and operational criteria. The CNE may determine the development of specific electricity projects, such as transmission projects, that are not being pursued by the private sector. The financing of these projects is done through a standard bidding process in which private companies are free to participate.

In addition to the CNE, Chile's recently announced National Energy Strategy: 2012-2030 (National Energy Strategy) called for the establishment of Independent Operation Centers (IOCs) to organize and operate the country's electricity system with increased autonomy. The National Energy Strategy calls for the new institutions to provide transparent information on the electricity market as well as additional supervision of energy practices.<sup>9</sup>

The IOCs would play the role of regional operators, replacing the existing Economic Load Dispatch Centers. They would operate alongside the supervisory role of the CNE under an autonomous management structure, acting as independent legal entities with assets of their own. The IOCs would be responsible for planning transmission systems, contributing to the development of Chile transmission infrastructure, and finally securing the current and future electricity system.

### ***Key Players***

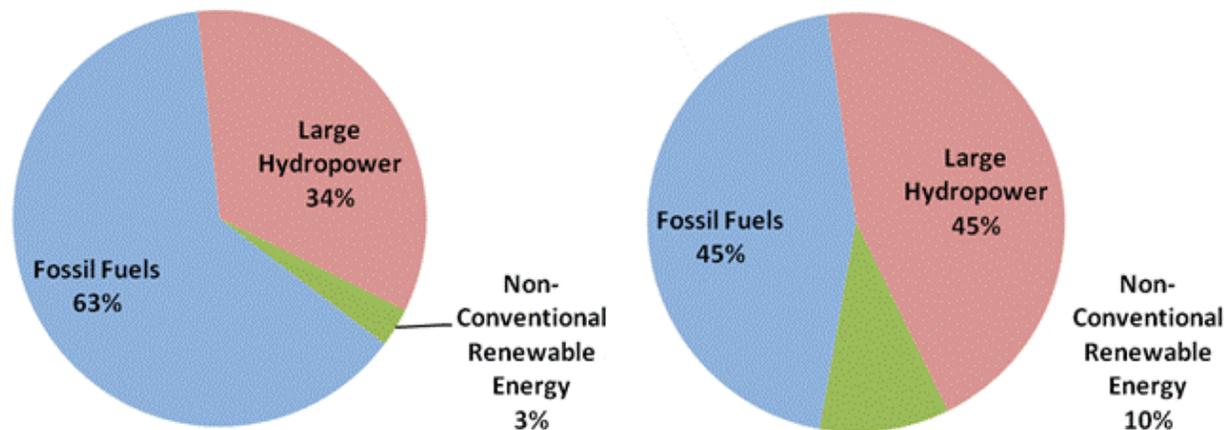
The Chilean energy industry can be broken into three categories: production, transmission, and distribution. These markets operate separately with intense competition often acting as the driver of decision-making.

The electricity production market involves several participants and competing technologies. The market is widely considered flexible and open, with most energy projects operating under the traditional independent power producer model. Since 2008, generators of electricity can

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9 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 33 (February 2012)

Figure 1: Current and Future Energy Mix (2012 and 2024)



Source: Chile National Energy Strategy, pp. 12-13

participate in public tenders under long-term contracts (up to 15 years) to sell power to distribution companies at a fixed price. A “spot” market also exists for power transfers not subject to existing power purchase agreements (PPAs).<sup>10</sup>

Whether through long-term PPAs or the “spot” market, most power producers sell their electricity into the wholesale electricity market the Chilean electricity wholesale market is privately operated, but is controlled by a few large companies, which operate a virtual monopoly as a result of geography and the cost of building transmission grids.<sup>11</sup>

Finally, utility companies buy power from the wholesale market and supply it to electricity customers. Chilean utilities are often well-known companies that have a geographic monopoly through a concession granted by the Ministry of Economy, which awards concessions for an indefinite period of time for electricity systems greater than 1,500 KW.<sup>12</sup>

Importantly, some large energy consumers – mainly mining companies in Northern Chile – have recently built their own power systems, cutting out the remaining part of the value chain, including wholesalers and utilities. These firms have decided to build and operate their own power stations since either connecting their operations to a far-away electricity grid or operating diesel generators has become increasingly cost prohibitive. Many of these firms have turned to renewable energy – either solar, small wind, or

geothermal energy – to provide their power needs, opening a new market for U.S. firms with expertise developing off-grid applications.

#### Renewable Energy

In 2012, 37% of Chile’s energy was produced from renewable energy sources – mostly large hydro projects, which accounted for 34% of Chile’s energy production.<sup>13</sup> Non-conventional renewable energy, which is defined by Chilean law as renewable energy excluding hydropower projects over 40 MW, remains a small but growing part of the Chilean energy mix, contributing only 3% of Chile’s energy production.<sup>14</sup> As of 2011, Chile had only 843 MW of non-conventional renewable energy capacity installed, much of it in the form of small hydropower projects.<sup>15</sup>

Despite little progress to date, the solar and geothermal markets appear poised for significant growth as a result of both resource potential and high energy prices, which together have catalyzed investment in the sector and built a strong pipeline of planned projects. Bloomberg New Energy Finance (BNEF) estimates that \$4.5 billion was invested in Chile’s clean energy industry over the last five years – 5% of all renewable energy investment committed to Latin America, trailing only Brazil and Mexico.<sup>16</sup> By 2015, ITA expects Chile to produce 264 MW of solar energy and 1,361

10 Country Energy Profile: Chile – Clean Energy Information Portal ([www.reegle.info/countries/chile-energy-profile/CL](http://www.reegle.info/countries/chile-energy-profile/CL))

11 Ibid

12 Ibid

13 Government of Chile, “National Energy Strategy 2012-2030: Energy for the Future,” pp. 12 (February 2012)

14 Ibid, 12

15 Bloomberg New Energy Finance, “Climate Scope 2012: Assessing the Climate for Climate Investing in Latin America and the Caribbean,” pp. 47

16 Ibid, 48

### Brief History of Chilean Renewable Energy and Energy Efficiency Policy

1992	Chile's economic development and growing energy needs of mining sector increase awareness of the need to consume and produce energy more responsibly
1997	Chile and Argentina sign the Convention on Energy Integration, facilitating the import of natural gas from Argentina.
1998	The first electrical interconnection between Chile and Argentina is established (Inter-Andes).
2000	The new Energy Electricity Law is developed and passed.
2003	First Chilean energy project receives funding through Clean Development Mechanism (one Colbun Power Plant is certified to have completed CO2 reduction of 112,607 tons).
2004	The Short Act I is passed, improving the safety of the energy supply transportation system and exempting transmission charges for new renewable energy sources below 20 MW of capacity).
2005	The Short Act II is passed fostering investment in the energy and electricity sector, simplifying legal procedures for projects below 9 MW.
2006	The Chilean Government announces its support for increased use of biofuels and the Energy Safety Plan is reinforced.
2008	Chile's legislature passes Act No. 20.257, which requires utility companies to produce 5% of their electricity from non-conventional renewable energy sources by 2014, rising 0.5% per year to 10% by 2024.
2009	The Chilean Government publishes 20 separate tenders for the production of geothermal energy.
2009	Chile's Renewable Energy Center is launched with support from the U.S. Department of Energy and the National Renewable Energy Center.
2010	President Pinera announces plans to achieve 20% renewable energy (not including large hydropower) by 2020; he later backs off these comments.
2010	Chile creates the Ministry of Energy and the Ministry of Environment. Additionally, the National Energy Efficiency Program becomes the Chilean Energy Efficiency Agency.
2011	Blackout keeps 10 million – of 17 million total Chileans – without electricity for several hours, demonstrating the need for additional energy capacity
2012	Chilean Government publishes “National Energy Strategy 2012-2030: Energy for the Future,” a policy document outlining its energy strategy over the coming two decades.

Source: Government of Chile, “National Energy Strategy 2012-2030: Energy for the Future”

MW of wind power, more than quadrupling the country's installed capacity of these technologies in 2011.

The renewable energy sector is also being driven increasingly by supportive government policies. Chile's recently announced National Energy Strategy, a key part of President Pinera's economic development agenda, laid out a clear commitment to renewable energy development. If followed, the strategy would likely create a strong RE&EE market, creating new export opportunities for American firms.

#### Policy

The Chilean energy sector is largely governed by the 2006 General Law on Electricity Services, which defined non-conventional renewable energy as renewable energy except large hydropower over 40 MW.<sup>17</sup> In 2008, the Chilean

17 Country Energy Profile: Chile – Clean Energy Information Portal ([www.reegle.info/countries/chile-energy-profile/CL](http://www.reegle.info/countries/chile-energy-profile/CL))

Government added to the 2006 law by passing its first renewable energy act (Act No.20.257), which established a renewable portfolio standard (RPS) requiring utilities to obtain 5% of their electricity from non-conventional renewable energy sources by 2014.<sup>18</sup> The RPS was set to increase 0.5% per year until a 10% overall mandate was achieved by 2024.<sup>19</sup> The law also called for the use of large hydropower to increase, with the hope that large dams could produce 45% of Chile's energy by 2024.<sup>20</sup>

In 2010, Chile bolstered its support of the sector by creating the Ministry of Energy and Ministry of the Environment. In addition, the Chilean Energy Efficiency Agency (ACHEE) was formed, transforming the National

18 Presentation by Chilean Embassy in Washington, DC entitled “Energy Policy in Chile” (received in person on 19 December 2012)

19 Marcelo, H. Orellana, U.S. Foreign Commercial Service, “Chile: Solar Energy Industry,” pp. 1 (December 2011)

20 Government of Chile, “National Energy Strategy 2012-2030: Energy for the Future,” pp. 13 (February 2012)

Energy Efficiency Program into a separate, stand-alone agency.<sup>21</sup> Today the energy sector is managed by the Energy Ministry through CNE, although the Ministry of Economy plays an active and important role as well.

It remains to be seen whether the creation of new government ministries and the current legal structure supporting renewable energy development will be enough to reach the 10% target. In fact, with only 843 MW of renewable energy technologies installed and just 260 MW under construction, significant development must occur over the coming decade to meet the 10% target in 2024.<sup>22</sup>

At the beginning of his administration, President Pinera had announced an ambitious renewable energy target of 20% by 2020, but later abandoned the plan on economic and fiscal grounds. In dropping the plan, however, the government reaffirmed its commitment to achieve a 10% target by 2024 by introducing the National Energy Strategy in 2012, which detailing its plans for transforming Chile's energy sector over the coming two decades.

The strategy explained six fundamental pillars that the Government will use to guide its implementation of the Strategy going forward:

1. Strong commitment to energy efficiency;
2. Large increase in the use of non-conventional renewable energy;
3. Increase the use of large hydropower plants;
4. Strengthen the Chilean transmission and distribution system, making it easier to get electricity produced in one part of the country to consumers in other parts;
5. Address the challenges faced by electric utilities, as they seek to provide electricity directly to consumers; and
6. Promote the development of international interconnections.

### Incentives and Support

In addition to the policy supports established in law and the rhetorical supports offered in the National Energy Strategy, the Chilean Government also announced in 2012 that it will consider the possibility of using tax incentives

to reorient the country's energy mix towards renewable energy and energy efficient technologies. Despite Chile's history of limited government involvement in the energy sector, President Pinera declared that the country would pass "100 laws" in support of its National Energy Strategy.<sup>23</sup>

According to the National Energy Strategy, Chile will also use several additional policy mechanisms to encourage the development of non-conventional renewable energy resources:

- *Tender Mechanism:* Open tenders will be carried out in which developers could be awarded a state subsidy to make the price associated with energy production more attractive. According to the Chilean Government, price supports will be defined according to the bids submitted, so developers may be unaware of potential subsidies or incentives when bidding on projects.<sup>24</sup>
- *Geo Reference Platform:* To facilitate private sector investment in renewable energy projects, the Government of Chile announced it will create a "geo reference platform" to provide up-to-date information on the viability of renewable energy projects. The information provided by the platform will include a description of existing renewable projects, a database of potential resources, state-owned land available for development, detail of energy demand at an industrial, commercial, and residential level, information on roads and electricity infrastructure, environmental protection areas, and information on land-use and planning. The goal of the project is to provide certainty regarding the feasibility of RE projects and to take greater advantage of public lands for renewable energy development.<sup>25</sup>
- *Chilean Renewable Energy Center:* Additionally, Chile has established a Renewable Energy Center (Centro de Energías Renovables, or CER), a new public institution to promote and facilitate renewable energy development in Chile. The CER is supported by the U.S. National Renewable Energy Laboratory (NREL) in Golden, Colorado and the U.S. Department of Energy. CER will provide technical assistance,

21 Presentation by Chilean Embassy in Washington, DC entitled "Energy Policy in Chile" (received in person on 19 December 2012)

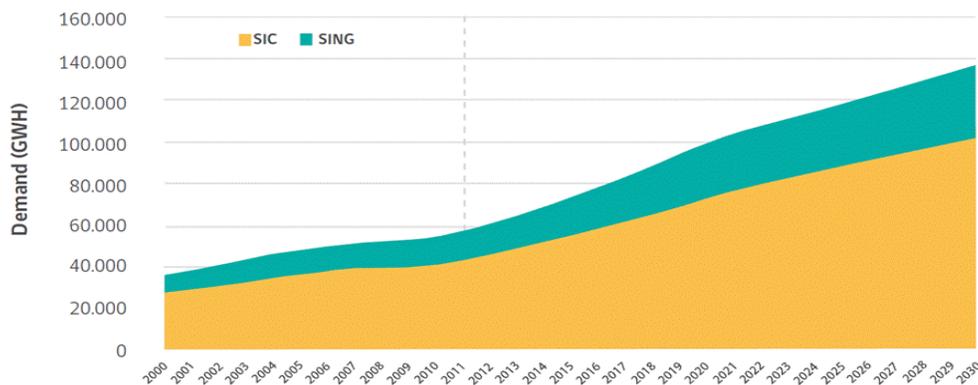
22 Bloomberg New Energy Finance, "Climate Scope 2012: Assessing the Climate for Climate Investing in Latin America and the Caribbean," pp. 47

23 Conversations with State Department officials -- 08 March 2012

24 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 21 (February 2012)

25 Ibid, 21

Figure 2: Energy Demand Growth (SIC and SING Demand, 2000-2030)



Source: Chile National Energy Strategy, pp. 7

share best practices from across the renewable energy industry, and contribute to research and development efforts that can support all of Latin America in the development of a strong clean energy economy.<sup>26</sup>

- *Subsidy and Incentive Plan:* The National Energy Strategy also called for the development of a new subsidy and incentive plan to further develop cutting-edge renewable energy technologies. The program is yet to be designed, but will be implemented only for pilot-scale non-conventional renewable energy technologies. ITA advises interested parties to monitor communications from the Chilean Energy Ministry for more details on the program.<sup>27</sup>

### Market Drivers

Understanding the market drivers that impact Chilean policy-making and continue to shape the energy market are critical for any American company seeking to do business in Chile. The main driver is simply energy demand growth – a driver that remains at the forefront of all Chilean policy-making in the sector.

### Energy Demand

As the world's leading copper producer and with a rapidly growing economy, Chile must meet an estimated 6-7% energy demand growth between now and 2020.<sup>28</sup> According to estimates, Chile will need to meet 100,000

<sup>26</sup> Ibid, 22

<sup>27</sup> Ibid, 22

<sup>28</sup> Presentation by Chilean Embassy in Washington, DC entitled "Energy Policy in Chile" (received in person on 19 December 2012); and Bloomberg New Energy Finance, "Climate Scope 2012: Assessing the Climate for Climate Investing in Latin America and the Caribbean," pp. 46

GWh of electricity demand by 2020, most of which is needed in the SIC system utilized by central Chile [see Figure 2].<sup>29</sup> This will require 8 GW of new generation projects, much of which is expected to utilize the country's considerable renewable energy potential.<sup>30</sup>

In September 2011, Chile experienced first-hand the need for additional energy production when nearly 10 million energy consumers experienced a blackout that paralyzed the country's mines and left the capital city of Santiago debilitated.<sup>31</sup> Power was restored within hours, but policy-makers now face increasingly strong calls from their constituents to address the country's looming power deficits.

### Energy Security

Not only must Chile deal with strong energy demand growth, but it is increasingly reliant on energy imports to meet demand, putting the country's economic growth at the mercy of global energy markets. Chile's dependence on imports from foreign countries has grown dramatically since 1980, when the country imported 42% of its energy. Today, almost three-fourths of Chile's energy is imported, mainly in the form of natural gas from Argentina.<sup>32</sup>

<sup>29</sup> Bloomberg New Energy Finance, "Climate Scope 2012: Assessing the Climate for Climate Investing in Latin America and the Caribbean," pp. 46; and Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 7 (February 2012)

<sup>30</sup> Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 7 (February 2012)

<sup>31</sup> Robin Yapp, Renewable Energy World Magazine, "Chile's Uncertain Renewable Energy Future," pp. 1 (9 April 2012) – <http://www.renewableenergyworld.com/rea/news/print/article/2012/04/chile-looks-to-renewables-as-its-grid-falters>

<sup>32</sup> Robin Yapp, Renewable Energy World Magazine, "Chile's Uncertain Renewable Energy Future," pp. 2 (9 April 2012) – <http://www.renewableenergyworld.com/rea/news/print/article/2012/04/chile-looks-to-renewables-as-its-grid-falters>

Consequently, the Chilean economy has faced considerable hardship when natural gas shipments from Argentina were reduced starting in 2004, or when long periods of drought, limited hydropower production.<sup>33</sup> Both examples resulted in electricity rationing. In the mid-2000s, the acute sense that Chile's economy was at risk from global energy price shocks catalyzed large investments in domestic energy production – mainly utilizing traditional fossil fuel resources. As a result, coal now represents 63% of Chile's energy mix.<sup>34</sup>

But these same energy security concerns have also facilitated growing investments in renewable energy, particularly in Northern Chile. ITA expects this investment to result in significant opportunities for U.S. companies that have expertise in developing off-grid solar, geothermal, and wind projects over the next several years. In the medium- and long term, experience working in Chile on these smaller projects may provide opportunities to develop or supply larger utility-scale projects throughout the country.

### Pricing

Chile's lack of domestic energy production and its growing demand for energy has forced consumers to pay higher electricity prices relative to other Latin American markets.<sup>35</sup> While the situation is difficult for rate payers, it makes Chile one of the few markets where renewable energy can compete without incentives. As the price of solar energy in particular continues to fall, Chile should provide a captive and valuable market for development.

Importantly, prices are not the same across Chile. Consumers in central Chile pay close to the median average for Latin America, but consumers in the North – mostly large mining companies – pay higher prices due to high demand and to a reliance on natural gas.<sup>36</sup> This should provide ample opportunity for U.S. companies capable of developing off-grid applications.

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renewableenergyworld.com/rea/news/print/article/2012/04/chile-looks-to-renewables-as-its-grid-falters

33 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 10 (February 2012)

34 Ibid, 12

35 Bloomberg New Energy Finance, "H2 2012 Latin America Market Outlook," pp. 2 (02 December 2012)

36 Bloomberg New Energy Finance, "Climate Scope 2012: Assessing the Climate for Climate Investing in Latin America and the Caribbean," pp. 47

### *Challenges Facing U.S. Exporters*

The challenges faced by U.S. RE&EE exporters in Chile are often not that different than the challenges faced by Chilean companies. Unlike other markets where protectionist policies place U.S. firms at a disadvantage, U.S. exporters receive the same incentives as local companies and thus the challenges are more structural and market driven than policy-based.

Nevertheless, an understanding of the hurdles that face renewable energy projects is critical for U.S. companies to be successful. The most common barriers are the high cost of initial investment; limited availability of financing – especially from local banks; difficulties connecting projects to transmission lines; and difficulty negotiating long-term contracts.<sup>37</sup> Some projects can suffer from extremely long lead-times as a result of environment concerns and the process of proving environmental sustainability. Overcoming these barriers can be difficult and finding an experienced local partner can therefore be essential.

### Financing

Local Chilean banks have been slow to invest in Chile's renewable energy industry, limiting the sector's growth potential over the previous decade. The exception has been the Chilean Government's Corporacion de Fomento de la Produccion (CORFO), which has disbursed roughly \$12 million for the renewable energy industry and is one of the key incubators for the renewable energy industry in Chile.<sup>38</sup>

Without the involvement of local financiers, many international organizations like the European Investment Bank, the Inter-American Development Bank, or the World Bank have taken the lead in developing projects.<sup>39</sup> These institutions, as well as several private sector investors from the United States, Europe, and China often find Chile a great place to do business thanks to its well-functioning capital markets and business-friendly culture. While some local banks may continue to play a limited role in the sector, continued growth should provide enough incentive that local lenders will begin to invest to a greater extent.

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37 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 20 (February 2012)

38 Bloomberg New Energy Finance, "Climate Scope 2012: Assessing the Climate for Climate Investing in Latin America and the Caribbean," pp. 48

39 Ibid, 48

### Interconnection and Grid Transmission

In addition to financing, connecting renewable energy projects to one of the Chilean electricity grids remains difficult. Today, the completion of electricity transmission projects faces serious difficulties that affect the strength of the entire Chilean energy system.<sup>40</sup> Projects that otherwise enjoy financial support are often delayed for environmental or political reasons. Like in the United States, many worthwhile projects struggle to find community acceptance.

To address these concerns, the Chilean Government announced that it will create a new plan to accelerate investment in the country's electricity grid, hoping that this investment will facilitate additional renewable energy development. Importantly, this announcement demonstrates that the Chilean Government will likely play a key role in planning the country's electricity transmission system, developing electricity transmission networks, and creating new "utility corridors," which should make connecting renewables to the grid easier and more reliable.<sup>41</sup>

The utility corridors concept is particularly interesting for renewable energy project developers. If implemented, the Chilean Government could be allowed to build transmission lines to support renewable energy development in an expedited process, removing some of the decision-making authority of local communities. It remains to be seen if this policy becomes a reality; and if so, to what extent will the Government use its power to override so-called "not in my backyard (NIMBY)" concerns or other political challenges.

### Environmental Sustainability

Several renewable energy projects have been delayed or eventually left undeveloped as a result of environmental concerns. Projects located in the Chilean Patagonia region have faced considerable backlash from local and international advocates seeking to protect this treasured local environment.

### **Opportunities by Sector**

Chile is one of the most open economies in the Western Hemisphere. It has signed trade agreements with over 50 countries, including the United States. As a result of the Free Trade Agreement with the United States, all U.S.

manufactured goods now enter Chile duty free, providing ample opportunities for U.S.-based suppliers.<sup>42</sup>

Chile is open to foreign entrants. The Chilean Government notes in its National Energy Strategy that the country's policy framework should "encourage and facilitate the entry of new actors into the system," including foreign companies.<sup>43</sup> The first clean energy auction should be announced in early to mid-2013, creating opportunities for U.S. developers to bid on projects, ultimately creating export opportunities for U.S. firms capable of selling technology or expertise to projects generated through the auction.<sup>44</sup>

Importantly, Chile is also home to supply chains in each renewable energy technology, but none that can build, supply, and support projects from start to finish.<sup>45</sup> As a result, imports are needed and U.S. companies are well positioned to find success in these markets. In general, ITA recommends that U.S. exporters consider potential buyers in three separate categories:

1. Construction companies, which represents the largest potential in terms of import value;
2. Engineering consulting firms, which is a strategic group to target for their involvement in all parts of the energy supply chain. In many instances, these companies define the specifications of new renewable energy power plants, and the procurement processes for the services and products needed to construct projects;
3. End-use clients, which are often the owners of power plants and purchase replacement parts or need equipment to expand existing facilities.

### Wind

The high-cost of energy in Chile should make onshore wind (estimated at \$91/MWh) an attractive alternative for large energy consumers who pay relatively high rates for electricity (estimated at \$120/MWh).<sup>46</sup> Yet the country did not commission a single wind farm in 2012<sup>47</sup> and has only

42 Marcelo, H. Orellana, U.S. Foreign Commercial Service, "Chile: Solar Energy Industry," pp. 8 (December 2011)

43 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 32 (February 2012)

44 Bloomberg New Energy Finance, "H2 2012 Latin America Market Outlook," pp. 4 (02 December 2012)

45 Bloomberg New Energy Finance, "Climate Scope 2012: Assessing the Climate for Climate Investing in Latin America and the Caribbean," pp. 49

46 Bloomberg New Energy Finance, "H2 2012 Latin America market Outlook" pp. 6 (02 December 2012)

47 Ibid, 8

40 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 28 (February 2012)

41 Ibid, 29

205 MW of wind power in operation,<sup>48</sup> representing just 1% of the country's total energy capacity<sup>49</sup> – this despite an estimated 40,000 MW of wind energy potential.<sup>50</sup>

Only one project was even announced in 2012, the 115 MW El Arrayan Wind Farm in Chile's 4th region. The project is set to be fully commissioned in 2014 and will use 50 2.3 MW turbines produced by Siemens.<sup>51</sup> The project included a 20-year power purchase agreement with Minera Los Pelambres, a mining company in Northern Chile controlled by Antofagasta Minerals S.A.<sup>52</sup>

According to the Global Wind Energy Council, Chile's lack of strong policy support, its poor grid infrastructure, and its need for more electrical engineers are the main barriers to continued wind development.<sup>53</sup>

The wind industry may get a slight boost from setbacks in other energy sectors. In 2012, the Chilean Supreme Court ruled against the construction of a 900 MW coal-fired power plant.<sup>54</sup> With demand for power rising, wind energy may be turned to as a convenient solution.

The largest areas of wind potential are in Southern Chile, in the remote areas of the Patagonia region. Since energy demand in Southern Chile is low, the distance from these windy areas to large population centers in the North and Central part of the country makes distribution and transmission the key to any future development.<sup>55</sup> To date, utilities have been reluctant to make investments in utility scale wind power, which has slowed the industry's progress.<sup>56</sup> Progress will likely depend on the willingness of utility companies, particularly Endesa – the largest utility in Chile – to include wind in their energy mix.

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48 Global Wind Energy Council

49 Bloomberg New Energy Finance, "H2 2012 Latin America market Outlook" pp. 8 (02 December 2012)

50 Robin Yapp, Renewable Energy World Magazine, "Chile's Uncertain Renewable Energy Future," pp. 1 (9 April 2012) – <http://www.renewableenergyworld.com/rea/news/print/article/2012/04/chile-looks-to-renewables-as-its-grid-falters>

51 Bloomberg New Energy Finance, "H2 2012 Latin America market Outlook" pp. 6 (02 December 2012); and [http://www.patternenergy.com/business/projects/el\\_arrayan](http://www.patternenergy.com/business/projects/el_arrayan)

52 [http://www.patternenergy.com/business/projects/el\\_arrayan](http://www.patternenergy.com/business/projects/el_arrayan)

53 Robin Yapp, Renewable Energy World Magazine, "Chile's Uncertain Renewable Energy Future," pp. 1 (9 April 2012) – <http://www.renewableenergyworld.com/rea/news/print/article/2012/04/chile-looks-to-renewables-as-its-grid-falters>

54 Bloomberg New Energy Finance, "H2 2012 Latin America market Outlook" pp. 8 (02 December 2012)

55 Country Energy Profile: Chile – Clean Energy Information Portal ([www.reegle.info/countries/chile-energy-profile/CL](http://www.reegle.info/countries/chile-energy-profile/CL))

56 Bloomberg New Energy Finance, "H2 2012 Latin America market Outlook" pp. 8 (02 December 2012)

Disinterest in wind power, however, may be changing, as Bloomberg New Energy Finance (BNEF) predicts a surge in new wind projects entering the pipeline, including six projects (totaling 392 MW) from Ireland-based firm Mainstream Renewable Power.<sup>57</sup> In total, BNEF notes that 530 MW (more than double current capacity) of new wind projects has secured financing, with many projects expected to be commissioned in 2013 and 2014.<sup>58</sup>

### Solar

Though little development has occurred to date, Chile is home to one of the world's largest solar resources, particularly in the North where the Atacama Desert, (the world's driest desert) receives up to 9.28 KWh of sunlight daily, among the world's highest.<sup>59</sup> In fact, due to high energy prices in certain areas, Chile is poised to become one of the world's first markets where the economics of utility-scale PV can facilitate private-sector investment without subsidies.<sup>60</sup> This may explain why Chile attracted \$159 million worth of solar investment in 2012 despite the lack of large-scale solar capacity.<sup>61</sup>

Currently, Chile is home to a very small solar supply chain. However, with expected growth in the future, ITA expects the domestic supply chain to fill out quickly. In total, 3.1 GW of new solar capacity remains in development.<sup>62</sup> While certainly not all of this planned expansion will be commissioned, BNEF expects 1.1 GW of solar capacity to be online by 2015 – with 116 MW of new capacity connected to the grid in 2013.<sup>63</sup>

Often U.S. solar exporters need to develop relationships with local entities to be successful in the Chilean market. Good points of contact include Chile's Economic Development Agency (CORFO), the Chilean Renewable Energy Center (CER), the Chilean Association of Solar Energy (ACESOL), and the Chilean Association of Renewable Energy (ACERA). One practical option is to partner with local real estate developers, construction companies, and engineering firms that are already involved in the energy sector.

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57 Ibid, 8

58 Ibid, 9

59 Country Energy Profile: Chile – Clean Energy Information Portal ([www.reegle.info/countries/chile-energy-profile/CL](http://www.reegle.info/countries/chile-energy-profile/CL))

60 Bloomberg New Energy Finance, "H2 2012 Latin America market Outlook" pp. 4 (02 December 2012)

61 Ibid, 10

62 Ibid, 11

63 Ibid, 12

An additional area of opportunity may be the solar industry's ability to provide off-grid electricity to the mining industry in Northern Chile, which is mainly powered by diesel generators or expensive natural gas. Already, several mining companies have partnered with solar developers to bring projects online even without the use of government subsidies or incentives. In September 2012, for example, Chilean mining company CODELCO announced it would partner with Energia Llama and Sunmark to develop a 35 MW solar thermal power plant in Sierra Gorda, 120 kilometers southwest of the Chilean city of Calama.<sup>64</sup>

### Geothermal

Located on the so-called "ring of fire," Chile has an astounding 10% of the world's active volcanoes, providing an abundant potential for geothermal energy.<sup>65</sup> To date, no geothermal projects have been completed in Chile – or anywhere else in South America. This despite 16 GW of geothermal potential existing in the country and Chile's growing need for base load electricity.<sup>66</sup>

Nevertheless, deep exploration drilling is underway in Chile and several projects are in the pipeline. An April 2012 tender generated \$250 million worth of investment for 20 geothermal energy exploration concessions. By law, geothermal drilling concessions come with a two-year expiration date by which time concession owners must have either reached an exploration milestone or receive an extension. While sometimes difficult for drilling companies, these stipulations should help jump-start the market for geothermal development.<sup>67</sup>

Chile is home to a relatively robust geothermal supply chain, although most Chilean geothermal firms are focused on the early stages of geothermal development, including exploration project development. Large sections of the downstream supply chain remain unfilled, leaving significant business opportunities for U.S. firms capable of providing technology and expertise. With several large projects planned to begin operation from 2016-2020, ITA expects the geothermal supply chain to grow dramatically in the coming years.<sup>68</sup>

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64 Ibid, 11

65 Country Energy Profile: Chile – Clean Energy Information Portal ([www.reegle.info/countries/chile-energy-profile/CL](http://www.reegle.info/countries/chile-energy-profile/CL))

66 Ibid

67 Bloomberg New Energy Finance, "H2 2012 Latin America market Outlook" pp. 15 (02 December 2012)

68 Country Energy Profile: Chile – Clean Energy Information Portal

### Hydropower

Analysts estimate that Chile's hydropower potential could exceed 9 GW, both in reservoir and run-of-river projects.<sup>69</sup> Today, the country produces roughly 5 GW of large-scale hydropower, leaving significant room for growth for an industry that has traditionally been a major energy producer for Chile. In particular, the Southern part of Chile – from the Maule region to the basins separating the Aysens from Magallanes – offers tremendous hydropower potential.

These are also areas of extreme environmental sensitivity and several hydropower projects have been stalled or cancelled due to environmental concerns, including the HydroAysen project, which President Pinera approved in May 2011. The project would have facilitated the construction of five dams built on two rivers in the Chilean Patagonia region at a cost of \$3.2 billion, and contributed 2,750 MW of new power capacity.<sup>70</sup> If completed, the dams would have flooded large tracts of wilderness, threatening several endangered species. One poll found the proposal was so unpopular that 74% of Chilean citizens opposed the HydroAysen project on environmental grounds.<sup>71</sup>

Given the cost – both financial and environmental – to large scale construction in southern Chile, and the need to transport large amounts of energy from southern power plants to northern consumers, ITA remains skeptical that future large hydropower development will occur in the region. The Chilean government has called for a "special plan" to be developed that would safeguard the Chilean Patagonia from development in areas of "exceptional" environmental value.<sup>72</sup> It remains to be seen if such a plan will be developed.

Small to medium-sized hydropower companies may find opportunities developing small-scale hydropower projects. U.S. exporters should be well positioned to take advantage of this opportunity, should additional small hydro development take place.

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([www.reegle.info/countries/chile-energy-profile/CL](http://www.reegle.info/countries/chile-energy-profile/CL))

69 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 24 (February 2012)

70 Robin Yapp, Renewable Energy World Magazine, "Chile's Uncertain Renewable Energy Future," pp. 1 (9 April 2012) – <http://www.renewableenergyworld.com/rea/news/print/article/2012/04/chile-looks-to-renewables-as-its-grid-falters>

71 Ibid

72 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 24 (February 2012)

What is more, as tidal and ocean energy technologies become increasingly commercialized, few countries offer as much potential to deploy these technologies as Chile. To the extent that U.S. firms that are developing ocean energy technologies can interact with Chilean policy-makers and project developers, the better positioned they will be to capture opportunities in this market once it develops.

### *Biomass/Biofuels*

To date, Chile's use of biomass energy is mainly in the area of co-production from industrial waste for the pulp and paper industry.<sup>73</sup> In fact, Chile's forest industry has become so cost-efficient at converting its waste to electricity that it abandoned efforts to convert it to second-generation biofuels.<sup>74</sup>

As of June 2012, Chile had 278MW of installed capacity of biomass power with an additional 170MW under construction.<sup>75</sup> Landfill gas and agricultural waste are also being targeted for bioenergy. However, only 76MW of future projects were in the pipeline. Compared to other sectors such as wind and solar, which have thousands of megawatts planned, biomass does not appear to be a high growth sector for Chile.<sup>76</sup>

In the area of biofuels, Chile took no interest in first-generation biofuels, due to its limited agricultural resources.<sup>77</sup> However, three government-funded consortia are focused on producing biodiesel from algae, as well as several private sector initiatives, including the use of technology imported from the United States.

### *Energy Efficiency*

In addition to renewable energy power production, Chile provides a significant opportunity for U.S. companies capable of improving the efficiency of its energy consumers. The country's high energy prices and consistent government support for efficiency provides a captive audience for companies that can offer an innovative product or service.

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73 Country Energy Profile: Chile – Clean Energy Information Portal ([www.reegle.info/countries/chile-energy-profile/CL](http://www.reegle.info/countries/chile-energy-profile/CL))

74 Evolution of biofuels in Chile, USDA Foreign Agricultural Service, March 9, 2012, p. 4. [http://gain.fas.usda.gov/Recent GAIN Publications/Evolution of biofuels in Chile\\_Santiago\\_Chile\\_3-9-2012.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Evolution%20of%20biofuels%20in%20Chile_Santiago_Chile_3-9-2012.pdf)

75 Rudnick, Hugh, Presentation January 22, 2013 "Direct Line Webchat on Renewable Energy Opportunities in Chile," slide 10

76 Ibid

77 Evolution of biofuels in Chile, USDA Foreign Agricultural Service, March 9, 2012, p. 3

Chile's focus on energy efficiency dates back to 2005 when the government created the National Energy Efficiency Program (Programa País de Eficiencia Energetica, PPEE), which was implemented for five years before becoming the Chilean Agency for Energy Efficiency. The Agency is designed to strengthen the public-private partnerships needed to improve the efficiency of the Chilean economy and to help meet the National Energy Strategy's call to decrease Chile's energy intensity by 12% by 2020, decreasing Chile's expected energy demand by 1,122 MW.<sup>78</sup>

In 2012, the Chilean government announced its Energy Efficiency Action Plan 2012-2020, which contained four key action items and provides a window into the thinking of the country's policy-makers.<sup>79</sup> First, the plan called for improvements in the "green buildings sector," including social housing. The action plan aimed to reduce the energy intensity of already constructed buildings, to design buildings to new, high-efficiency standards (building codes), and to offer construction products and services with efficiency criteria (labeling). The plan also called for the establishment of new residential street lighting programs to accelerate the deployment of efficiency lighting technologies in the residential and public sectors.

Second, the mining sector and other industrial consumers were encouraged to adopt energy efficiency measures, including the implementation of smart energy systems, the use of cogeneration technologies at existing sites. In some instances, the government offered to provide technical assistance for projects that have a significant energy reduction impact.

Third, the plan called for the transportation sector to compile data on energy use that will be used to encourage greater efficiency in passenger transport and freight. A vehicle labeling system and the setting of minimum energy efficiency standards for vehicles will also be established to support greater efficiency levels.

Finally, the plan created strong appliance standards to facilitate the transformation of home appliances into low energy consumption devices through the establishment of minimum efficiency requirements and incentives for replacing old appliances. The plan called for the development of an energy efficiency seal, like Energy Star, to demonstrate the achievements of those companies who lead

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78 Government of Chile, "National Energy Strategy 2012-2030: Energy for the Future," pp. 17 (February 2012)

79 *ibid*, 17

the way in promoting energy efficiency efforts. To oversee these efforts, the government announced it will create an Inter-ministerial Commission for the Development of Energy Efficiency Policies, which will periodically report directly to the President of Chile on the country's energy efficiency improvements.<sup>80</sup>

### Smart Grid

In addition to using energy more efficiently, the Chilean government has also signaled its interest in the development of a more dynamic electricity market that includes distributed sources and pricing schemes to enable enhanced efficiency—creating opportunities for U.S. smart grid companies.

According to plans, the Chilean government will implement a large net-metering regime in the coming years, allowing residential consumers and small business to install renewable energy systems in their homes and businesses. The net-meters would facilitate the sale of excess electricity back to one of Chile's three electricity grids.<sup>81</sup> As the market for distributed solar and other energy sources develops in Chile, opportunities will arise for smart grid software and services firms that can enhance utility capabilities to manage both electrons and data.

Chile has also embarked on the deployment of smart meters, led by the largest distribution company and with high levels of support from the federal government. CGE Group – the distribution company responsible for electricity services to 40% of Chile's population – began deploying smart meters to select neighborhoods near Santiago last year. CGE's smart meter system allows for flexible tariffs and home automation, and is part of the utilities efforts to expand energy efficiency services to consumers.

Additionally, smart grid technologies will be used in the medium and long-term to facilitate interconnections between regional distribution networks, both within Chile and with neighboring countries. Already the Chilean government has announced its support for the Deep Integration Agreement, which would facilitate the building of regional transmission lines running from Central America through Colombia and from Peru to Chile. Additional interconnects are possible with Argentina along different parts of the 3,300 mile border, along with Peru, Bolivia, and Ecuador.<sup>82</sup>

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<sup>80</sup> Ibid, 18

<sup>81</sup> Ibid, 34

<sup>82</sup> Ibid, 36

### **Important Contacts**

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## *About the Office of Energy and Environmental Industries*

The Office of Energy and Environmental Industries (OEEI), a part of the International Trade Administration's Manufacturing and Services unit, is dedicated to enhancing the global competitiveness of U.S. energy and environmental industries, expanding their market access, and increasing their exports. Industry analysts perform strategic research and analysis in order to shape and implement trade policy, create conditions that encourage innovation, lower the cost of doing business, and promote U.S. economic growth. For more information, or to access other OEEI reports, contact the office at (202) 482-5225.

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