

**CTF PRIVATE SECTOR PROPOSAL
A JOINT SUBMISSION FROM IFC and IDB**

<i>Name of Project or Program</i>	Chile Large-Scale Photo-Voltaic Program
<i>CTF amount requested (US\$):</i>	<ul style="list-style-type: none"> ➤ Investment – up to US\$49 million equivalent (US\$24.5 million for IFC’s account, US\$24.5 million for IDB’s account) ➤ Implementation and supervision budget – US\$1.0 million (US\$500,000 for IFC’s account, US\$500,000 for IDB’s account)
<i>Country targeted</i>	Chile
<i>Indicate if proposal is a Project or Program</i>	Program

1. DETAILED DESCRIPTION OF PROGRAM

1.1. Proposal Context:

This programmatic proposal is one of three IFC and IDB Private Sector Proposals for Chile under Chile’s Country Investment Plan (“CIP”), which was endorsed by the CTF Trust Fund Committee on May 3rd, 2012 and allocated up to US\$200 million for flexible implementation to the private sector. The three proposals allocate these funds between (a) a Concentrated Solar Power Program (“CSPP”) proposal for up to US\$100 million, (b) a Large-Scale Photo-Voltaic Program (“LSPVP”) proposal for up to US\$50 million and (c) a Renewable Energy Self-Supply and Energy Efficiency (“RESSEE”) proposal and its preparation grant, for up to US\$50 million. The CSPP proposal for an amount of US\$67 million was approved by the Trust Fund Committee in September 2012, and the RESSEE preparation grant for an amount of US\$1 million was approved in October 2012. The LSPVP proposal (the “Program”) addresses use of CTF funds to support the development of multi-megawatt scale solar photovoltaic (“PV”) projects. More specifically, the program seeks to encourage the rapid development of the private solar PV sector by establishing a series of direct, project-level interventions in the solar PV sector in Chile, which is very much nascent but offers significant growth potential given the unparalleled solar resource in the northern part of the country. The Program addresses use of CTF funds of up to US\$49 million for investments and US\$1 million for an implementation and supervision budget. The initial investments will help to demonstrate that private sector participation in the solar PV sector can be successful in the Chilean context (thereby helping to reduce risk for future investors), while also addressing some of the early entrant barriers related to establishing precedents and reducing costs. The Program is consistent with the policies of the Government of Chile (“GoC”) and will directly support the GoC’s specific goals of generating 10% of the country’s electricity requirements from renewable energy sources by 2024. Chile’s CIP identifies large-scale solar PV as a key strategic area for application of CTF resources. A third programmatic proposal, which targets support to renewable energy self-supply and energy efficiency investments via local financial institutions or otherwise, will be submitted by IFC and IDB at a later date.

1.2. Country and Sector Context:

Chile undertook a series of comprehensive sector reforms to restructure, deregulate and privatize the power sector from the mid-1970s to the early 1990s. The reforms were pioneering and successful, and thus became a model of sector reforms which have been emulated elsewhere in Latin America. During the 1970s and 1980s, the two existing vertically-integrated public utilities, Endesa and Chilectra, were restructured into 7 generation companies, 8 distribution companies and 2 vertically-integrated generation/distribution companies. The sector was subsequently deregulated and privatized from the mid-1980s to the early 1990s, being unbundled into generation, transmission, and distribution. All of these functions are performed by private sector entities under competitive frameworks laid out by regulations, which have remained largely consistent through changes in the macroeconomic and political environment.

Chile has two large interconnected transmission systems and two smaller vertically-integrated isolated systems, with a total installed capacity of 16,740 MW and a total estimated annual demand growth of between 600-700 MW. The two large interconnected systems are the Northern Interconnected System (“SING”) and the Central Interconnected System (“SIC”). The SING supplies the northern zone of the country, from Arica in the north to Antofagasta in the south, a

distance of about 700 km. The installed capacity in the SING was 3,964 MW as of December 2011. Electricity production in the SING is 99% fossil based (69.6% coal, 25.8% gas, 2.1% diesel, 1.4% fuel, 1.1% others), resulting in a 2011 emission factor of 0.725 t CO₂e/MWh, the highest of any of the major Latin American electricity grids. The SIC supplies the central zone of the country, from Taltal in the north, to Quellón in the south, a distance of about 2,100 km. This system supplies electricity to about 92.2% of Chile's population. The SIC's installed capacity reached 12,365 MW in December 2011, of which approximately 47% is hydropower.

Hydropower has historically been Chile's single largest electricity generation source. However, droughts have periodically reduced hydropower production causing supply shortfalls and blackouts and revealing hydro to be an uncertain supply of power. Climate change is expected to aggravate this uncertainty even more in the future. In the 1990s, Chile began to diversify its energy mix by investing in natural gas transportation (pipelines) and power generation infrastructure. By 2004 up to 40% of power generation ran on gas imported from Argentina. However in that year Argentinean exports were suspended, resulting in widespread blackouts in Chile, and deliveries have not been re-instituted. Gas-fired generation was then substituted by oil product-fired generation. As a consequence the country now has an increased reliance on thermal generation.

In the country as a whole, fossil fuels accounted for about 75% of primary energy consumption in Chile and about 66% of the overall national electricity matrix in 2011. Most of these fuels are imported, and in total represent about 23% of total imports into the country. Accordingly, Chile is the second least energy self-sufficient country in the Latin American region (after Panama) and its energy supply an important national security issue. Complicating matters, recent large-scale conventional fossil fuel and large-scale hydro power generation project proposals have been met with popular rejection stemming from perceived negative environmental impacts. Public protests by Chilean citizens, numerous and persistent court challenges and adverse judicial decisions have impacted, delayed or cancelled a number of large energy projects throughout the country over the last three years.

Cognizant of these challenges, the GoC has taken up a number of initiatives designed to streamline the approval procedures for its energy projects, diversify its energy supply and improve the utilization of the country's considerable existing renewable natural resources for energy generation. One of the most important is the implementation of concrete actions to incorporate clean energy in their energy matrix, with a goal of achieving about 10% of its energy generation from Non-Conventional Renewable Energy ("NCRE"), defined as solar, wind, biomass, geothermal and small hydro sources (less than 20MW) by the year 2024.

The development of solar energy in the country is particularly important given the world-class solar resource present in Chile's Atacama desert region. The solar resource in Northern Chile, the location of the driest desert in the world, is one of the best globally. Global horizontal irradiation in this area is about 3,300 kWh/m²/a and direct normal irradiation is 3,000 kWh/m²/a, with around 3,000 hours of sun per year. Northern Chile has a high, constant solar radiation with little variation between days and seasons because of its latitude and lack of clouds. The presence of this excellent, but currently untapped, resource is the primary reason for the focus on the development of this energy technology as part of the GoC's CTF funds application.

1.3. Barriers to Private Sector Development:

The basic principles of Chile's energy policy were defined in the early 1980s, and have been maintained without major changes. They can be summarized as: (i) meeting energy demand at the least cost; (ii) through the operation of competitive energy markets and (iii) with a subsidiary role of the State, primarily encompassing the development of mechanisms for supplying energy to disadvantaged segments of the population, including targeted consumer subsidies. Competitive open markets have been established for the production, refining, import, transport and distribution of liquid, gas and solid fuels, as well as for the generation and supply of electricity at the wholesale level. In all these activities prices are not regulated. However, in areas like transmission and distribution of electricity, where natural monopolies exist, prices and other conditions for supply are regulated. Some regulations and incentives are also applied to the energy market for ensuring environmental protection, security of service and diversification of the energy matrix.

In April 2008 Chile enacted Law 20,257 to foster the development of NCRE. In accordance with the law, beginning on January 2010 all generating companies must have at least 5% of the energy committed in supply contracts signed after August 2007 supplied by NCREs. The limit of 5% will be maintained until 2014 and raised by 0.5% every year thereafter until year 2024. The law would be enforced by a penalty of approximately US\$30/MWh for each contracted MWh that does not comply with this requirement, leading to the creation of a market for the NCRE “attribute” with a current market price of about US\$15/MWh. This is a market mechanism, however, as Chile does not currently have specific mechanisms used to provide general subsidies to renewable energy projects, such as a feed-in tariff. This initiative has been insufficient to stimulate the rapid development of the solar PV sector.

At the end of 2012, the participation of NCRE sources in the energy matrix was close to 4.8% of installed capacity, or a total of 880 MW. The composition of this total was biomass (394 MW), small hydro (278 MW), wind (205 MW) and only 2.4 MW solar PV, with a further 2.5 MW under construction. This 4.9 MW represents only 0.1% of the total of 4,015 MW of solar projects that have obtained (77%) or are in the process of obtaining (23%) environmental permits as of December 2012. Clearly there is great interest in developing these type of projects, but important barriers to achieving their financing and construction remain, including:

- *Lack of a track record in Chile:* It is evident that the four small projects totaling 4.9 MW which are currently operational or under construction cannot be considered a sufficiently robust base to foster confidence in the industrial or financing sectors that solar energy represents a tested, reliable source of power. This will require the development of larger and more numerous projects to demonstrate that the associated costs and risks of being a pioneer in the sector can be successfully overcome.
- *Lack of Power Purchase Agreements (“PPAs”).* To date, there have only been four solar PV projects with PPAs: (a) a 1 MW project with Codelco (state mining company); (b) a 25 MW project with Collahuasi (private mining company); (c) a 2 MW project with Quiborax SA (private mining company); and (d) a 2 MW project with an agriculture landowner. Most mining companies are reluctant to enter into suitably long-term PPAs with PV developers due the perception of the inadequacy of intermittent renewable energy for their operations and the lack of familiarity with the reliability of solar technologies;
- *Absence of local bank financing.* While Chile has fairly liquid and deep banking and capital markets, most banks are unwilling to finance less-familiar NCRE technologies such as solar, wind or geothermal without long-term PPAs. Even if local banks were able to extend financing, the current maturities offered by them are insufficient to provide an appropriate rate of return for developers at unsubsidized tariffs which need to be competitive with other generation technologies.

1.4. Program Summary:

The Program represents an IFC-IDB joint initiative to accelerate private sector participation in solar PV generation in Chile by addressing the barriers described above. It will target and apply CTF funds to support large-scale private sector solar PV projects which will: (a) provide a demonstration effect and help create a track record and solid precedents to the successful financing of these technologies in the market; (b) either increase the interest of the large consumers in entering into long-term PPAs (once the viability of these initial projects is proved), or alternatively provide clear precedents that solar projects can be adequately financed even on a merchant basis; (c) in turn, stimulate the entry of the local banking sector into the industry both through PPA contracted and merchant projects, enabling its self-sustainability. This will create a virtuous cycle that will help to accelerate and consolidate the development of a solar industry in Chile, one of the few environments in the world where the combination of an exceptional solar resource, decreasing equipment costs and high market tariffs hold the promise of creating grid parity conditions in a relatively short time period.

The Program will seek to retain flexibility (in terms of approach, project selection, and application and structuring of CTF funds) to follow the best way to accelerate the implementation of solar PV projects. The financial instruments, their pricing and terms of the CTF funds offered to private sector projects will be tailored on a project by project basis to address the barriers identified for each project. IFC and IDB will seek to provide the minimum concessionality necessary to enable projects to proceed. These initial projects will set a precedent by demonstrating PV technologies at an appropriate scale, developing capacity in the advisory market, and mitigating the increased costs that first entrants

face (setting contractual, operational and financial precedents, creating transmission links to key solar PV resource areas, building the sectoral scale that enables lower equipment prices from international suppliers, etc.), as well as the higher risks perceived by investors in these initial investments.

IFC and IDB have been actively engaging with project developers to determine the most advanced and suitable projects that merit CTF support. Specific projects are not discussed in this programmatic proposal given issues of confidentiality and to preserve flexibility in the MDBs' private sector discussions, although some representative project sizes and investment amounts are presented. Project selection will be made on the basis of the sponsors' commitment and ability to deliver on the project, as well as their influence in the market (as this is crucial for establishing a track record and enticing future developers). To further encourage awareness, once the Program is approved, IFC and IDB plan to advertise its availability, but do not intend to run a formal competitive process. Doing so would likely incur delays, and the MDBs do not believe there are enough projects that are ready to justify such a process. The individual projects would be financed by either IFC, IDB, or both MDBs. In situations where both MDBs are financing the project, the CTF investment would be structured by one or other of the MDBs.

The projects anticipated to be supported by the Program are expected to include projects in both the SING and the SIC. As noted earlier, the Program will be expected to support projects which will operate either under long-term PPAs and/or a merchant commercial strategy, namely, selling their output at spot market tariffs directly into the grid. The projects may incorporate different proven solar PV technologies, including the more prevalent crystalline silicon or newer thin-film technologies.

CTF funding is likely to be applied as low-cost, long-tenor senior loans alongside loans from IFC and/or IDB. In some cases the CTF funding could also be applied as mezzanine or subordinated debt to the extent higher leverage is needed for developers to obtain market rates of return on their equity investments. Note that final agreement to provide CTF funding to any individual project would be subject to a full due diligence and approval by an internal IFC or IDB approval body, as well as IFC or IDB's Board, per the CTF private sector guidelines. All projects financed under the Program will be required to meet the MDB environmental, social, governance and other compliance requirements, as well as all Chilean regulatory requirements.

1.5. Describe the Proposal's strategy for achieving market transformation

The Program will provide a transformational role in the Chilean solar sector both by supporting early successes in private sector projects to catalyze further market uptake, and by supporting some of the first truly large-scale solar PV projects in the country (i.e. greater than the 1.0–1.4 MW essentially pilot projects, which represent the achievements to date). The demonstration effect of the projects included under this Program will include: (a) demonstration of different commercial models for private sector participation in solar PV, both under long-term PPAs and on a merchant basis, selling at spot market tariffs into the grid, which will lead the way for developers, investors and lenders to follow with scaled-up investments under both modalities; (b) demonstration of the viability of large-scale PV projects, able to efficiently take advantage of the world-class solar resource in Northern Chile. These demonstration efforts will improve capacity in the sectors providing these technologies (equipment supply, engineering, advisors etc.), and prove the technical and economic realities of these technologies in the Chilean context.

The Program is consistent with the policies of the GoC and with Chile's CIP, endorsed by the CTF Trust Fund Committee on May 3, 2012. The Program will directly support the GoC's specific goals of generating 10 percent of the country's electricity requirements from renewable energy by 2024 and remains flexible to support initial private sector investment both under a PPA regime or on a merchant basis, depending on the speed of the demonstration effect achieved on the mining or industrial sector's willingness to enter into PPAs. Chile's CIP identifies large-scale PV as a key strategic area for application of CTF resources to the private sector.

IFC and IDB will leverage their experience in solar energy to support developers in these initial projects. IFC has financed dozens of megawatts of solar PV projects over the last three years in a range of countries and regulatory

environments, including several first of kind projects in the solar sector. IDB is currently engaged in the financing of what will be the first project-financed solar project in Chile. IFC and IDB will apply innovative structuring to apply CTF funds in the most effective and efficient manner with minimum concessionality to address the key barriers that are preventing progress of private sector investment in the targeted sector.

2. FIT WITH INVESTMENT CRITERIA

2.1. Potential GHG Emissions Savings

The emission reductions of this Program in Chile over its lifetime are 7.4 Mt CO₂e. Assuming a 5x multiple in terms of indirect, demonstration impact, the Program could result in overall reductions of 44.3 Mt CO₂e. Solar PV generation is fully proven, both technically and commercially, and there are widespread examples of successful application at scale around the world. Falling solar PV system prices, the high cost of fossil fuels in recent times and effective and broader incentive schemes have driven the growth in large-scale PV plants. Since 2005, more than 1,200 PV plants with a capacity greater than 1 MW have been commissioned worldwide. Chile has a unique solar resource that promises gigawatt scale development opportunities for solar PV generation.

2.2. Cost-Effectiveness

Based on the above calculations the implied direct GHG reductions per CTF dollar spent will be 0.15 tons CO₂e/\$ during the life of the Program, and the overall reductions considering the implied indirect GHG reductions per CTF dollar spent will be 0.89 tons CO₂e/\$. Technology for the solar PV projects should continue to evolve leading to improved equipment pricing and lower project costs.

2.3. Demonstration Potential at Scale

The Program seeks to support and enable the implementation of large-scale private sector solar PV projects in Chile. Expansion of these projects has been limited to date by a number of financial, institutional, and technical barriers. Solar PV projects are generally higher cost solutions than alternative conventional generation technologies, and relatively important amounts of CTF support will be necessary to enable such projects. These projects have the potential to provide power in the gigawatt scale in Chile, so the initial projects supported by the LSPVP will provide a demonstration effect and could provide the impetus for at least a five-fold increase in projects. As shown in the foregoing calculations, this could provide annual GHG emission reductions of 2.2 MtCO₂e against current energy sector annual emissions of 30.6 MtCO₂e.

The Program is expected to result in a transformed solar PV sector that will allow projects to be considered as mainstream in the future as any current power generation projects in the country. In the long term, CTF will not be needed and the sector will be sustainable because: (i) the reduced perception of risk will increase the interest of the banking community and lower the cost of capital, enabling future projects to achieve reasonable returns; and (ii) as the global markets reach scale, equipment costs for solar PV will continue to fall, allowing for market tariffs to be sufficient to provide an incentive to invest in the sector. Given the exceptional solar resource in Chile, further technological advances and sector scale, and high current tariffs in Chile, it is expected that solar PV can offer power at costs that are competitive with thermal technologies in the short to medium time frame.

2.4. Development Impact

The expected co-benefits achieved by the Program include:

- By enabling and accelerating solar PV power generation in Chile, the Program will directly support the diversification of the country's power generation mix, which is almost completely dependent on coal and diesel in the northern SING system.
- By demonstrating two different models of solar PV commercial strategy in the sector (under a PPA or on a merchant basis), the Program will maximize the expansion of solar PV technologies in the power sector as a whole.
- The construction and operation of the solar PV projects will provide employment, much of it rural, given the location of the most propitious project sites.

- As stated on the CIP, the GoC will launch coordinated efforts toward promoting jobs for women in the RE industry, in line with its Plan for Equal Opportunities, which aims to increase the participation of women in the labor market and eliminate discrimination.
- By accelerating the development of the solar PV sector and supporting its achievement of critical scale in Chile, the Program will open up opportunities for potential future solar PV energy equipment manufacture in Chile, with its associated employment benefits.
- By accelerating the development of this sector in Chile, which has one of the best global solar resources, it is expected that the development of the sector in other Latin American countries will be also be stimulated.

2.5. Implementation Potential:

See description above regarding Chile’s solar PV activities for details on the market context and regulatory environment. The economics of solar PV projects are highly variable, with (a) site-specific resource data; (b) type of panel technology (crystalline or thin-film), and (c) type of tracking technology (fixed-tilt, single-axis, or double-axis) being the most prominent variables.

In all cases, projects supported under the Program will seek to minimize the use of CTF funds and maximize the leverage achieved from the MDBs, other multilaterals active in Chile, the private sector, and other sources. The US\$50 million allocation could be utilized by several projects depending on the interest of commercial banks and other funding sources. Based on the assumption that the Program will support approximately 300 MW of solar projects, the total US\$50 million of CTF funds will leverage approximately US\$700 million in other financing.

2.6. Additional Cost & Risk Premium

Solar PV is a technically and commercially fully proven technology outside of Chile and there are widespread examples of successful applications at scale around the world. Chile has a world-class solar resource, which encompasses a wide area of the Atacama desert in the north of the country. CTF support will (i) lower perceived risk of implementing solar PV in a country which today has almost none, despite the richness of its resource; and (ii) lower the costs of power from such projects to be in line with what industrial or commercial users would pay from more conventional, polluting technologies. CTF support to first-mover solar PV projects will mitigate the higher costs (setting contractual, operational and financial precedents for IPPs, creating transmission links to key solar resource areas, building the sectoral scale that enables lower equipment prices and perhaps even local support and manufacturing from international suppliers, etc.) and higher perceived risks faced by the early projects. A successful demonstration of the first few truly large scale projects is expected to create the sustainable growth of the industry in Chile.

2.7. Financial Sustainability

The development of small hydro in Chile sets a precedent of how the availability of concessional finance (in that case a concessional credit line from the German development bank KfW through the Chilean national development bank CORFO) can lead to a self-sustaining market. Growth for the solar PV sector has been much slower due to higher costs, lower production and unfamiliarity with solar PV technology. The sector has thus been viewed as a higher risk proposition as compared to other renewable energy technologies. The first few large scale solar PV projects will require additional support to initiate the first few projects due to still high (but rapidly decreasing) equipment costs and high perceived risk. The projects within the Program are expected to promote sustainability by helping to establish a demonstrated track record for the technical and financial viability of solar PV projects, thereby assisting to accelerate the development of the sector.

Future project developers are expected to benefit from the development efforts, persistence and high costs encountered by the early movers in the sector, including the projects within the Program, which should ease the development and implementation process and lower entry costs for future project developers. The lowering of risks, which results from the establishment of such a track record, along with improvements in the financial markets and ongoing lowering of equipment costs, will make Chile’s PV projects attractive on their own merits in the future. By providing a demonstration to developers of how such investments can be made, the Program will enable an accelerated scale-up of these sectors, which will become economically sustainable over the coming years as the cost of capital and the equipment prices decrease.

2.8. Effective Utilization of Concessional Finance

Solar PV shows great promise for long-term cost reduction and competitive provision of low-carbon power, but for now is still a relatively high-cost form of generation. Initial multi-megawatt scale projects in solar PV in Chile will face higher costs and higher risks associated with first movers, and concessionary financing will be used to address these issues. In the long-term however, it is believed that the lower cost of capital from lower perceived risk once the initial projects have been completed, coupled to lower equipment costs, will be sufficient to enable the sustainable growth of the solar PV sector.

Given the varying economics of the PV technologies considered under this programmatic proposal and the site-specific economics of the solar resource, the structuring of CTF funds will need to be tailored on a project by project basis but will always seek to maximize the use of other sources of funding (MDBs, other multilaterals, private sector, carbon finance and other concessionary sources), while minimizing the use of and the concessionary nature of CTF funds.

Other concessional financing has not been committed for solar PV projects so far.

2.9. Mitigation of Market Distortions

The Program is designed specifically to have a supporting rather than distorting impact on the nascent solar PV projects. The Program will provide CTF funds to individual projects and will enhance the rapid development of these large-scale projects until they have reached a sufficient critical mass to grow in a self-sustainable manner. It is unlikely that these initial large scale projects could be financed without multilateral involvement, concessional financing and appropriate commercial bank maturities in order to provide market rates of return to project sponsors. If they did, the poor returns received would provide little incentive for replication and growth of the market to scale, inhibiting the market's rapid growth and limiting it to equity financed 1 – 3 MW demonstration projects for a far longer period than could otherwise be achieved with these funds.

2.10. Risks

Risks associated with the Program include:

- *Risk:* First large-scale private projects of solar PV in Chile will face risks associated with lack of experience and capacity in the sector.
Mitigant: The Program will benefit from the MDBs' selection of projects with the right combination of sponsors, suppliers, and off-takers to maximize the chances of success. The Program will also benefit from IFC's and IDB's experience in financing private sector renewable energy projects.
- *Risk:* Risks that are typical of similar transactions, including tariff and market considerations, completion risks and technology concerns.
Mitigant: These risks will be considered by IFC and IDB when selecting projects to benefit from the Program. Residual risks stemming from the inherent uncertainty of the solar resource, possible cost overruns, and other factors may be addressed through financial structuring measures such as the establishment of minimum financial ratios or reserve accounts.
- *Risk:* While the SING and SIC regions have vast land areas which could be used for solar PV development, power grid infrastructure development is more concentrated. Several large-scale solar PV projects could operate in close proximity, using the same grid node injection points and transmission lines. This could cause saturation in a given area, preventing a certain amount of solar PV projects from injecting energy.
Mitigant: Chilean law makes it mandatory to extend the capacity of the relevant electrical node in this circumstance, although the process can take between 24-36 months depending on the size of the expansion. In order to mitigate this risk, an US\$14 million NCRE insurance program which is currently under development will help to address annual forgone revenue due to a delay in commissioning.
- *Risk:* The International Labor Organization Convention No. 169 (2009) establishes the need to achieve the consensus of indigenous communities for a project to be installed in their territory. The opposition to energy projects by indigenous communities in which the courts have failed for them has resulted in cancellation of approvals and indefinite cessation projects.
Mitigant: Given their arid conditions, the areas in which solar PV projects are expected to be developed are not heavily populated by indigenous communities. In any event, the Chilean Ministry of Energy, Chile's Renewable Energy Center and IDB are designing a program to increase awareness of NCRE projects in the general population.