HIDROAYSÉN CASE: BUILDING DAMS IN CHILE'S PATAGONIA REGION

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ABSTRACT

Purpose – *This teaching case intends to be a tool for academic purposes as a way to show the different assessments an investor should make and the many problems he/she may face, when evaluating a megaproject. It reviews the experience of two large corporations in Chile, intending to build a major hydroelectric generation project in Chile while facing major opposition from environmental NGOs and other stakeholders. Although in the view of many industry experts and consultants Hidroaysén was a good and necessary project, the environmental implications and some of the project's stakeholders created a deadlock.*

Design/methodology/approach – *This teaching case was written with the idea of being used as a tool for classes in order to discuss the implications of environmental issues in big projects. The research was based on*

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particular information of the project, financial data of the companies involved, and other public sources (news, interviews, etc.).

Findings – *The conclusion of this case is that private initiatives, without the right alignment of political actors and civil society, could face the risk of being blocked and not being executed.*

Practical implications – *COP21 guidelines for responsive investment could be a guideline to follow, aligning private interest with development for countries in the third world.*

Originality/value – *We offer a way to analyze external impacts on a project of this kind, that using a common framework (COP21 guidelines) could avoid risks taking all considerations into the project.*

Keywords: Hidroaysen; dams; Patagonia; environmental impact; Hydroelectricity

HIDROAYSÉN CASE – THE CONTEXT IN 2012

The morning of May 18, 2012 was a different morning. Bernardo Larrain Matte, Colbún's CEO, stood gazing through the window of his Apoquindo office in Santiago, Chile. Absorbed in his own thoughts he watched the city wake up and slowly get into motion. He was afraid that Hidroaysén, the largest hydroelectric project ever considered in Chile, might be hitting a wall. Having obtained environmental approval for the generation portion of the $10 billion hydroelectric project was with no doubt an important milestone, but without the approval of the 1,250 miles transmission line to evacuate its energy, the project had no future. His team had worked hard and in minute detail on every aspect of the project, and he was convinced that it would be an utmost success both environmentally and economically, for both the investors and the whole nation.

The investment had already reached $500 million in environmental and engineering studies. How much more could he afford to spend in a project that might never be fully approved? Next week was Hidroaysén's board meeting and he wanted to give a sensible recommendation. Bernardo knew he had to make a decision – and soon. Should he stop all development plans or should he continue pushing the project until Chileans finally understood the importance of this endeavor?

HIDROAYSÉN PROJECT

Hidroaysén is a 2,750 MW hydroelectric project that would be constructed in the Aysén region in the Chilean Patagonia (Fig. 1). The project sponsors are Endesa Chile (51%) and Colbún (49%). The total aggregated

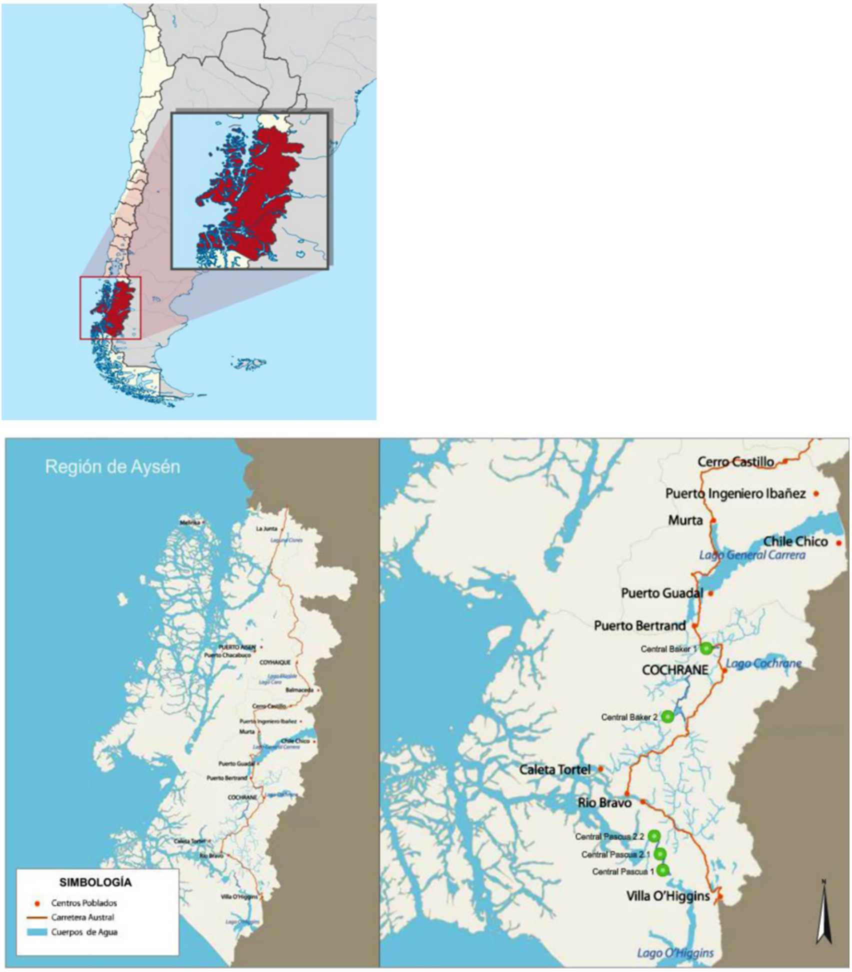

Fig. 1. Map of the Aysén Region and Location of the Power Plants. *Source*: Hidroaysén official documents – Hidroaysén website. TUBS (HidroAysen, 2011).

investment is estimated at $10 billion, and the production capacity at 18,430 GWh per year. The energy generated by the project would be transported using a dedicated 1,250 miles HVDC transmission line to be finally injected into the Interconnected Central System (SIC), where 90% of the Chilean population lives. The entire area to be flooded by the reservoirs is estimated to be 5,910 hectares (which is equivalent to 0.05% of the Aysén region), and the total construction period is of approximately 12 years.

Bernardo sighed before reflecting again and again about this megaproject. Nothing seemed to be simple or straightforward, except the fact that Hidroaysén was unique worldwide in terms of efficiency. To better organize his mental puzzle, he thought separately about the project's history, engineering challenges, and environmental implications.

History

The first studies on the Baker and Pascua rivers, where Hidroaysén would be constructed, commenced in the 1970s when the Chilean government started exploring the region and doing prefeasibility analyses for harvesting some of the hydroelectric potential of the region.

Endesa Chile was privatized in the 1980s and inherited the project's water rights. The project suffered a number of adjustments and modifications until 2006 when the current design was presented by Endesa Chile. That same year, Endesa Chile invited Colbún to form a joint venture to develop the project. This JV was named Hidroaysén S.A. One of the likely key reasons for inviting Colbún to this project was to: (i) share the risks and investment burden of the project, (ii) involve a 100% Chilean shareholder in the project to inoculate potential controversy regarding a multinational exploitation of Chilean natural resources, and (iii) obtain sufficient political clout from the respected Matte family, owners of Colbún.

Endesa Chile and Colbún are the largest power generation companies in the country with a combined aggregate generation capacity of 9 GW, of which more than 50% is hydroelectric power. Endesa Chile is a subsidiary of the Italian Enel, Colbún is controlled by the Matte family. Both companies are publicly traded in the Santiago Stock Exchange.

Engineering

Hidroaysén has two main components: Generation and Transmission. The generation portion includes five hydroelectric power plants with an

Table 1. Description and Capacity of Hidroaysén's Power Plants (HidroAysen, 2011).

Power Plant	Flooded Area (ha)	GWh per Year	Capacity
Baker 1	710	4,420	660
Baker 2	3,600	2,540	360
Pascua 1	500	3,020	460
Pascua 2.1	990	5,110	770
Pascua 2.2	110	3,340	500
Total	*5,910 ha*	*18,430 GWh*	*2,750 MW*

aggregated generation capacity of 2,750 MW and will require a reservoir area of 5,910 hectares (see Table 1). Hidroaysén is expected to be one of the most efficient hydroelectric projects worldwide, with an estimated capacity per flooded hectare of 0.47 MW per ha and an annual generation of 3.12 GWh per ha. Table 1 details the information per power plant.

The project would use the robust and steady water flows of the Baker and Pascua rivers to generate hydroelectric energy. These rivers are formed from the Bertrand and O'Higgins lakes, which are formed by melting waters from glaciers. This makes the generation profile of the project complementary to that of the hydroelectric power plants located in central Chile, stronger during dry seasons and thus very attractive to the country's energy mix.

Bernardo smiled to encourage his thoughts: the complexity didn't end in the generation facilities, which were already extremely challenging. Energy still needed to be transmitted for a large number of miles to be only then connected to the already existing SIC transmission lines. The Transmission project would consist of 1,250 miles of transmission infrastructure, of which 130 miles would be underwater, to transport the energy generated by the project and inject it on the SIC grid. The transmission project would be constructed using HVDC (high voltage, direct current), which despite having a higher CAPEX is more efficient in terms of number and height of towers, clearing affected area, and diminishing energy losses due to transmission. Approximately 300 miles of the transmission line would be constructed in virgin and sheer terrains, very close to national parks and other points of interest (Fig. 2).

Though the construction is expected to last for 12 years, the power plants would commence operating in stages starting from the 6th year thus

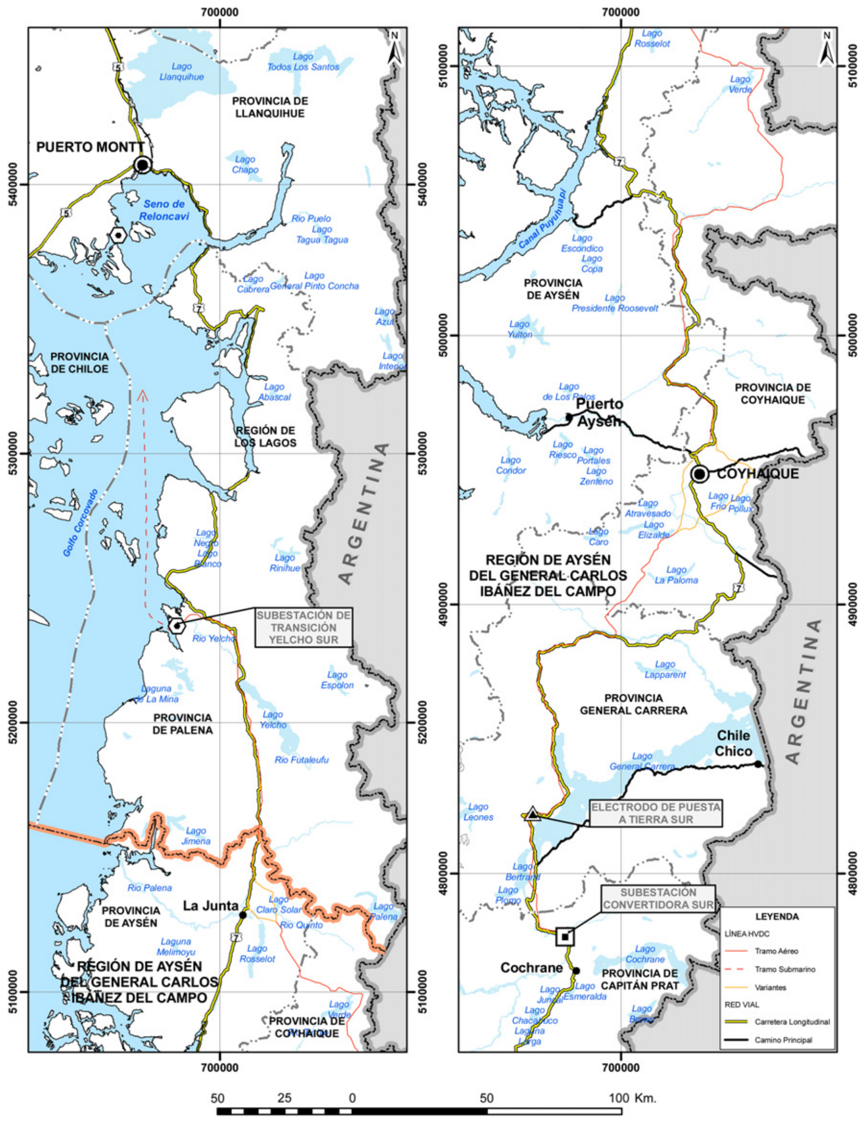

Fig. *2*. Scheme of the Transmission Line from Cochrane. *Source*: Hidroaysén Transmission official documents – description of the project (HidroAysen, 2011).

smoothing both the investment burden and the impact of the project on the SIC.

Environmental

Bernardo frowned. The environmental piece was undoubtedly the most complex and sensitive component of the project. Hidroaysén has been extremely cautious in minimizing its environmental impact so as to reduce the antagonism to the project. In this way, Hidroaysén was able to get a portion of government officials, technicians, and environmentalists on board to explain about the benefits of the generation project, to the extent that enabled getting environmental approval (RCA) for the power plants. In the months following the RCA, social unrest scaled and protests and manifestations against Hidroaysén soared. Strong opposition and campaigns led by politicians, environmentalists, and a large number of NGOs were able to reduce the public approval of the project from 50% to a mere 26%. The loudest voice opposing the project was the NGO "Patagonia sin Represas" – "Patagonia without dams," which had united efforts and resources among more than 50 organizations, including Greenpeace, to raise awareness and fight for the dismissal of the project (see Fig. 3 for a sample of advertising pieces).

Fig. 3. Advertising Pieces of "Patagonia sin Represas" (Patagonia Sin Represas, 2014). From left to right: The worst image for the country. There are alternatives; Destruction is not a solution; Here, it would not be acceptable. Nor would it be in Aysén.

Having lost the battle for the generation portion of the project, critics put the transmission project in the spotlight. It would "put a scar on Chile," the environmentalists say. The transmission line environmental impact study has yet to be submitted by Hidroaysén and then approved by the authorities. Bernardo sighed. This was going to be a major sell as approving the transmission project essentially meant that Hidroaysén as a whole was shown green light. Having the approval for the generation portion without transmission was of no value. Thus, Bernardo knew that the approval of the transmission line would require more than sound technical argument: it would be necessary to have a supporting national energy policy backing the project as a whole.

Bernardo was convinced that Hidroaysén had done everything in its power to minimize the environmental impact in the area. As he watched the Santiago City smog getting thicker as activity increased through the morning, he reflected how the project pros compared to its alleged cons (Table 2).

POLITICAL AND ECONOMIC SITUATION IN CHILE

Chile's economy is distinguished from its Latin American neighbors and is considered one of the most stable economies in the region. GDP growth, income per capita, economic policies, and low corruption differentiate

Table 2. Pros and Cons.

Pros	Cons
• 16 million tons of CO_2 displaced • 7 coal-fired power plants replaced • 3.12 GWh per flooded ha efficiency • 78% plant factor • Competitive prices • Chilean renewable energy • Complementary to current energy mix • Steady flow • Almost no seasonality • Few aquatic life • No displaced communities	• Native flora and fauna at risk • Landscape forever damaged • Local communities affected • Energy will not stay in the communities • Intervene in one of the most pristine sites in the world • Tourism affected • Profits of this project are for private companies and not for Chileans • Risky project • Controversy: Patagonia sin Represas claims that the flooded area is bigger than the officially informed area • 57.6% of the Chileans disapproved Hidroaysén project in April 2012, based on Patagonia sin Represas figures

Chile from some of its volatile peers in the region. After its open market revolution started in 1973, the Chilean economy boomed. Over the past 35 years, poverty has fallen from 50% to 14% and per capita income has increased fivefold to approximately USD 20,000. Current GDP growth is 4.7% and unemployment rate is 5.7%. Chile stands strong behind its well-earned reputation and was the first South American country invited to join the OECD.

From 1990 to 2010, after 17 years of dictatorship under Augusto Pinochet, left-centered wing politicians governed Chile. Albeit left-centered, these governments continuously supported the market liberalization that commenced under Pinochet's government. Chile has arguably become one of the most capitalist countries in the world. Economically, Chile depends largely on the mining industry, where copper represents 20% of its GDP. Agriculture, forestry, fisheries, and services in general constitute Chile's other main industries.

In 2010, after 20 years of left-centered wing governments, Sebastian Piñera, a successful right-centered wing impresario was elected president. Piñera's election was received with joy by most of Chile's business world. The initial joy however was soon turned into discomfort as Piñera's government was focused on tackling the raising social unrest coming from Chile's inherited social inequalities dragged from deficient policies during the past decades' booming economy. Shortly after Piñera took office, protests started soaring, the most relevant being those involving reforms in quality and access to higher education and those involving flagship power generation and mining projects such as Hidroaysén, and Barrick's gold extraction megaproject, Pascua Lama. Indeed, an empowered middle class started challenging Chile's long-dated "successful" economic model by evidencing the large gap between wealthy and poor families (ranking 15 in the GINI index).

In the midst of this scenario, environmentalists started to gain traction and support from the general public. Several large mining and energy projects were halted because of "unresolved environmental issues" involving indigenous communities as well as environmental impact concerns.

As a former successful businessman, with a net worth of $2.5 billion according to Forbes, some left wing politicians put Piñera as a symbol of Chile's business owners' naked greed. Under these conditions, and according to several political analysts, Piñera struggled to find the political support to make the tough decisions that, in view of the environmentalists and protesters, could "benefit business owners and foreigners, in detriment of Chileans." Piñera's presidency approval ratings went from a high of 63%

in October 2010 after rescuing the miners that were trapped in a collapsed mine in northern Chile, to a record low of 27% in July 2011, after the approval of the power generation portion of Hidroaysén (EPC Engineer, 2012).

Bernardo knew that despite the global economic crisis and all political pushback to Piñera's government, the country was growing strong and unemployment rates falling. In addition he knew that Piñera's term ended in March 2014 and that the most likely successor was socialist former president Michelle Bachelet who had publicly stated that "[I am] not in favor of Hidroaysén and [I] do not think it is viable."

ENERGY INDUSTRY IN CHILE

Chile imports virtually 100% of the raw fossil fuels it requires to power the country. In 2011, out of the total imports of $70 billion, Chile spent $14 billion in fossil fuels such as crude, gas, and coal. With almost no domestic fossil fuels extraction, Chile is highly exposed to both international prices' volatility and trade agreements with supplying countries. It is understandable that Chile fears this dependency after the so-called "Argentinean gas crisis." During the 1990s, Chile entered into natural gas long-term purchase agreements with Argentina and consequently based its power generation matrix on the presumed long-term availability and accessibility to Argentinean gas. Numerous pipelines and gas-fired power generation units were constructed and operated for several years until the Argentinean government, starting in 2002, decided to rationalize the gas supply, and in 2007 definitely cut it. The cost of generating a unit of energy (MWh) jumped from $40 to $300 in just a couple of years, forcing several power generation companies to enter bankruptcy, mining companies to stop production, blackouts, and to the virtual rupture of the Chilean power generation industry (US Energy Information Administration, 2014; CentralEnergia, 2013a, 2013b).

In the Chilean power generation industry, approximately 65% of the electricity output is based on fossil fuels. Renewable sources such as hydroelectricity (34%), solar, and wind (1%) are the only ones that can be considered domestic. As of 2010, Chile had 16 gigawatts (GW) of installed electric capacity distributed in four different grids namely (from north to south), the SING (28% of installed capacity), the SIC (71%), Aysén (0.3%), and Magallanes (0.6%). In the SING 90% of the energy is consumed by mining companies whereas in the SIC it is approximately 30% with the balance consumed by residential consumers and small and medium enterprises. Aysén and Magallanes are comparatively very small and most of the consumption is residential (CentralEnergia, 2011).

Since the Argentinean gas crisis, Chile has been struggling to equalize its supply/demand gap, which combined with stringent environmental approval processes, is far from being resolved. The high dependency on imported fossil resources for generating energy exposes consumers and power generators to potentially high and volatile costs, which directly affect the production costs for several industries, including the mining industry, not to mention the important CO_2 emissions coming from burning fossil fuels (CentralEnergia, 2013a, 2013b).

Power generators and developers have pushed several projects that would help narrow the gap but most of these have confronted fierce opposition from environmental groups and other groups of interests. In particular, in the central grid, the SIC, since 2007 a mere 3,800 MWs of new installed capacity have entered into operation (of which 1,800 MW are diesel back-up units) and coal-fired generation projects accounting for more than 4,000 MW have been either canceled or halted in judicial processes that could take several years to resolve, if resolved. On top of this, even run-of-the-river hydroelectric projects (which do not require a reservoir) have been stopped by local communities, demanding better compensation packages, more water for their agricultural needs, or simply for the sake of not having a power plant next to them (SYSTEP, 2012).

The technologies that appear to count with some public support are wind and solar. These technologies however would require to obtain long-term power purchase agreements (PPAs) to be financed, but given the daily spot market volatility and these technologies' variable volume output, renewables developers are having tremendous difficulties in bringing the projects to completion. The government is encouraging energy from nonconventional renewable sources, but under optimistic scenarios these would be able to account for 20% of the necessary increase in installed capacity. Moreover, it is unlikely that the current gap can be filled only with renewables, and the nuclear option is not even considered in a country with two of the top-ten largest earthquakes in the past 150 years. In the meantime, Chile is losing competitiveness among its regional peers. Some regional initiatives have been developed, but "development finance must reflect changes in both energy supply and demand while replacing fossil fuel inputs in electricity generation" (Phillips, 2016).

Spot Prices

Any power generation plant in Chile can opt to either contract its energy output or to sell it in the spot market. The spot price, or marginal cost, is calculated every 15 minutes and is equal to the marginal cost of the last generator that was dispatched by the CDEC, the central dispatch entity, in that fifteen-minute window. A marginal cost dispatch order permits, in theory, an efficient and minimum cost operation of the system, and that more efficient power generation units replace the most expensive ones. To ensure operation at a minimum price, the first generators to transmit energy are the ones with the cheapest marginal cost (e.g., run-of-the-river, wind, and solar) and then the CDEC starts dispatching more expensive units (e.g., coal-fired and gas-fired power plants, large hydro power and diesel units). Although large hydroelectric power plants have zero marginal cost, they have the ability to store energy and thus assigned with a higher marginal cost to displace units that are more expensive during peak demand (NRDC, 2012).

In the SING, where there are no hydroelectric plants and supply is fairly equalized with demand, marginal costs are rather stable. Conversely, in the SIC they are highly volatile due to the fragile base-load installed capacity and the high hydroelectric component dependent on weather conditions.

A company can obtain energy contracts with third parties such as distribution companies or large consumers. Typically power generators seek contracts with investment grade counterparties that could facilitate obtaining financing. Thus, PPAs are normally at a fixed price and under a take-or-pay scheme. Large consumers prefer to sign long-term PPAs to avoid exposure to the volatile spot market. Given the energy shortage that the country is currently suffering, there is an important risk for power generators in contracting the energy at a fixed price. If the project supplying the energy breaks or fails to produce, the power generator has to buy energy in the volatile spot market and then sell at a fixed price. Similarly, if a greenfield project is delayed, the sponsor of the project has to go to the spot market to cover any potential energy shortfalls. Spot market prices are highly volatile, ranging from \$10 to \$300 per MWh sometimes within the same day. According to market estimates, long-term PPAs are signed at a 10% discount on the expected average long run spot price, which is currently close to ~\$100 per MWh in the SIC. Most PPAs are awarded via formal bidding processes in which power generators offer a price and have a duration of between 7 and 15 years. An additional revenue stream comes from "capacity payments," which is equal to approximately \$9 per Kw-month

(Comisión Nacional de Energía de Chile, 2014; Pontificia Universidad Católica de Chile, 2007).

FINANCIALS

The total CAPEX for the project has been estimated to be $10 billion. Of this 50–55% would correspond to the transmission line and the balance to the power plants. It is estimated that Endesa Chile and Colbún have already invested approximately $500 million.

Although detailed engineering for the power plants has been finished, the transmission line had not been submitted for environmental approval and is still in its basic engineering stage. Significant money had yet to be spent in order to give notice to proceed to the project (NTP, i.e., start construction). It is estimated that Hidroaysén had yet to spend $200 million during this development period (before obtaining the RCA for the transmission line) as capital expenditures would likely have to be made in order to build roads, docks, and other early investments that would allow Hidroaysén to maintain an early date of first power.

The project would be constructed in stages and is expected to be fully constructed 12 years after the first civil work is done. Among other considerations, a sudden injection of such a volume of energy into the grid would not only significantly drop prices but potentially would also endanger the stability of the entire SIC grid.

Although Endesa Chile and Colbún are among the largest power generation companies in Chile, Hidroaysén is too big of a project so as to be balance-sheet financed. Thus, the project is expected to be financed using a typical project finance 60/40 debt to equity allocation. There are several considerations to take into account when assessing the bankability of Hidroaysén. First, an estimated $6 billion will need to be debt financed, arguably the largest project finance in South America. Bernardo reflected that given the size of the required debt financing, a syndicate of specialized project finance banks will likely be required. Second, disregarding his long-term relationships with top banks, these have shown reluctance to lend to such visible, risky, and controversial types of projects. Third, lenders will probably require Hidroaysén to contract a significant portion of their expected energy output with investment grade off-takers (e.g., mining companies, distribution companies, other power generators), and thus ensure that Hidroaysén counts with a solid base of customers and fixed prices. Bernardo remembered that recently, a wind project was financed at

LIBOR + 150 bps. The syndicate provided 55% of the required funds. Approximately 60% of the project's expected output was contracted to an investment grade mining company on a take-or-pay variable volume basis (the balance sold in the spot market) and the required transmission line was approximately 100 miles long. Bernardo wondered if Hidroaysén would be capable of accessing the same financing conditions.

Bernardo's thoughts then shifted to another concern: equity requirements. The equity requirements would also be significant. Each company would need to contribute $2 billion *pari pasu* and the project financing would likely be on an equity-first basis. This equity would be financed using their existing capital structures.

An alternative that had been discussed for years was to divide the project into two: generation and transmission. There were more than a couple of large transmission companies in the world that may find Hidroaysén's transmission project attractive. Bernardo added in his puzzle his earlier, and unfruitful, conversations with Brookfield (owners of the SIC trunk system) and China State Grid (EPC Engineer, 2012). Having a partner that takes care of the HVDC transmission project would relieve Endesa Chile and Colbún from half of the project's financial needs. Nonetheless, introducing a partner would also add several risks (e.g., completion, operational, financial, and environmental).

Regulation allows transmission companies to charge a "toll" on power generators that make use of the transmission infrastructure. Such tolls aim to allow a pretax return on assets equal to 10%. Dedicated transmission lines, which are not part of the trunk system, are not subject to regulation. Common practice however between private companies is to emulate the returns of the trunk system.

Typically a hydroelectric project has a gross margin of 100% and an EBITDA margin between 85% and 95%. Electric transmission losses for Hidroaysén are expected to be 1.5% for every 600 miles in the HVDC project and 3.5% in the HVAC connecting the projects to the converter substation. There was a recent transaction involving a 140 MW operating hydroelectric power plant that generated 368 GWh per year, which was purchased at $415 million.

DECISION TO MAKE

Having analyzed the most important pieces of the project, Bernardo sat down and started crunching numbers. He wanted to be sure that the project was financially viable taking into account all the uncertainties and all the stakeholder's opinions. Although he knew that both the energy price he could secure and the quantity of energy that would be generated by the project were almost a given, he was not sure how to reflect the risks of the project and the environmental concerns.

He believed Hidroaysén was a valuable project for the stakeholders and for the country itself, but did Chile have the right alignment behind the energy policy to support a project of this kind? Were all the stakeholders taken into account and their concerns being managed in the project plan? Had the project the political force to be completed in the volatile political environment?

Bernardo scratched his head and got ready to play with the numbers. He had to build a compelling case for his recommendation during Hidroaysén's board meeting next week.

AFTERWORD

On May 30th 2012, both Colbun and Endesa decided to put the project on hold, declaring: "lack of consensus for a national policy aligning the energetic requirements for the country" (Diario La Tercera, 2012). This decision was largely celebrated by NGOs and environmentalists. Both companies continued for 2 years trying to get alignment of the different stakeholders. After 8 years of negotiations, the minister´s committee finally rejected the project on June 10, 2014, based on the following criteria:

- Lack of relocation program mitigating the impact of the project.
- Lack of analysis of the impact on water flows diverted by the project.
- Endangered species in the area of influence of the project (Diario La Nación, 2014).

This case is an example of how all the stakeholders must be taken into account in the early stages of a project, especially if the project has deep environmental impacts such as was the case for Hidroaysén. Especially after Chile's president Michelle Bachelet's intervention in the session for Heads of State and Government of the COP21 in Paris, Chile has a deeper commitment with these environmental guidelines that set a framework for the projects that are going to be built around the country (Gobierno de Chile, 2015).

REFERENCES

CentralEnergia. (2011, July 29). Retrieved from http://www.centralenergia.cl:http://www.centralenergia.cl/2011/07/29/energia-primaria-chile/comment-page-1/

CentralEnergia. (2013a, June 1). Retrieved from www.centralenergia.cl:http://www.centralenergia.cl/centrales/mapa-centrales-operacion/

CentralEnergia. (2013b, August 2). Retrieved from www.centralenergia.cl:http://www.centralenergia.cl/2013/08/02/energia-tiempo-de-ver-la-luz/#more-8504

Comisión Nacional de Energía de Chile. (2014, January 1). *Comisión Nacional de Energía*. Retrieved from Estudios – Electricidad. http://www.cne.cl/estudios/electricidad/

Diario La Nación. (2014, June 10). Retrieved from http://www.lanacion.cl/:http://www.lanacion.cl/noticias/economia/energia/dura-derrota-de-hidroaysen-rechazado-por-comite-de-ministros/2014-06-10/111656.html

Diario La Tercera. (2012, May 31). Retrieved from http://diario.latercera.com:http://diario.latercera.com/2012/05/31/01/contenido/negocios/10-109995-9-colbun-suspende-linea-de-hidroaysen-y-demanda-cambio-en-politica-energetica.shtml

EPC Engineer. (2012, January 13). *EPC engineer*. Retrieved from www.epcengineer.com:http://www.epcengineer.com/news/post/7093/chile-Hidroaysén-ceo-confirms-china-state-grid-interest-in-project-report

Gobierno de Chile. (2015, December 1). *Gobierno de Chile*. Retrieved from www.gob.cl:http://www.gob.cl/2015/12/01/the-president-of-chile-at-cop21-climate-change-is-not-just-an-environmental-problem-it-is-also-a-social-problem/

HidroAysen. (2011, January 1). *Hidroaysen*. Retrieved from http://www.hidroaysen.cl:http://www.hidroaysen.cl

NRDC. (2012, June 01). www.nrdc.org. Retrieved from www.nrdc.org:https://www.nrdc.org/laondaverde/international/files/chile-LCOE-report-sp.pdf

Patagonia Sin Represas. (2014, October 14). Retrieved from http://www.patagoniasinrepresas.cl/final/contenido.php?seccion=materiales

Phillips, T. (2016). UNASUR-GRID: Financing sustainable energy sovereignty with the Bank of the South. In C. Gurdgiev, L. Leonard, & M. Gonzalez-Perez (Eds.), *Lessons from the great recession: At the crossroads of sustainability and recovery* (pp. 77–109). Emerald Group Publishing Limited.

Pontificia Universidad Católica de Chile. (2007, January 1). Retrieved from http://web.ing.puc.cl:http://web.ing.puc.cl/~power/alumno12/estabili/introduccion.html

SYSTEP. (2012, November 20). Retrieved from http://systep.cl:http://systep.cl/documents/reportes/122011_Systep_Reporte_Sector_Electrico.pdf

US Energy Information Administration. (2014, January 1). Retrieved from http://www.eia.gov/countries/country-data.cfm?fips=CI