

## CHILE AIMS TO WIN GREEN HYDROGEN RACE

WHILE THERE ARE A NUMBER OF COUNTRIES CONTENDING TO BE GLOBAL LEADERS IN COMMERCIALISING GREEN HYDROGEN AT SCALE, WE THINK CHILE MAY BE POSITIONED TO ASSUME A GLOBAL ROLE IN THE NASCENT GREEN HYDROGEN INDUSTRY GIVEN A COMBINATION OF POLICIES, RESOURCES AND CONDITIONS THAT WE EXPLORE IN THIS ARTICLE. BY **MARIA-LETICIA OSSA DAZA, JORGE KAMINE, MATTHEW VITORLA AND JAVIER PEREZ-MARCHANT, WILLKIE FARR & GALLAGHER LLP.**

The year 2020 will undoubtedly be remembered for the global pandemic and its devastating and disruptive effects on people's lives, global markets and national economies. Moreover, it independently proved to be a year of global shocks for energy – first due to the oil price war between Russia and Saudi Arabia, followed by the collapse of demand as a result of the pandemic-related lockdowns around the world.

It may also come to be remembered as the year that a diverse group of forces converged to accelerate a global push to expand the development and use of hydrolytic or green hydrogen generated from renewable energy as a cornerstone for the energy transition to a net-zero carbon emission global economy. Those forces have included:

- New or expanded public policies in many advanced and emerging economies to accelerate the energy transition in their countries given another record year of adverse weather changes and natural disasters and parallels drawn between the global pandemic and dangers of climate change. Those policies have also linked pandemic recovery and economic development to incentivising investment in energy and infrastructure, particularly the expanded deployment of electrification and use of renewable energy. Green hydrogen production and use have been a key part of those public policies, with Australia, Chile and Spain emerging as regional forerunners. Those policies have spanned various levels of government with the support of an array of international and non-governmental actors all focused on promoting green hydrogen.
- Last year also saw a wide range of private sector industries making significant commitments towards the decarbonisation of their companies, manufacturing, and supply chains. There was an emphasis on reorientation of the corporate strategies of major energy companies and other major corporations towards reducing carbon intensity, incorporating green hydrogen as part of changes intended to address business, consumer and public concerns about advancing towards net-zero emission targets, and improving ESG (environmental, social and governance) outcomes and impacts, including those related to carbon intensity and climate change.

- The culmination of various factors improving the economics of green hydrogen, including expanded investment in projects, lower energy and technology prices due to the deployment of renewables and other market forces.
- An accelerating pace of new green hydrogen projects, including 50 viable global projects announced in the past year with a total hydrogen production capacity of four million tons per annum.

As many commentators and critics have observed, we have been here before. The recent surge of attention has focused on hydrogen, specifically green hydrogen, as an energy carrier that can play a pivotal role, together with electrification in decarbonising key sectors of the global economy, specifically industry, the built environment and transport.<sup>1</sup> In the past, waves of enthusiasm for hydrogen have waned in the face of challenges to making hydrogen a cost-competitive energy carrier manufactured at scale to allow it to compete and displace hydrocarbons. The current wave of interest can be attributed to a convergence of essential and catalytic factors described above that appear certain to lead to sustained momentum behind the development of a global hydrogen industry.

As noted above, chief among these factors is the accelerating global push for the energy transition away from hydrocarbons and, where green hydrogen allows for advancing those goals through sector coupling, in achieving net-zero emission targets in power generation, transportation and industrial processes. An equally important factor in the resurgent focus on green hydrogen has been the broad and rapid deployment of renewable energy generation facilities worldwide, which has significantly reduced the price of electricity, particularly in countries such as Chile.

Given that electricity accounts for up to 60% of the total production costs of green hydrogen,<sup>2</sup> a significantly lower price of electricity translates into a lower cost factor for green hydrogen production, which increases the possibility of making it cost-competitive with other energy carriers.<sup>3</sup> Hence, as further discussed below, Chile's substantial deployment of and significant capacity for expanding renewable generation and its potential to supply a large, decarbonising

mining sector and promising export market, as well as its strong regulatory and institutional foundations, mean that Chile is well positioned to be a leader in developing a scalable, cost-competitive green hydrogen industry that effectively navigates the financeability challenges inherent in nascent technologies and applications.

### Chile

While there are a number of countries contending to be global leaders in commercialising green hydrogen at scale, we think Chile may be positioned to assume a global role in the nascent green hydrogen industry given a combination of policies, resources and conditions that we explore in this article.

- *Chilean energy policy and electricity prices* – As noted above, the market competitiveness of green hydrogen turns primarily on the price of renewable energy.<sup>4</sup> Chile made significant headway towards driving down the cost of renewable-sourced electricity by encouraging an immense mobilisation of the renewables industry, starting in the late 2000s and achieving a greater penetration of renewables than many other advanced economies.<sup>5</sup> Building on advantageous natural geographic conditions<sup>6</sup>, Chile's success with renewables has been the result, in part, of policies creating strong incentives for investment in renewable projects.

Chile introduced a 10% renewable energy target in 2008, which was increased in 2013 to 20% of energy consumed nationally.<sup>7</sup> Chile also introduced other favourable regulatory features credited with significantly boosting the renewables industry's development, including exemptions from transmission tolling and VAT charges on critical imported equipment and other services used in constructing renewable energy projects, simplified reporting and pricing frameworks for distributed generation assets and an aggressive coal retirement strategy. This scheme of industry-friendly features was built on the strong legal foundation that has made Chile an attractive investment target for years, as described further below.

Chile's continuing success in stimulating dynamic renewable energy development should impart a good deal of optimism for the green hydrogen industry. The experience with renewables has provided the national government of Chile (the Chilean government) and other institutions a set of familiar policy tools that have already proven their viability. We discuss below several ways in which such tools might be applied in the early stages of the green hydrogen industry.

In addition to the value that renewable energy development has in serving as a model for government and industry with respect to green hydrogen technologies and applications, the expansion of renewable energy generation is itself a major component of green hydrogen's massive potential in Chile. The boom in

renewable generation has yielded increasingly lower electricity prices in Chile.<sup>8</sup> This trend is expected to continue steadily into the future with Chile's more immediate planned expansion of installed renewable capacity (expected to double in the next few years) as well as its vast, untapped resources.<sup>9</sup> According to the Hydrogen Council Report, these factors could enable Chile to achieve the world's lowest production costs for green hydrogen, making it cost-competitive not only in Chile but also in the growing export market.

- *Strong domestic demand and export potential* – In addition to favourable cost conditions, Chile's hydrogen industry is positioned to benefit from strong domestic demand – generated primarily by the large mining sector, the country's largest fuel and energy consumer, as it sets out to achieve carbon neutrality goals – as well as from its ability to export, at low cost, significant amounts of hydrogen to key locations in the Asia-Pacific market (ie, China, Japan and South Korea) and the United States where hydrogen consumption is expected to be stronger and develop faster.

The domestic hydrogen market is expected to be buoyed in large part by Chile's mining industry, which has already begun a transition away from its traditional fuel sources by turning to renewable energy and supporting sustainability-focused research and development. Green hydrogen and its derivative products, such as green ammonia, will be able to play a key role in helping this major Chilean industry achieve its net-zero emission targets when used as an alternative power source for heavy machinery and mining vehicles. In addition, Chile's National Oil Company (Empresa Nacional del Petroleo, or ENAP) is already engaging in the development of a major green hydrogen project that will produce components of synthetic green gasoline and other eFuels.

With respect to exportation, Chile has strategically leveraged its geographic and economic conditions by consistently investing in its port infrastructure and by developing a strong network of trade and tax treaties that facilitates access to high-demand markets and lower transaction costs. With the rise of renewables, Chile's trade and shipping infrastructure could see a corresponding transition from importing fossil fuels to exporting green hydrogen and related products.

In South America, Chile's position as a leader in the green hydrogen race may enable it to strategically assist other countries to make progress in their renewable energy transitions. In fact, Chile recently committed to helping Colombia become a partner in the region and to coordinating efforts across the region to develop a broader hydrogen market. Chile's work to create a strong network in the region will help position its industry to benefit from the steady growth of neighbouring developing economies, such as those of Colombia, Brazil, and Peru.

The large North American hydrogen market also represents a significant opportunity for the Chilean hydrogen industry's future. The expansion of ambitious carbon emission targets and other favourable policies supporting electric vehicles and fuel cells, including those supported by the Biden-Harris administration, would significantly accelerate the shift in demand from grey and blue hydrogen to green hydrogen and could outpace the domestic industry's ability to transition its production to renewable energy.<sup>10</sup>

Moreover, the United States has already seen the development of several green hydrogen-fuelled projects, including large projects to supply power to major cities in California and Florida, such as the Los Angeles Department of Water and Power's (LADWP's) proposed Intermountain Power Project/ACES Project, which will convert existing coal-fired generation projects supplying electricity to the City of Los Angeles into gas-fired and ultimately green hydrogen-fuelled projects.

• *Developing industries in an advanced economy* – Chile is consistently recognised as a regional success for having built an attractive economic and regulatory framework from a foreign investment perspective. The first Latin American country accepted into the OECD, Chile has achieved one of the highest levels of GDP per capita in South America and provides foreign investors with easy access to its competitive and dynamic domestic capital market. There is no doubt that Chile has become a leader in foreign direct investment in Latin America and the Caribbean for a number of reasons, including its stable institutions, which have shown themselves to be resilient amid recent social unrest and the ongoing constitutional process, and a favourable tax scheme, both generally and with respect to infrastructure projects, which combines a simple structure with favourable incentives for foreign investors.

Although the Covid-19 pandemic has affected the country's development forecast, as it has for other developed economies, the Chilean government has been committed to its recovery plan by increasing investment in critical infrastructure. Chile's green recovery plan is expected to provide the private sector with attractive investment opportunities in the energy, infrastructure, public works, water, and transportation sectors, and will prioritise projects involving emission reductions and other sustainability features. Green hydrogen and other renewable projects are thus well positioned to benefit from the recovery plan, and the prioritisation of such projects appears to have emerged as a global trend amid the pandemic, which has highlighted sustainability as a key social and environmental issue.

#### Strategies for financeable projects

Prior to the pandemic, debt and equity financing seemed readily available from a variety of sources for a wide range of well-structured

energy and infrastructure projects in Chile and other parts of Latin America. Infrastructure funds were raising record amounts of capital to deploy in the region. Given intense competition and tightening margins for financing renewables, we increasingly saw investors and lenders expanding the types of projects that they sought to finance. The pandemic certainly disrupted those trends and seems to have ushered in more conservative plans. Nevertheless, even the second half of 2020 saw steadily increasing interest in hydrogen among investors.

Most green hydrogen projects that have been discussed in the press appear to rely on financing from corporate balance sheets and occasionally on grants or other support from government, such as the Haru Oni pilot project in southern Chile, which aims to produce sustainable eFuels using green hydrogen.

As credit and capital markets return to their pre-pandemic levels of activity and confidence, we would expect that well-structured green hydrogen projects in Chile should be able to access third-party debt and equity financing. As with any project financing, sponsors will need to present projects with sound economics based on creditworthy offtake arrangements and sustainable production, transportation, and storage costs, as well as minimal exposure to any lingering technology risks.

In addition, some commentators have noted that hydrogen projects tend to involve project-on-project risk that will make it more difficult to secure financing. Based on our experience, strong sponsors in a burgeoning industry will be able to structure their projects to address these issues as costs continue to drop. We also believe that project sponsors and policymakers may be able to look to the financing of certain other energy projects for useful ideas and models for addressing these issues and mobilising financing for green hydrogen projects.

Chile's National Green Hydrogen Strategy (Estrategia Nacional de Hidrógeno Verde, the National Strategy)<sup>11</sup> sets as one of its primary goals addressing the significant hurdles that every nascent technology faces: navigating regulatory frameworks not designed to accommodate the new technology and obtaining access to financing at a cost of capital that makes scalable projects feasible with an attractive equity return. The scope of the National Strategy demonstrates recognition that governmental support through either direct financing or other incentives, eg, tax and permitting relief, will be critical to ensuring that green hydrogen facilities are financeable.



The large North American hydrogen market represents a significant opportunity for the Chilean hydrogen industry's future

- *Providing direct support to green hydrogen projects and other development initiatives* – With the first green hydrogen pilots in Chile still in their early stages, the Chilean government has been quick to recognise that access to financial assistance will be key to their success. In its initial targeted development programme, the Chilean Economic Development Agency, CORFO, is providing direct financial support to green hydrogen projects and promoting innovation and research efforts directed towards expanding hydrogen applications in key industries.

Substantial grants have been awarded to projects in the pre-feasibility and engineering study phases under CORFO's Innova High Technology Program. One of these projects is the Hydra Project being run by Engie, in partnership with Australian research agency CSIRO and major players in the mining sector, to examine replacing the powertrain of mining vehicles with hydrogen-powered fuel cells.

CORFO's Innova High Technology Program has also provided to the Hyex project, also developed by Engie, which focuses on producing green ammonia, a key component in mining processes, and to the Caex project, led by Anglo American and the Catholic University of Chile, which promotes the use of a hybrid diesel-hydrogen-powered engine in mining trucks and machinery.

In addition, CORFO awarded a consortium of foreign and domestic universities with a concession and over US\$190 million in funding to form and operate the Clean Technologies Institute (Instituto de Tecnologías Limpias, or ITL), which will focus its research efforts on the development of a green mining industry in Chile, including applications of green hydrogen and innovation with respect to renewables. CORFO will also offer US\$50m in direct grant funding available for early-stage projects. The tender for this pool of grant funding is expected to be available as early as March 2021.

At the same time, the Chilean government is working diligently with international organisations, financial institutions, and development banks in an effort to grant developers of green hydrogen projects access to either government-backed financial guarantees for new projects or bank financing on terms similar to concessional financing, which is not usually available to Chilean projects.

It is worth noting that a recent request for information issued by CORFO for the development of green hydrogen projects on government land caught the attention of several investors. As reported by the Chilean Development Agency, the initiative has received at least 18 expressions of interest from interested parties in diverse industries – energy, mining and green hydrogen derivatives, among



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others. The proposed projects, which entail an aggregate private investment of US\$12bn, involve the development of facilities to produce green hydrogen or its derivatives in locations with an ample supply of renewable energy resources, easy interconnection to the electrical grid and good transportation access.

The Chilean government has also announced that specific tax benefits are likely to be included in forthcoming legislation that will introduce the initial set of green hydrogen regulations. The benefits are expected to be tied to the use of hydrogen-powered electric vehicles, which may include tax deductions for the purchase of a vehicle or the cost of green hydrogen-based fuel. Other incentives currently being discussed by Chilean officials range from increasing the current carbon tax rates on the use of fossil fuels, to eliminating fossil fuel subsidies to the freight and transportation industries, to introducing a temporary tax holiday for green hydrogen.

In addition to these new potential benefits, developers of green hydrogen projects will still have access to the typical suite of tax and investment incentives under the Chilean tax framework. A tax-reduction mechanism commonly used in renewable energy projects, the VAT refund, allows developers to recoup certain costs paid on goods and services. Developers may also benefit from the zero-VAT regime for certain imported capital goods.

- *Establishing a favourable, efficient regulatory framework* – As noted above, Chile has a history of successfully recognising the importance of developing a clear and favourable regulatory framework for growing industries that are facing high investment costs and uncertainty associated with new technologies. Support from governmental authorities with respect to permitting and reporting requirements is key to actually achieving viable projects and to further reducing project financing costs.

As regulatory regimes adapt to accommodate green hydrogen, traditional lenders and other sources of credit will be more comfortable entering the new market. As a more immediate accommodation, the Chilean Energy & Fuels Superintendency (Superintendencia de Electricidad y Combustibles) is working with the Ministry of Energy & Mining to provide some flexibility in granting permits requested by green hydrogen pilot projects and in allowing developers to apply international industry standards in the absence of local regulations.

As part of Chile's effort to mitigate the regulatory and legal risks that can drive up financing costs, the National Strategy calls for establishing a legal framework that will be independent from political changes and provide clear incentives and guidance to investors.

Chile's current regulatory regime refers to hydrogen only in the context of hazardous substances, and provides only a handful of generic safety, transportation and storage

standards arising from a disparate body of regulations. The Chilean government thus had to build from the ground up a legal framework that addresses the uncertainties that might endanger the feasibility or financing of a green hydrogen project.

In this regard, the Ministry of Energy & Mining retained the German development agency, GIZ, to issue a hydrogen regulation proposal based on international standards. The proposal, issued in April 2020, suggested that initial efforts focus on key regulations that will enable the industry to grow relating to hydrogen infrastructure, transportation and storage, and the use of hydrogen in freight vehicles to ensure that the industry has sufficient clarity to grow in its early stages.

Comprehensive safety regulations and regulations customised for other applications will follow in order to support the continued expansion of the industry. Eventually, a mature legal framework will include municipal regulations and updated labour and work safety standards, as well as regulations for the use of hydrogen in specific vehicles. The Ministry of Energy and Mining is aiming to draft and issue regulations within the time frame suggested by the proposal, which entails completing the key regulation by 2024 and a secondary regulation by 2028, with the final layer following thereafter.

The Chilean government is acting rapidly to implement this proposal. In January 2021, the Ministry of Energy & Mining, joined by the heads of several Senate Committees – Energy, Mining, Science and Technology, and Future Challenges – presented the H2V Initiative, which is designed to coordinate the upcoming regulatory policies and proposals relating to the development of the green hydrogen industry in Chile. Key policies that are expected to be issued as part of this initiative in 2021 include an “electromobility plan”, which will provide for tenders to supply hydrogen-fuelled buses for public transportation, certain regulatory changes to disincentivise the use of diesel in industrial processes and, notably, the proposed regulations governing the production, storage, transportation and use of hydrogen in the mining sector.<sup>12</sup>

- *Creating a robust export market* – One of the pillars of Chile's National Strategy is securing a strong market for the exportation of green hydrogen to allow the industry to replicate the scale and financial success of Chile's mining industry, which has historically been the main driver of the country's economic activity. As part of this effort, the Chilean government, employing what it has designated as “green hydrogen diplomacy,” is actively promoting



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the creation of international cooperation agreements to support innovation and research on green hydrogen's potential applications and is currently negotiating with public agencies and private organisations from Germany, Japan, Singapore, Spain, and the United Kingdom.

As discussed above, the Chilean Government has also agreed to assist Colombia in designing its own green hydrogen roadmap for joining Chile as a large-scale hydrogen producer and exporter. The agreement also provides for the creation of a regional plan to promote the development of the hydrogen industry, which may provide Chile with greater access to potential hydrogen buyers in the region. Combined with Chile's trade policies and shipping infrastructure, the cost competitiveness that Chilean green hydrogen is expected to achieve will mean that it will be supplying not only the growing domestic market, but also the regional and broader international markets as well. With plentiful buyers, low export costs and the potential for long-term supply agreements, green hydrogen developers should be able to demonstrate to investors and lenders that their projects mirror the favourable economics that drove the success of Chile's mining industry.

- *Addressing offtake risk* — As green hydrogen projects mature and become more familiar to industry and investors, they may find that long-term revenue agreements with reputable offtakers provide another solution to attracting investment and lowering financing costs. In Chile, green hydrogen and its derivative products (such as green ammonia or green methanol) present the mining industry and retailers with an alternative to fossil fuel-derived products.

A prime example is the Haru Oni Highly Innovative Fuels (HIF) project mentioned above, which has brought together Porsche, Siemens Energy, Andes Mining & Energy (AME), ENAP and Enel as partners. The project, which has received substantial financial support from the German government, will supply a German oil company with eFuels and will also be able to provide green methanol to ENAP.<sup>13</sup>

As we know from past experience with other novel or innovative energy projects, this type of long-term offtake contract with a creditworthy offtaker is key to demonstrating the demand necessary to support the development of a stable, domestic market for green hydrogen projects in Chile and the bankability of those projects. Government support, in the form of funding, guaranties and other credit enhancements, bolsters confidence with offtakers that the project will have access to the financial resources necessary to realise the project and fulfil the offtake contract, which in turn improve the project's financeability and ultimate rate of return. Like the trajectory observed in the development of renewable generation in Chile, these structural elements work together to push and accelerate the

development of a scalable industry with adequate access to investment.

From a policy perspective, Chile had a good deal of success stimulating demand for renewable energy projects using government-supported auctions of offtake agreements, mandates and portfolio standards in a way that could be emulated to increase the demand for green hydrogen projects, which could help reduce costs and improve overall economics, as discussed above. In some cases, the auctioned power purchase agreements involved public entities or government support to raise the creditworthiness of the offtaker and reduce the overall credit risk of the project, which in turn served to lower the cost of financing.

Again, similar approaches could be employed to expand the deployment of green hydrogen projects in the short to medium term. For example, the LADWP Intermountain Power Project/ACES Project will be a transformative power and underground storage project with improved bankability given LADWP's involvement as an offtaker. As we have seen with the evolution of the renewable energy industry, those government supports can be reduced over time and ultimately eliminated as the projects become more cost-competitive and accepted by commercial debt and capital markets.

- *Structuring to resolve project-on-project risk* — As previously noted, some observers have noted that green hydrogen projects will have difficulties being financed because of project-on-project risk: a hydrogen production facility may require the construction of other facilities such as storage or transportation facilities for the hydrogen, the production may be primarily intended for another project that will distribute or utilise the hydrogen, or the hydrogen production may require the construction of infrastructure to supply inputs such as the electricity and water supply (or perhaps the renewable energy generation project itself).

While the interdependency of these parts of the project certainly introduces additional risks to be addressed, we have the experience and tools to structure these complex projects — much like LNG-to-power projects, renewable energy projects requiring new transmission facilities (or vice versa), and midstream projects serving larger manufacturing or production facilities — into bankable projects.

In some cases, it may be a matter of using a tolling arrangement, minimum capacity payment or reservation charge to ensure that a key part of the project is not exposed to commodity, volumetric or other variable offtake risk. It may mean requiring termination payments where the offtake project does not proceed. In all cases, the party making those payments must be creditworthy (or provide appropriate credit enhancements).

Another example would be to structure the incorporation of hydrogen as a post-financing phase of a project, as appears to be the case

with New Fortress's Long Ridge Energy Terminal, which is a gas-fired project in Ohio that will ultimately run on hydrogen but that will start with a blend of natural gas and hydrogen. In our experience, we would expect to see strategies like these used to overcome this type of risk and allow the financing of these projects to proceed.

### Conclusion

Despite the potential challenges, we remain very optimistic that the momentum around a transition to a hydrogen economy will continue, both in Chile and globally, given the range of private sector companies – from oil majors to renewables companies – and the diverse group of public sector actors that are committed and actively engaged in different aspects of the transformation.

This year will be an important year in assessing the pace of those advances and whether such pace will follow more conservative predictions or accelerate. Of course, it will be important to see how we emerge from the pandemic midyear. We will also be watching the trajectory of previously announced green hydrogen projects and the implementation of Chile's National Strategy.

In introducing the National Strategy and building on its competitive advantages and past successes with renewables deployment, Chile has emerged as a likely candidate to perform well in the global green hydrogen race. Sponsors and developers of green hydrogen projects, together with the Chilean government, will nevertheless need to address the complex commercial and legal challenges and uncertainties that exist in Chile, and around the world, in order to attract favourable financing terms and encourage investment in the industry. ■

### Footnotes

1 – See, eg, the DNV GL Group Technology & Research Position Paper 11-2020 entitled "Sector Coupling: Creating an interconnected decarbonised energy system benefiting industry, the power sector and society" and available at <https://www.dnvgl.com/publications/sector-coupling-192058>.

2 – See <https://www.spglobal.com/ratings/en/research/articles/201119-how-hydrogen-can-fuel-the-energy-transition-11740867>.

3 – Please see the report from the International Renewable Energy Agency (IRENA), "Green Hydrogen Cost Reduction," available at <https://www.spglobal.com/platts/en/market-insights/latest-news/metals/121720-irena-outlines-path-to-cost-competitive-green-hydrogen-at-scale-report>; see also the report published by the Hydrogen Council, supported by consulting firm McKinsey & Co, "Path to hydrogen competitiveness: A cost perspective," available at [\[Competitiveness\\\_Full-Study-1.pdf\]\(#\) \(the Hydrogen Council Report\).](https://hydrogencouncil.com/wp-content/uploads/2020/01/Path-to-Hydrogen-</a></p></div><div data-bbox=)

4 – In the Chilean context, renewable energy means energy from non-conventional renewable sources (energías renovables no convencionales), such as solar photovoltaic, wind, small hydroelectric, biomass, geothermal, and tidal sources.

5 – Starting from having virtually no facilities in 2011, Chile now has more than 6,000MW of renewable generation installed, representing around 25% of total installed capacity.

Furthermore, Chile is currently on the path to meeting 70% of its electricity demand with renewables by 2050.

6 – Chile possesses outstanding conditions for the development of renewable energy, in particular the complementary pair of solar and wind energy, with the Atacama Desert in the north boasting one of the world's best solar irradiation indexes, and an extensive coastline and southern region presenting excellent wind resources.

7 – See Law No 20.257, dated as of April 1 2008; Law No 20.698, dated as of October 22 2013.

8 – Chile's energy auctions have consistently yielded low prices for energy due to growing participation by renewable generation. In the most recent auction, held in 2017, the winning bid was priced at US\$21.48 per MWh, when the average price in previous years had ranged between US\$47 per MWh and US\$79 per MWh.

9 – Chile has the potential to develop more than 70 times its current renewable generation capacity, around 1,300GW and 1,800GW. See Hydrogen Council Report.

10 – On January 27 2020, President Biden signed an executive order on key climate change actions, which included a direction to federal agencies to procure carbon-free energy and electric vehicles, support the commercialisation of clean energy technologies, and accelerate clean energy generation. See <https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/27/fact-sheet-president-biden-takes-executive-actions-to-tackle-the-climate-crisis-at-home-and-abroad-create-jobs-and-restore-scientific-integrity-across-federal-government/>.

11 – Chile officially announced the National Strategy during the International Green Hydrogen Summit it hosted in November 2020. Since then, the Ministry of Energy and Mining has been actively promoting the National Strategy through a range of Chilean investment and development agencies, ie CORFO, InvestChile, ProChile, as well as with the active support of the German development agency, GIZ.

12 – See [https://www.senado.cl/senado/site/mm/20210113/asocfile/20210113233046/iniciativa\\_h2v.pdf](https://www.senado.cl/senado/site/mm/20210113/asocfile/20210113233046/iniciativa_h2v.pdf).

13 – See <https://www.siemens-energy.com/global/en/offerings/renewable-energy/hydrogen-solutions/haru-oni.html>.