PROGRAMME DESIGN DOCUMENT FORM FOR CDM PROGRAMMES OF ACTIVITIES (F-CDM-PoA-DD) Version 02.0

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

PV Project Development in Chile
Version 5
2/12/2012

A.2. Purpose and general description of the PoA

1. General operating and implementing framework of PoA

This PoA will implement a series of grid connected photovoltaic projects across Chile (particularly in the territories covered by the northern and central grids, SING and SIC respectively) that will provide clean, carbon-free electricity to Chile. The projects will include the siting, planning, financing, engineering, construction and operation of these facilities. C-Quest Capital will be the Coordinating/Managing Entity (CME) for this project and the on-the-ground work related to project planning and implementation for each CPA will be handled by Solar Chile or a third party sponsored by C-Quest Capital.

2. Policy/measure or stated goal of the PoA

The goal of the PoA is to bring a vital clean energy resource to Chile that currently has little PV development. This is important because Chile faces serious energy challenges. In the last few years, Chile, which has relied on Argentina for cheap natural gas, suddenly found itself in an energy crisis when Argentina cut off its gas supply. This has forced the construction of expensive LNG terminals[1] and driven the move towards cheaper coal. As a result, the Chilean grid is becoming more carbon-intensive every year. At the same time, Chile has one of the best solar resources of any country. Its desert north, long dominated by large industrial concerns like mining, has energy demand and few days without complete sun. The northern part of the country is looking at the construction of many new coal-fired power plants because of the large investment expected in the mining sector[2]. Chile, for example, has become the copper mining capital of the world, producing more than one-third of global copper output. According to SONAMI (National Mining Association) the investment in new mining projects until 2015 will reach $80 billion. This portfolio of new projects will allow the country to increase copper production to 7.4 million tons by the end of the decade, while gold output will triple.[3]

[1] http://www.bnamericas.com/news/oilandgas/GDF_Suez_official:_Mejillones_LNG_price_tied_to_project_cost

[2] http://www.bloomberg.com/news/2012-04-24/power-shortage-hurts-chile-s-100-billion-copper-push.html

[3] http://www.latinomineria.cl/revistas/index_neo_en.php?id=883

The goal of this PoA will be to balance the skyrocketing needs of the mining industry (and the country as a whole) with environmental concerns by bringing solar electricity to the country. As the graph below shows, the carbon intensity of the country has increased substantially over the years and this trend will continue if no clean energy is injected to the grid.

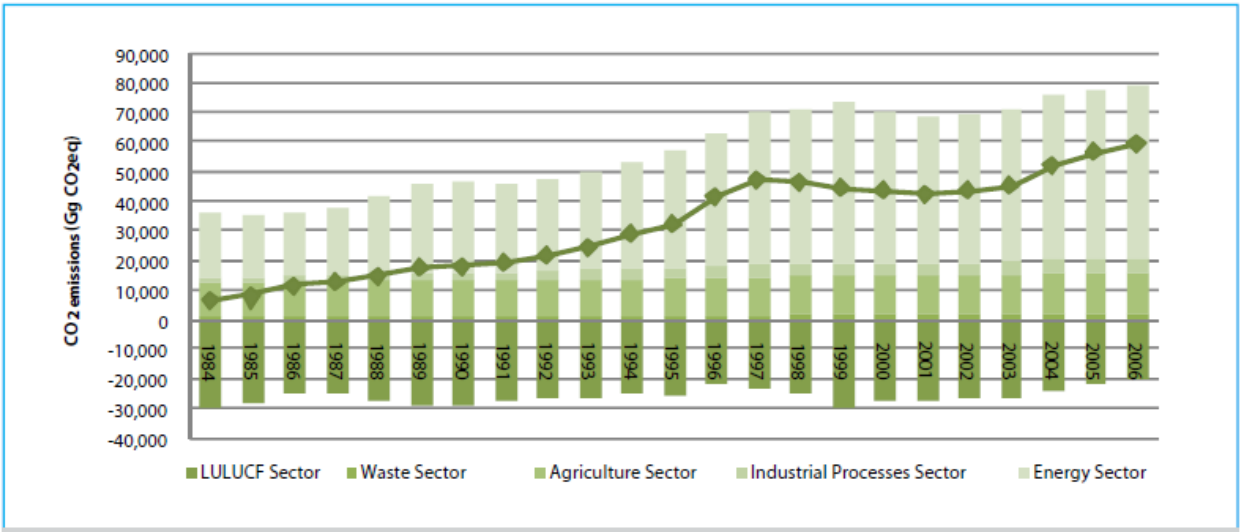
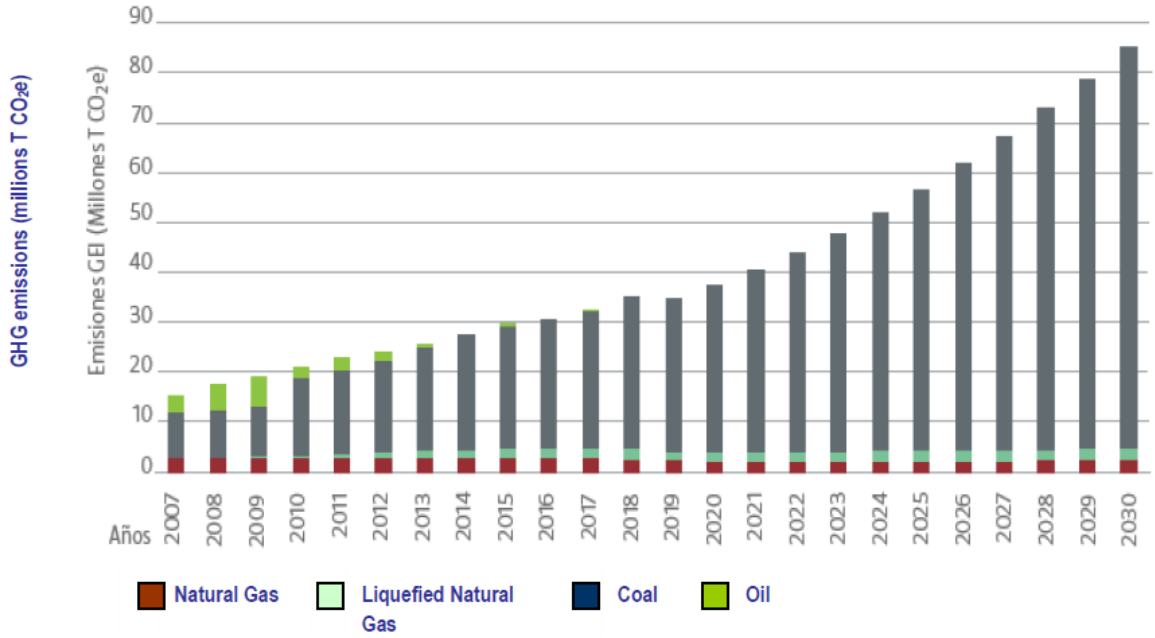


Figure 3. Sectoral contributions and balance of Chile's National GHG Inventory (INGEI), 1984-2006
Source: Ministry of the Environment, 2011

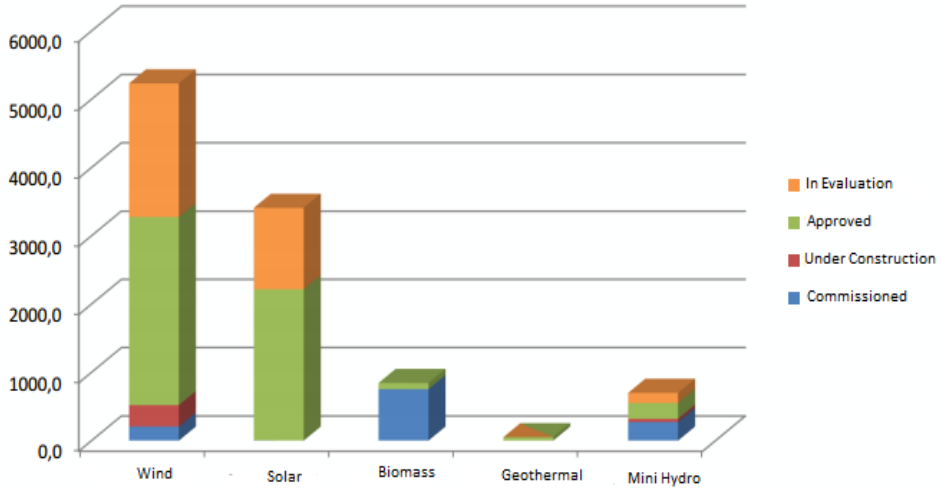
Source: Ministry of the Environment 2011

Future projections for the GHG emissions of the electricity generation sector suggest that the average carbon intensity of the grid in Chile will increase dramatically as a consequence of the growth in coal fired electricity generation.



Source: International Institute for Sustainable Development (IISD), 2010

This project and other renewable energy development can help mitigate this rise in coal-dominated electricity by providing solar power. PV power generation is nearly non-existent in Chile, despite the tremendous solar resource in the Atacama Desert. While there are several solar facilities in the north on the drawing board, none have been completed. Bringing in the benefit of CER sales will help greatly accelerate the development of PV in the north and the rest of the country.



Source: ACERA 2012[4]

Additionally another goal of this PoA is to promote the technology transfer of solar technologies to Chile. Considering the large potential of the solar resource in Chile, it is likely that local production capacity for components of PV plants will be set up if this technology has incentives like the CDM to be developed.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

The implementation of solar power projects is not a requirement in Chile. The proposed PoA is a voluntary initiative developed by CQC and Solar Chile with no law mandating such a project. It is a voluntary initiative of both parties.

A.3. CMEs and participants of PoA

The coordinating entity of the PoA is C-Quest Capital LLC, which will be the entity responsible of communications with the EB. Solar Chile will be a project participant. All the on-the-ground work related to project planning and implementation for each CPA will be handled by Solar Chile or a third party sponsored by C-Quest Capital LLC. The Energy Prediction Reports (EPR) for each CPA will be developed either by the CPA implementer or by a technical expert sponsored by the implementer.

A.4. Party(ies)

Name of Party involved ((host) indicates a host party)	Public or private entities Project Participants	Parties involved wish to considered as project participant?

[4] http://www.acera.cl/wp-content/uploads/2012/01/Newsletter-Octubre-ACERA.pdf

Chile	C-Quest Capital LLC	No
Chile	Solar Chile	No

The following map represents the country of Chile:

A.5. Physical/ Geographical boundary of the PoA

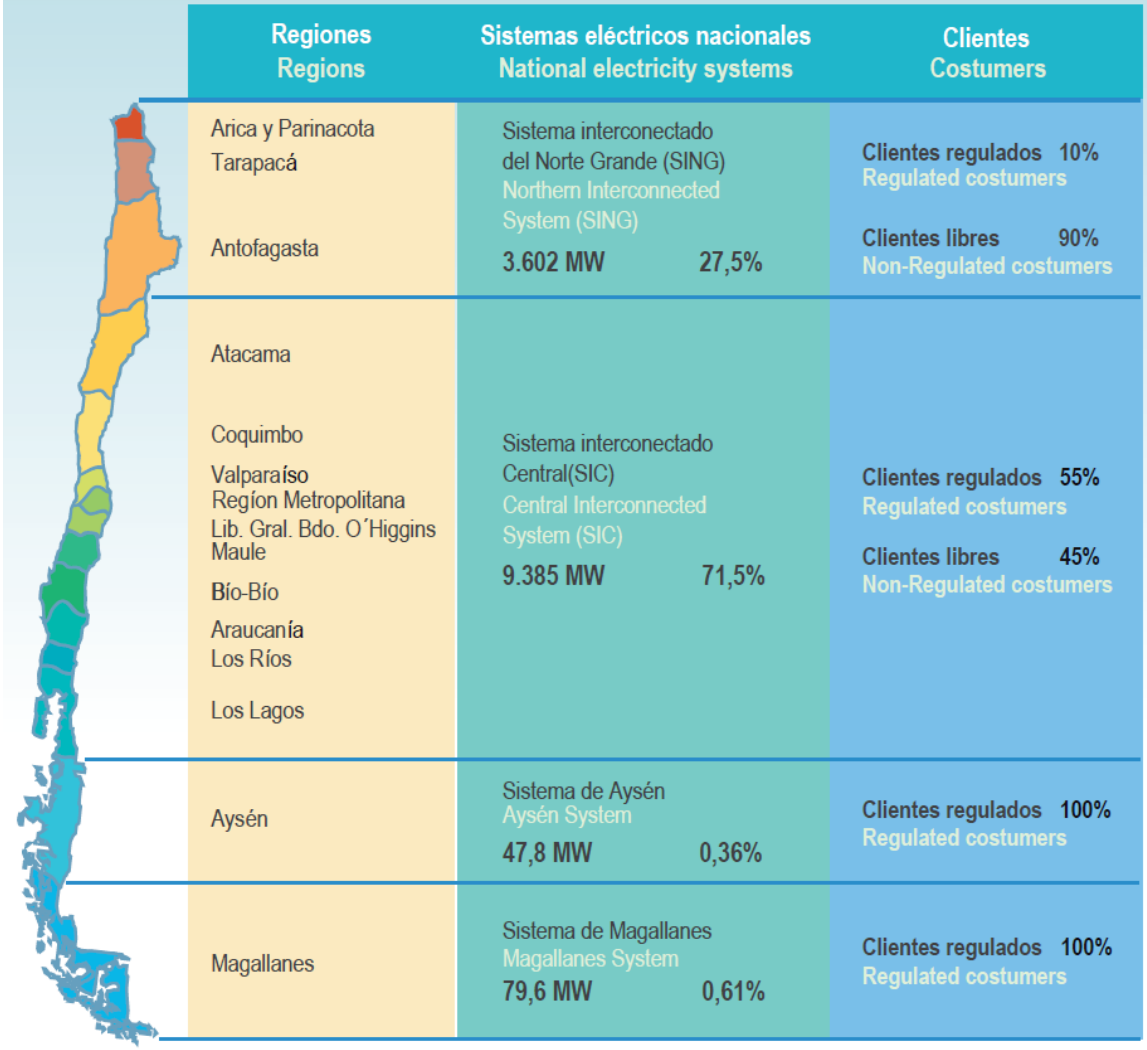
This PoA will cover the territory of Chile included in the SIC and SING grids. Both of these systems combined represent the 99% of the installed capacity in Chile and cover over 98% of the population. Only two regions from the country are left outside of the boundary of this PoA: Aysen and Magallenes, which are the most southern regions and are served by independent electricity systems.

In terms of geographic coordinates the geographical boundary if this PoA is the following:

North	17°29′S 69°18′W
East	43°15,663′S 74°24,271′W
West	23°00′S 67°00′W
South	43°47,87′S 72°30,127′W

Any project located in continental Chile and Chiloe within this boundaries could be part of this PoA.

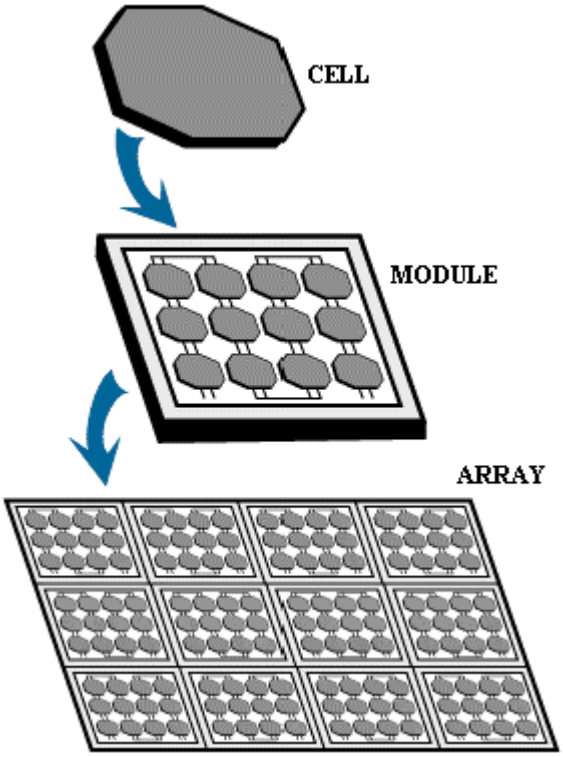
Figura 5: Capacidad instalada por sistema eléctrico 2008
Installed capacity by electricity system 2008



Source: CNE 2009

A.6. Technologies/measures

The CPAs under this PoA will consist of grid-connected PV systems that will produce electricity from the sun. There will be no minimum or maximum capacity or output for these PV facilities and the key requirement is that they use PV technology and feed electricity into the SIC or SING regional grids. The solar cells will typically be inserted into a module and multiple modules placed into an array, as illustrated below. An unlimited number of these arrays can be situated together to provide electricity into the grid. PV modules (also referred to as PV or solar panels) convert sunlight into direct current (DC) electricity via the photoelectric effect. Large arrays of PV modules will be arranged to form a complete solar energy generating plant. The DC output from multiple rows of PV modules is collected, combined and directed to an inverter. The inverter converts the DC power to AC power, which flows to a medium-voltage transformer where it is stepped up to a collection system voltage of 34.5 kV or to an agreed standard. Multiple medium-voltage transformers are connected in parallel to on-site switchgear prior to transmission for interconnection. Commonly, but not exclusively, the PV facilities will comprise of modules on single axis tracking structures designed to track to the path of the sun from east to west throughout the day.



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The CPA implementer, Solar Chile, will help construct and operate the PV facilities, with outside investors providing the financing. The CME, C-Quest Capital, will maintain overall responsibility for ensuring compliance with the CDM methodology (ACM002) and all other UNFCCC guidelines. The CME will work with Solar Chile and any other on-the-ground partners to ensure, for example, that output is metered and a monitoring plan is strictly adhered to. In addition, the CME will calculate the emissions factor of the grid for each year, including the operating and build margin. Each CPA project will carry out its own environmental impact analysis and stakeholder consultation process as required in typical CDM projects. The CME will help oversee each of these tasks to ensure compliance will all applicable UNFCCC guidelines. Any involvement of the CME in the projects and its relation with the project participants will be ruled by a management system, specifically developed for this PoA.

A.7. Public funding of PoA

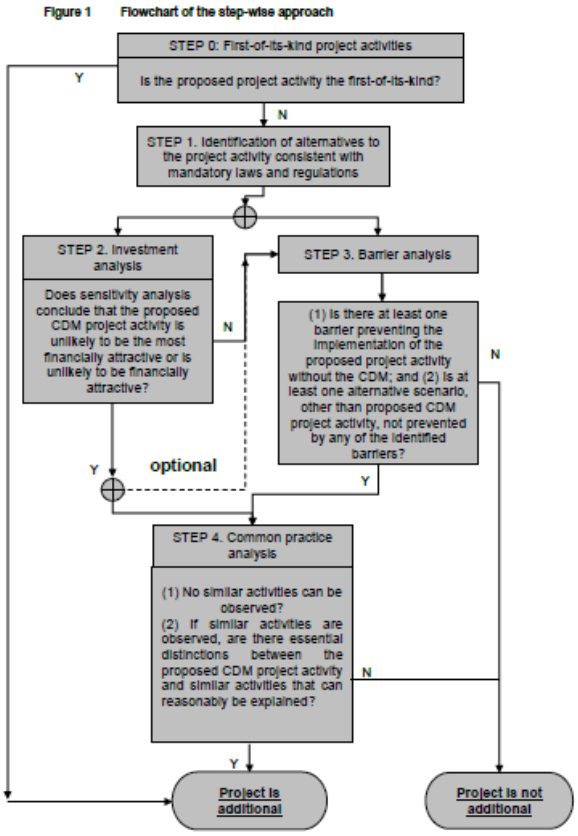
No public funding will be used for this PoA

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

ACM0002: "Consolidated baseline methodology for grid connected electricity generation from renewable sources", Version 12.3.0, states that "the additionality of the project activity shall be demonstrated and assesses using the latest version (version 07.0.0) of the 'Tool for the demonstration and assessment of additionality." Additionally the "tool to calculate the emission factor for an electricity system" Version 03.0.0 will be used.

The following will be the flow that the CPAs will have to carry out for additionality assessment:



This PoA will provide a framework for additionality that has to assessed in each CPA. The key steps are as follows:

Step 1: Identification of Alternatives

Sub-step 1: Define alternative scenarios to the proposed CDM project activity. The following could be considered the range of alternative scenarios:

- Development of PV projects without CDM
- Development of other renewable energy projects
- Continuation of the current situation with the dominance of fossil fuel across the Chilean grids.

Sub-step 1b: **Consistency with mandatory laws and regulations:**
All three possible alternative scenarios outlined above are consistent with local laws and regulations. No laws or regulations prevent the continued use of fossil fuels for the generation of energy or the development of renewable energy projects. There are no laws preventing the development of solar plants and currently no mandatory regulations requiring the development of PV.

The most important laws that regulate the electricity generation activities in Chile are the following:

- Law N° 19.940: General Law of Electric Services, which is the most important law that regulates the sector. This general law includes important features of the system such as a dispatch system based on marginal cost pricing and the creation of power markets that allow generators to trade electricity. Additionally the law grants access to the transmission line to all generation companies irrespective of size.

- Law N° 20.018: known as the "Short Law II" which makes it compulsory for transmission companies to issue a tender to acquire electricity through a competitive system securing long term prices (contracts up to 15 years)

- Law N° 19.300: General Bases of the Environment, which states that every energy project > 3MW needs to perform an Environmental Impact Assessment or Declaration.

- Law N° 20.257: "Non Conventional Energy Sources (ERNC)" which establishes that: Non-conventional energy sources are geothermal, wind farms, solar, biomass, wave/tidal and small hydro electricity generating technologies up to 20 MW.10% of the energy produced by large generation companies (>200MW) must be sourced from ERNC projects. This to be purchased in the market or generated in house. The regulation above is applicable in phases starting with an ERNC commitment of 5% for the period 2010 – 2014 and increasing by 0.5% afterwards up to the year 2024. Any excess generation using ERNC can be transferred between companies. Noncompliance with the regulation involves a fine of 0.4UTM/MWh (about 31.1USD/MWh).

For more details about the relevant laws, that regulate Chilean Market refer to Annex 3 of Non-Conventional Renewable Energy in the Chilean Electricity Market, Page 120 – 122.

Step 2: Investment Analysis: Each CPA will carry out an Investment Analysis to assess the additionality of the CPA. Note that each CPA will have different numbers in any financial analysis.

Sub-step 2a. Determine appropriate analysis method
Since the proposed project will earn revenues from not only CER sales but also electricity sales, the simple cost analysis method is not appropriate. Instead, benchmark analysis (Option III) will be applied.

Sub-step 2b. Option III. Apply benchmark analysis
The financial indicator for this analysis is the pre-tax project IRR, which is one of the most commonly used parameters to determine the investment decision. This indicator has been chosen because it is the same one that investors in Chile would look at, when evaluating an energy project.

The benchmark to be used to compare the project IRR is obtained from Chilean electric law (DFL 4/2006 ,article 174). According to this decree the official discount rate for electric projects is 10% in real terms[5]. This is used to determine Node Prices, transmission line and distribution investments, therefore it represents an opportunity cost for the investment in electricity generation. It should be noted that the

[5] http://www.cne.cl/archivos_bajar/DFL_N4.pdf

presented Benchmark is a conservative rate, applicable to the Chilean power sector where most of the projects investments come from large companies that benefit from scale economies.
There is precedence of the use of this benchmark in registered Chilean NCRE CDM projects.

Sub-step 2c. Calculation and comparison of financial indicators
Calculation and comparison of financial indicator of the Project is implemented according to the last version of *Guidelines on the Assessment of Investment Analysis*.

This section presents a framework for the variables and data sources for the calculation of the financial indicators that will be done at CPA level.

Item	Unit	Data Source
Installed Capacity	MW	EPR
Plant Factor	%	EPR
Operation Life	Years	EPR
Energy production	GWh / year	EPR
Electricity price	USD/GWh	Latest year of hourly spot prices (available ta CDEC SING or CDEC SIC), matched with the plant generation profile./PPA
Investment	USD	Letter signed by EPC contractor (The Capex includes construction costs of the plant and the line as well as development costs))
O&M costs	USD/kwac-year	Letter signed by service provider
Panels derate Factor	%	EPR
Discount Rate	%	Same as benchmark (10%)

Sub-step 2d. Sensitivity Analysis
The CPA implementer should then conduct a sensitivity analysis to confirm that under different scenarios, the CERs are still material to the project being financially attractive or not.

Parameter	IRR at -10%	Base Case IRR	IRR at + 10%
Construction Cost	XXXX	XXXX	XXXX
Electricity Price	XXXX	XXXX	XXXX
Actual Generation	XXXX	XXXX	XXXX
O&M	XXXX	XXXX	XXXX

If the outcome of this project IRR calculation is below 10% the CPA can be considered additional if it also complies with common practice.

Step 3: Barriers Analysis
This analysis will be used to determine whether the proposed project activity faces barriers that:

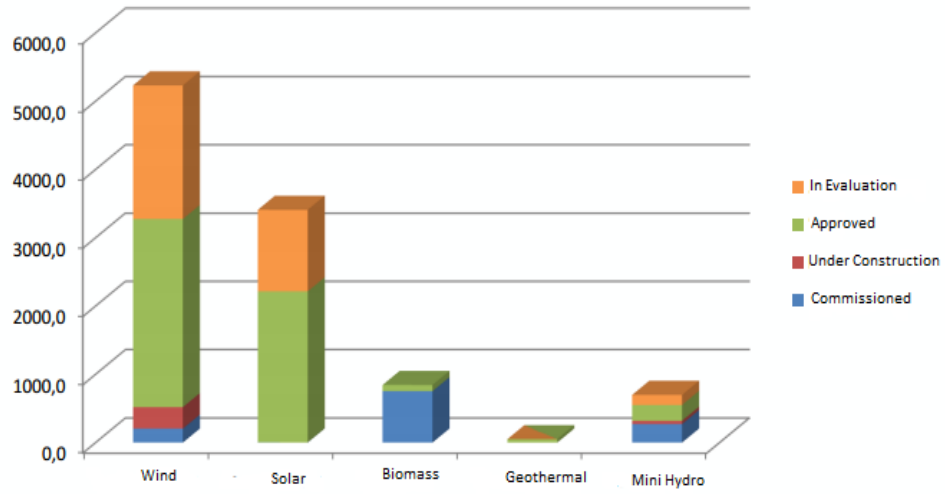
- Prevent the implementation of this type of proposed project activity; and
- Do not prevent the implementation of at least one of the alternatives

The analysis to be carried at PoA level consist in the barriers faced by solar development at a country or grid level.

Sub-step 3a: Identify barriers that would prevent the implementation of alternative scenarios

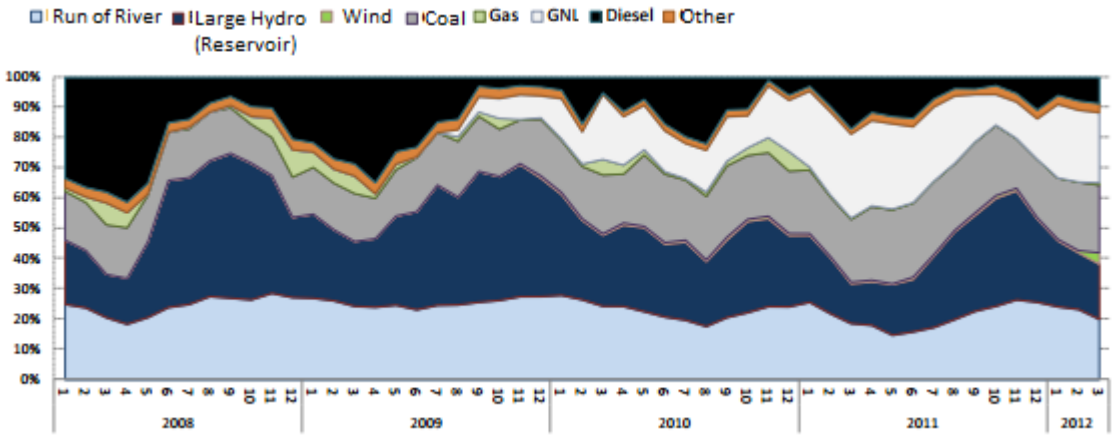
Barriers do to prevailing practice

As of the writing of this PoA-DD, there is no grid connected solar development in Chile and as a result of that there are no PV plants connected to the SIC or the SING grids [6]. Moreover [7] the pipeline of projects shows that no solar facility is yet under construction or commissioned.



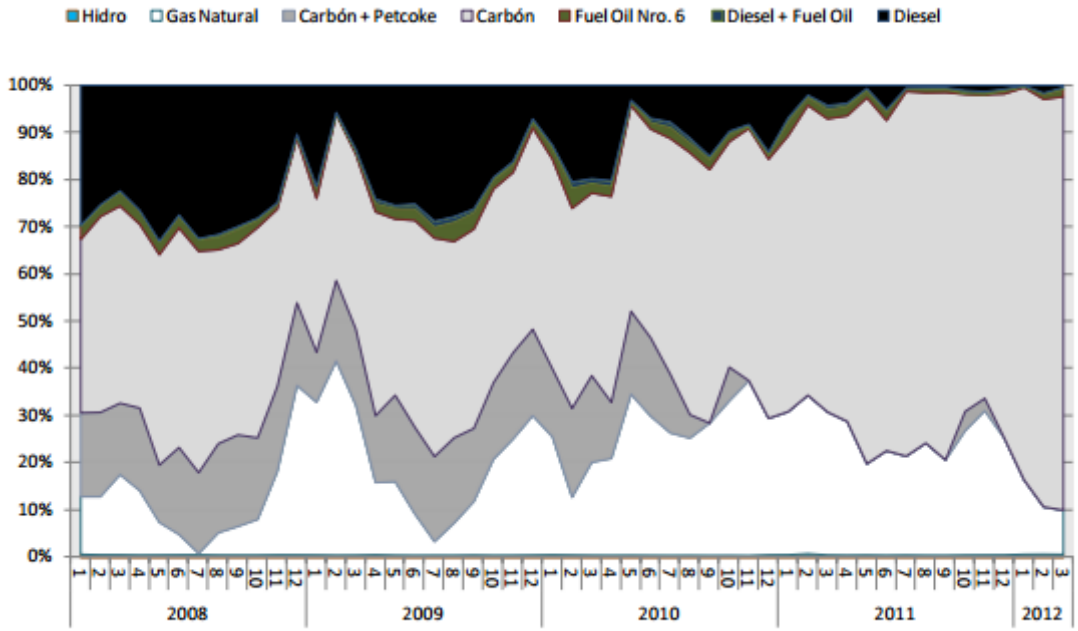
Source ACERA 2012[8]

Both in the SIC and the SING grids the contribution of NRCE is small, and the solar in particular is non-existent. In the SIC in particular most of the energy comes from large hydro (Over 20 MW) and thermal power plants with a small portion of wind. In the SING on the other hand over 98% of the electricity is generated using conventional fossil fuels.



Source: Systep 2012[9]

[7] http://cdec2.cdec-sing.cl/portal/page?_pageid=33,44050&_dad=portal&_schema=PORTAL
https://www.cdec-sic.cl/contenido_en.php?categoria_id=6&contenido_id=000044
[8] http://www.acera.cl/wp-content/uploads/2012/01/Newsletter-Octubre-ACERA.pdf
[9] http://www.systep.cl/documents/reportes/042012_Systep_Reporte_Sector_Electrico.pdf



Source Systep 2012[10]

As demonstrated above, the existing solar power capacity represents virtually none of total electricity generation capacity installed in Chile. The existence of the barrier of prevailing practice for photovoltaic technology in the SIC and SING is thus demonstrated by showing evidence that the use of this technology is marginal.

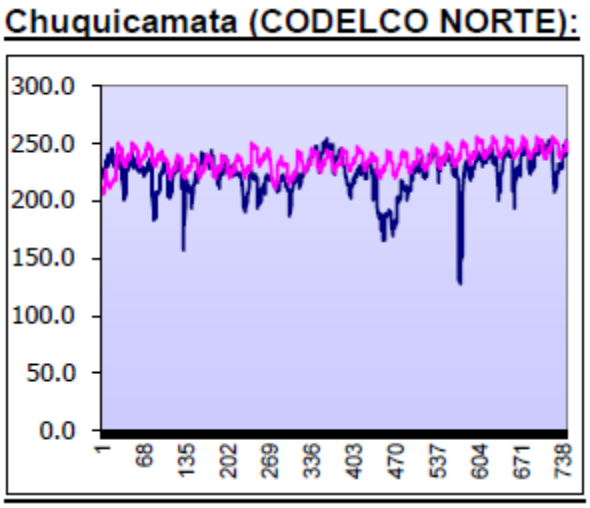
The key reason why the PV has made no market penetration is simply that it's too expensive relative to the spot market price for energy. In the SING, where the places with best solar resource in Chile are located, the spot market price averaged US$66/MWh toward the end of 2011, due in large part to the increased use of coal and the decreased reliance on relatively more expensive fuels (LNG and diesel). Meanwhile, the 2011 year average spot market price was US$96/MWh again as a result of coal representing a greater proportion of the overall mix, especially in the second half of 2011[11]. Currently, according to a study carried out by Bloomberg for the Chilean context, a PV facility has a levelized cost of energy (LCOE) of above 150 USD/MWh[12] ,well over the market price.

Access-to-Finance Barriers: Significant capital is required to invest in a programme which could match the achievements of the proposed PoA. There is no precedent for large-scale private or public-sector involvement in utility-scale PV facilities, and Solar Chile has been unable to find investors willing to provide the level of capital necessary to implement such a program without the sale of CERs. Solar Chile's team of investors, which have key roles in providing equity in the PV initiatives, have provided letters stating that they are keener to consider this kind of investment if this PoA is CDM registered and eligible to sell CERs. And CQC has been unable to find any other investors in this project, given the risks of doing this kind of project. The letters from the investors are included in as attachments to this PoA-DD. The statements from these investors are critical because they will be providing the capital necessary to build the PV facilities. Without this capital, the project simply could not move forward.

[10] http://www.systep.cl/documents/reportes/042012_Systep_Reporte_Sector_Electrico.pdf
[11] http://www.systep.cl/documents/reportes/122011_Systep_Reporte_Sector_Electrico.pdf
[12] http://docs.nrdc.org/energy/files/ene_11052401b.pdf

Perception of Risk: The perceived risk for PV solar technologies is currently twofold:

1) The mining industry in the north of Chile is highly dependent on base-load energy which makes solar and non-conventional renewable energy potentially less reliable form of generation. The graph included below represents the power demand of Chuquicamata, one of the largest copper mines in the world. It clearly shows the base-load energy requirement of this mine .



Source: CDEC SING Demand Control Report. 2012

2) There are currently no PV installations of significant size in Chile, and as a result there is no empirical data related to the performance of this technology in the country. The barriers presented above represent a general view of the solar industry and its complexities."

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives

As per the analysis undertaken above, the most viable alternative is the continuation of the current situation. This comprises the generation of electricity predominantly from coal and gas-fired power stations, which do not face any of the barriers listed above. The number of conventional power plants shows that these facilities do not have problems facing, for example, access to capital. The most recently built plants in northern Chile, for example, have all been coal or natural gas plants[13].

Step 4: Common Practice Analysis

The above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. This test is a credibility check to complement the investment analysis (Step 2) or barrier analysis (Step 3).

According to Tool for the demonstration and assessment of additionality V 07.00, the following steps need to be followed for common practice assessment:

Sub-step 4a: The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section of the Tool for the demonstration and assessment of additionality V 07.00.

[13] http://cdec2.cdec-sing.cl/pls/portal/cdec.pck_oper_real_pub.rpt_gen_centrales_sing_x_annos

Sub-step 4b: The proposed CDM project activity(ies) does not apply any of the measures that are listed in the definitions section of the Tool for the demonstration and assessment of additionality V 07.00.

Under this PoA all project activities will be PV solar projects. The former matches measure ii):

ii) Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy);

Since all for the projects under this PoA apply to the former measure the following stepwise approach shall be applied in each CPA as indicated in the guidelines on common practice V2.0.0

Stepwise approach for common practice (to be applied in each CPA)

Step 1: calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

Step 2: identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

(a) The projects are located in the applicable geographical area;
(b) The projects apply the same measure as the proposed project activity;
(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;
(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;
(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1; In general, capacity values should be considered in the common practice assessment. The use of output values should be justified and consistently applied in the assessment.
(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number Nall

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number Ndiff

Step 5: calculate factor F=1-Ndiff/Nall representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and Nall-Ndiffis greater than 3.

Outcome of Step 4: If outcome of Step 4 is that the proposed project activity is not regarded as "common practice", then the proposed project activity is additional. If outcome of Step 4 is that the proposed project activity is regarded as "common practice" then the proposed CDM project activity is not additional.

B.2. Eligibility criteria for inclusion of a CPA in the PoA

The criteria for including a CPA into the PoA shall be the following:

1 The CPA project must be geographically located within the country of Chile and be connected to one of the two major Chilean grids, the SIC or the SING The CME will check this eligibility criteria looking at the project description available in the environmental service of the region where the project will be located.

The CME will check the connection to the SIC or SING grid by consulting the list of active generators available in the SIC and SING websites[14]

2 The project must comply with all of the requirements, monitoring parameters, applicability criteria and baseline scenario analysis as outlined in Version 12.3 of ACM002, *Consolidated baseline methodology for grid-connected electricity generation from renewable sources.*

3 The projects implemented will be solar photovoltaic projects. To confirm the technology used in the CPAs the project developers will provide the CME with the description of the project that is made public in the environmental impacts declaration or evaluation .

4 Because both the stakeholder analysis and environmental impact assessments or declaration will be done on the CPA level, each CPA implementer must complete an EIA or EID and conduct local stakeholder consultations as outlined in Sections E and F in this PoA. The CME will find evidence of the EIA or EID application and resolution in the website of the Environmental Impact Service[15]. Since the stakeholder consultation is not a legal requirement under the EID, the CPA implementer will provide invitation letters, attendees signatures and video recordings of the meetings as evidence of its completion.

5 The CPA must be able to demonstrate that it is not included in any other registered CDM PoA by providing exact location or GPS data and comparing that data to any other CDM project registered or under validation. Evidence of the exact location of the project will available in the project's description of the EIA or DIA. This data will be compared by the CME against the data base of registered projects available in UNFCCC website.

6 Solar PV projects must be able to measure output precisely and demonstrate it is supplying electricity to the grid. In order to assess this criteria the CPA implementer will provide records of electricity sold and reports from the grid operator indicating electricity injected to the grid.

7 Projects must be able to demonstrate that the CPA is a voluntary activity, not required by law,

Evidence for the voluntary action will be delivered in the form letter signed by the CPA implementer.

8 Projects must comply with the additionality criteria as outlined in Section B.1 of this PoA and according to the standard "Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities" version 02.1.

[14] http://cdec2.cdec-sing.cl/pls/portal/CDEC.MENU_INSTAL_GENE.show
https://www.cdec-sic.cl/contenido_en.php?categoria_id=6&contenido_id=000044

[15] http://www.sea.gob.cl/

In order to check this criteria the project participant has to submit all the data and supporting evidence from the framework for project IRR Calculation. Also common practice analysis shall be applied in each CPA according to the guidelines established in the PoADD.

Item	Unit	Data Source
Installed Capacity	MW	EPR
Plant Factor	%	EPR
Operation Life	Years	EPR
Energy production	GWh / year	EPR
Electricity price	USD/GWh	Latest year of hourly spot prices (available ta CDEC SING or CDEC SIC), matched with the plant generation profile./PPA
Investment	USD	Letter signed by EPC contractor (The Capex includes construction costs of the plant and the line as well as development costs))
O&M costs	USD/kwac-year	Letter signed by service provider
Panels derate Factor	%	EPR
Discount rate	%	Same as benchmark (10%)

If the result of the calculation of the Project IRR is below the 10% benchmark the project will be considered additional. Evidence and data for common practice assessment will be obtained from ACERA newsletters[16], SIC[17] and SING[18] websites for active projects and CDM pipeline[19].

9 The CPA implementer will be able to provide documentary evidence indicating that the DNA has been informed of the a new CPA of the PoA. The CPA included in the DNA website would be enough evidence to prove this

10 The project in the CPA must affirm that no funding is coming from Annex I parties or that if such funding does take place, it does not result in a diversion of official development assistance. This will be demonstrated through a signed letter by the CPA implementer.

11 The CPA Implementer will be able to provide documentary evidence of the start date of the CPA. Evidence such as approved timeline, a supplier agreement, land purchase or a PPA can be provided as evidence for start date.

12 The CPA implementer will be able to provide documentary evidence for the reliability and performance of mayor components of the solar facilities. Manufacturer's performance warranty or certifications relevant for the industry are enough evidence for this criterion.

13 Projects under this PoA must be Greenfield sites. This will be checked by consulting the environmental impact declaration or study that clearly states this issue.

[16] http://www.acera.cl/centro-de-informacion/newsletter/
[17] https://www.cdec-sic.cl/contenido_en.php?categoria_id=6&contenido_id=000044
[18] http://cdec2.cdec-sing.cl/pls/portal/CDEC.MENU_INSTAL_GENE.show
[19] http://www.cdmpipeline.org/

B.3. Application of methodologies

ACM002 is an appropriate choice of a methodology, because all of the projects under this PoA will comply with the applicability criteria as outlined in ACM002. These include the following:

Applicability Criteria from ACM002	Project Case
This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	**All of the sites under this PoA will be grid-connected PV facilities that will be Greenfield sites. No capacity additions or retrofits, etc. are to be expected. This applicability criterion will be assessed using the project's description from the EIA or EID.**
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	**Any project activity under this PoA will be a solar PV power plant. This applicability criterion will be assessed using the project's description from the EIA or EID and with EPR from technology manufacturer.**
In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	**Not applicable as this PoA is only implementing CPAs that are Greenfield sites.**
In the case of hydro power plants, one of the following conditions must apply: • The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	**Not applicable as this PoA will not include hydropower plants.**

The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	**Not applicable since this PoA will not include biomass, hydroplants or any switching from fossil fuels to renewable energy.**
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	**Not applicable as this PoA is only implementing CPAs that are Greenfield sites.**

SECTION C. Management system

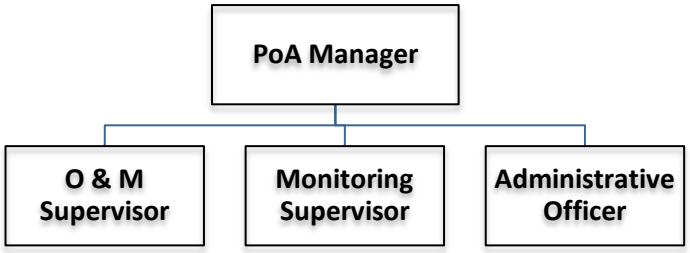
All of the requirements of the managements systems for the inclusion of CPA will be guided by the CME Manual - Chile Solar PoA.

Definition of roles and responsibilities:

The CME is comprised is comprised by

- PoA Manager,
- Operations & Maintenance (O&M) Supervisor,
- Monitoring Supervisor, and
- Administrative Officer.

The organizational chart below reflects an almost flat structure with well-defined responsibilities as noted under Our Team.



Our Team

Title	Tasks
PoA Manager	• Approves inclusion of CPAs and checks on their eligibility criteria during inclusion; • Oversees proper commissioning and distribution of the system; • Ensures compliance of the technology with the PoA requirements; • Communicates with CDM and DOEs; • Follows up with registration, inclusion and issuance of CERs; and • Checks on periodical and annual monitoring set up and reports per CPA.
Operations & Maintenance (O&M) Supervisor	• Oversees training and introduction to O&M during installation and commissioning; • Review and maintain records (evidence: land purchase, purchase order to suppliers, contract with service providers, equipment, etc.); • Verifies, collects and maintains legal agreements (power purchase agreements and others). • Periodically checks that implementation/ installation conforms to the standards detailed in the PoA; and • Ensures that innovations based on implementation experience are considered in future CPA-DDs.
Monitoring Supervisor	• Confirms that all CPA are following the monitoring steps in accordance with the registered monitoring plan; • Confirms that implementation/ installation conforms to the standards detailed in the PoA (recorded by the O&M Supervisor); • Ensures that all the monitoring data collected are consolidated and processed digitally in a central database; and • Ensures that each CPA implementer produces a coherent and standard monitoring report annually.
Administrative Officer	• Process and maintain the empanelment of CPA implementers; • Identifies, process and execute contracts with DOEs, IT service providers, consultants (specialists), counselors, etc.; • Coordinates the set up of and oversees the CME management software • Produces monthly and ad-hoc reports for CME staff, CPA implementers, DOEs, CDM, etc. as required.

Records of arrangements for training and capacity development for personnel

The CME will carry out an annual review of the overall PoA management system. This review will take place during verification to help the CME in obtaining an outside perspective of the overall management process from the DOE. The CME O&M Supervisor will prepare a report to be shared with the Team, CPA implementers and the DOE outlining any problem that occurred during the previous year and list specific actions that he/she wants to suggest to the PoA Manager. This review analysis and improvements suggestions to the PoA management system will be done every year and it will include a training plan for the staff that will be kept in the project data base. As it will be provided to the DOE upon verification the following year, the DOE can thus assess the status and effectiveness of the recommended improvements.

More details about training can be found in a separate document
Records and documentation control process:

CQC and Solar Chile will maintain a database system that will consist of the following details for each CPA, so each can be uniquely identified:

1. Name of the CPA implementer as well as contractual relationships (owner, operator, investor and counterparty to any power purchase agreement). The CME will also record any changes in this structure throughout the crediting period.

2. GPS coordinates and precise location (town, province, etc.).

3. Technical specifications, such as capacity, number of panels and manufacturer of panels, location of connection to grid.

4. Key dates for each facility, including financial closure, groundbreaking, construction and commissioning.

5. Copies of licenses, permits, environmental impact assessments and any other regulatory documentation.

6. Records of start dates for the crediting period as well as monitoring/verification reports and records of issuance of CERs.

7. All records of MWH output from each plant.

Prevention of Double Counting: Each CPA implementer, if not Solar Chile, will sign an agreement with the CME indicating it is agreeing to participate in the PoA and that it is not a part of any other PoA. To ensure against double counting the CME will undertake the following procedure:

- Review all other solar PV projects in Chile – in both registration and validation stage – to ensure that they are in fact different and distinct projects. This information can be obtained from the Project Registry of the UNFCCC website.

- For each CPA, the CPA implementer will declare to the CME that the individual project is not included in any other PoA.

- If there are any other PoAs in Chile that use ACM002, the CME will go through each and if any solar PV projects are included as CPAs, the CME will ensure that the basic criteria, such as GPS, technical specifications, etc. are different that any of the CPAs included in this PoA.

Procedures for technical review of inclusion of CPAs. CQC will work to ensure proper eligibility of the CPAs before they are uploaded for official inclusion into the PoA. CQC will review each CPA document and methodically go through each and every eligibility/applicability criterion of the PoA to make sure there is no question that the CPA meets each requirement. In cases where there is doubt, the CME will not upload the CPA document until the requirements are met to the CME's satisfaction.CQC will review all proposed monitoring procedures to ensure they are in line with PoA and ACM002. After inclusion, CQC personnel will spot check individual project sites to ensure all data is being collected and archived in accordance with the PoA.

Measures for continuous improvements of the PoA management system. CQC will undertake an annual review of the overall PoA management system, including identifying any problems with electricity metering and monitoring, data to determine the combined margin distribution, and overall performance of the project. This review will take place during the verifications stage, which will assist CQC in obtaining an outside perspective of the overall management process from the DOE. CQC will prepare a written report for its internal team, CPA implementers and the DOE outlining problems that occurred during the previous year and list specific actions that will take place to resolve any problems. This written analysis and improvements to the PoA management system will be done every year, with the written document being provided to the DOE upon verification the following year. The DOE can thus assess the status and effectiveness of the recommended improvements.

The main role of the CME will be to ensure that the CPA project is not registered or seeking to be registered either as a stand-alone CDM project activity or as part of another PoA. To do this, the CME will take the responsibility to search all relevant databases, including the UNFCCC project registry, to confirm that no project with the same location (GPS coordinates) or other identifying information is the same as the CPA that is proposed to be registered. All results from these searches will be provided to the DOE. The CME will also handle the task of calculating the emissions factor in accordance to the "*Tool to calculate the emissions factor for an electricity system"*, and ensure that the CPA complies with all other aspects of the methodology (ACM002) as well as all other UNFCCC guidelines.

SECTION D. Duration of PoA

D.1. Start date of PoA

The start date of the PoA has been established at 20/4/2012. This is when the PoA was posted to GSP.

D.2. Length of the PoA

28 years

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

Environmental analysis will be undertaken at the CPA level to address the possible impacts of the individual projects.

E.2. Analysis of the environmental impacts

Each CPA will be required to conduct its own environmental impact assessment (EIA) or declaration (EID) and must follow all procedures as outlined under Chilean environmental law (Law 19300, General Bases of the Environment). The EIA or EID will be submitted to the regional Environmental Impact Service, where the CPA will be located and this service will provide its resolution. Given that solar PV projects cause no air or water emissions, the environmental impacts are expected to be local (impacts on

ground use, such as effects on animal and plant habitats). Thus transboundary impacts do not need to be considered and Environmental Impact Assessment or Declaration will be carried out at CPA level

E.3. Environmental impact assessment

As stated in the 19300 Law, all energy projects of 3MW or more need to carry out an Environmental Impact Assessment or Declaration. If it the CPA needs carry out a EIA or EID depends entirely on the project and its expected impacts. Low impact projects carry out EID, while projects with bigger impacts develop EIA. Commonly, solar PV projects perform a EID.

SECTION F. Local stakeholder comments
F.1. Solicitation of comments from local stakeholders

The stakeholder consultation is a legal requirement under the process of a EIA. EID do not require by law to carry out a stakeholder consultation. Whether a project qualifies for EIA or EID depends entirely on the characteristics of the project. So far all solar PV projects in environmental evaluation in Chile have done EID.

In case the project submits a EIA, its approval will be the proof that the stakeholder consultation was carried out in line with local legal regulation.

Major requirements imposed by regulation for project proponents regarding stakeholder consultation are the following:

- To publish a summary of the EIA in the Official Newspaper and in a local newspaper. This summary has to be revised by the Local Environmental Assessment Commission and has to contain at least the following information: responsible of the project, location, type of project, investment, main environmental issues and mitigation measures.
- Local community and local organization will have the right to make observations about the project, counting with 60 days for this purpose after the publication of the summary.

Each CPA implementer should follow a general approach to obtain stakeholder comments in a manner that addresses any concerns about the project and seeks to rectify those concerns. CPA implementers will:

- Identify potential stakeholders, which could include community representatives living near the facility, other non-governmental organizations, local government agencies and related private companies (technology suppliers, installers, other construction firms).

- Send out invitations to the potential stakeholders at least two weeks prior to the scheduled meeting, asking them to participate and indicating the purpose for the meeting.

- Notify the community through local newspapers or local media

- At the meeting, CPA implementers should present an overview of the project and reveal the results of the environmental impact assessment, if that document has been completed. The project participants should provide a detailed overview of all positive and negative environmental and community impacts of the project.

- Stakeholders should be given the opportunity to ask questions and articulate their concerns, which should all be recorded in detailed minute meetings. In addition, stakeholder participants should put their names on sign-in sheets and other documentation, such as photos of the meetings, are also recommended.

- CPA implementers will carefully record overall concerns and recommend mitigation activities to meet the stakeholders' concerns. All of this information should be provided in the CPA-DD.

F.2. Summary of comments received

To be done at the CPA level.

F.3. Report on consideration of comments received

To be done at the CPA level.

SECTION G. Approval and authorization

Host government approval has been given to this PoA in the form of a letter of approval issued by the ministry of Environment. The letter is dated 13 December 2012.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The CPA will be a grid-connected arrangement of photovoltaic panels that converts direct sunlight into electricity. Under this CPA, a XXX MW solar photovoltaic plant will be developed that will provide approximately XXX MWH of electricity per year, which will be fed into the XXX grid of Chile, thus replacing fossil fuel based power plants and reducing GHG emissions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

Approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources," Version 12.3.0. Additionally the "Tool to calculate the emission factor for an electricity system" Version 03.0.0 and Version 07.0.0 of the "Tool for the demonstration and assessment of additionality" will also be applied.

B.2. Application of methodology(ies)

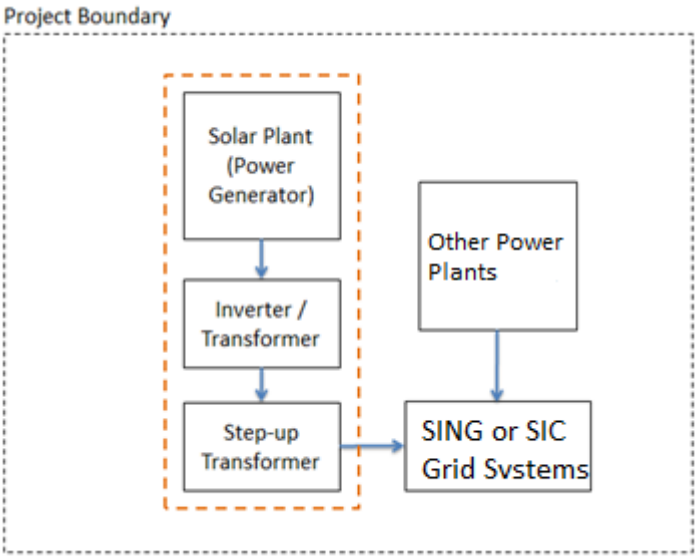
ACM002 is an appropriate choice of a methodology, because all of the projects under this PoA will comply with the applicability criteria as outlined in ACM002. These include the following:

Applicability Criteria from ACM002	Project Case
This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	**[How the CPA complies]**
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	**[How the CPA complies]**
In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	**[How the CPA complies]**
In the case of hydro power plants, one of the following conditions must apply: • The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	**[How the CPA complies]**

The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	**[How the CPA complies]**
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	**[How the CPA complies]**

B.3. Sources and GHGs

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM power plant is connected to.



Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	N/A, not a geothermal plant
		CH_4	No	N/A, not a geothermal plant
		N_2O	No	N/A, not a geothermal plant
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	N/A, not a geothermal or solar thermal plant
		CH_4	No	N/A, not a geothermal or solar thermal plant
		N_2O	No	N/A, not a geothermal or solar thermal plant
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	N/A, not a hydro plant
		CH_4	No	N/A, not a hydro plant
		N_2O	No	N/A, not a hydro plant

B.4. Description of baseline scenario

According to ACM002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

- Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

The following could be considered the range of alternative scenarios:

- Development of PV projects without CDM
- Development of other renewable energy projects
- Continuation of the current situation with the dominance of fossil fuel across the Chilean grid.

The details for determining the baseline are outlined in Section A.4.3 o the PoA, which illustrate that neither PVare being implemented in Chile for the reasons outlined in the barrier analysis. For this reason, the baseline scenario is expected to be the continuation of the dominance of fossil fuel use across the country.

B.5. Demonstration of eligibility for a generic CPA

The CPA project must be geographically located within the country of Chile and be connected to one of the two major Chilean grids, the SIC or the SING. The CME will check this eligibility criteria looking at the project description available in the environmental service of the region where the project will be located.	[How the CPA complies]

The project must comply with all of the requirements, monitoring parameters, applicability criteria and baseline scenario analysis as outlined in the version 12.3 of ACM002, *Consolidated baseline methodology for grid-connected electricity generation from renewable sources.*	[How the CPA complies]
. The projects implemented will be solar photovoltaic projects. To confirm the technology used in the CPAs the project developers will provide the CME with the description of the project that is made public in the environmental impacts declaration or evaluation .	[How the CPA complies]
Because both the stakeholder analysis and environmental impact assessments or declaration will be done on the CPA level, each CPA implementer must complete an EIA or EID and conduct local stakeholder consultations as outlined in Sections E and F in this PoA. The CME will find evidence of the EIA or EID application and resolution in the website of the Environmental Impact Service[20]. Since the stakeholder consultation is not a legal requirement under the EID, the CPA implementer will provide invitation letters, attendees signatures and video recordings of the meetings as evidence of its completion.	[How the CPA complies]
The CPA must be able to demonstrate that it is not included in any other registered CDM PoA by providing exact location or GPS data and comparing that data to any other CDM project registered or under validation. Evidence of the exact location of the project will available in the project's description of the EIA or EID. This data will be compared by the CME against the data base of registered projects available in UNFCCC website.	[How the CPA complies]
Solar PV projects must be able to measure output precisely and demonstrate it is supplying electricity to the grid. In order to assess this criteria the CPA implementer will provide records of electricity sold and reports from the grid operator indicating electricity injected to the grid.	[How the CPA complies]
Projects must be able to demonstrate that the CPA is a voluntary activity, not required by law. Evidence for the voluntary action will be delivered in the form letter signed by the CPA implementer.	[How the CPA complies]
Projects must comply with the additionality criteria as outlined in Section B.1 of this PoA and according to the standard "Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities" version 02.1.0 In order to check this criteria the project participant has to submit all the data and supporting evidence from the framework for project IRR Calculation. Aditionally CPAs will have to	[How the CPA complies]

[20] http://www.sea.gob.cl/

carry out a common practice analysis according to the steps presented in this PoA.

Item	Unit	Data Source
Installed Capacity	MW	EPR
Plant Factor	%	EPR
Operation Life	Years	EPR
Energy production	GWh / year	EPR
Electricity price	USD/GWh	Latest year of hourly spot prices (available ta CDEC SING or CDEC SIC), matched with the plant generation profile./PPA
Investment	USD	Letter signed by EPC contractor (The Capex includes construction costs of the plant and the line as well as development costs))
O&M costs	USD/kwac-year	Letter signed by service provider
Panels derate Factor	%	EPR
Discount rate	%	Same as benchmark (10%)

If the result of the calculation of the Project IRR is below the 10% benchmark and the project is not a common practice it will be considered additional.

Evidence and data for common practice assessment will be obtained from ACERA newsletters[21], SIC[22] and SING[23] websites for active projects and CDM pipeline[24].

The CPA implementer will be able to provide documentary evidence indicating that the DNA has been informed of the a new CPA of the PoA. The CPA included in the DNA website would be enough evidence to prove this.	[How the CPA complies]
The project in the CPA must affirm that no funding is coming from Annex I parties or that if such funding does take place, it does not result in a diversion of official development assistance. This will be demonstrated through a signed letter by the CPA implementor.	[How the CPA complies]
The CPA Implementer will be able to provide documentary evidence of the start date of the CPA. Evidence such as approved timeline, a supplier agreement, land purchase or a PPA can be provided as evidence for start date.	[How the CPA complies]
The CPA implementer will be able to provide documentary evidence for the reliability of mayor components of the solar facilities. Manufacturer's performance warranty or certifications relevant for the industry are enough evidence for this criterion.	[How the CPA complies]

[21] http://www.acera.cl/centro-de-informacion/newsletter/
[22] https://www.cdec-sic.cl/contenido_en.php?categoria_id=6&contenido_id=000044
[23] http://cdec2.cdec-sing.cl/pls/portal/CDEC.MENU_INSTAL_GENE.show
[24] http://www.cdmpipeline.org/

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The key calculation for consideration in the CPAs will be the emissions factor for the SIC or SING grids, which will be calculated using the latest version of the *Tool to calculate the emission factor for an electricity system*. The information below represents the methodological choices for the calculation of both the SING and the SIC that will be calculated on an ex-ante basis in the CPAs (three years of data on fuel input and electricity output for all grid-connected power plants in the grid). .

Project emissions: According to the methodology, project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(1)}$$

Where:
PE_y = Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)
There will be no fossil fuel consumption in all PV projects coming under this PoA. And because hydropower and geothermal plants are not considered under this PoA, these project emissions do not have to be considered. Thus, PE = 0.

Baseline Emissions: According to the methodology, baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

Where:
BE_y = Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(2)}$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)
BE_y = Baseline emissions in year *y* (t CO_2/yr)
PE_y = Project emissions in year *y* (t CO_2e/yr)

Calculation of $EF_{grid,CM,y}$

The emission factor of the grid will be calculated using the "Tool to calculate the emission factor for an electricity system v.3.0.0", applying the following steps:

STEP 1. Identify the relevant electricity systems.
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin (BM) emission factor.
STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1 - Identify the relevant electricity power systems

For the purpose of determining the electricity emission factors, a project electricity system is defined by the geographic extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the place where electricity is being saved) and that can be dispatched without significant transmission constraints.

Similarly, a connected electricity system, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraints.

As was explained before, the CPA will be developed either in the SING or the SIC grids. Both of these systems are not connected between each other or with any other system of the country, so there are neither exports nor import of electricity.

Step 2 - Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

Only grid connected power plants will be included: Option I.

Step 3 - Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

For the case of the SING the method chosen for the calculation of the OM is (a) Simple OM because in the SING low-cost/must run resources constitute less than 50% of the total generation of the national grid:

SING MIX	2006	2007	2008	2009	2010	2011
Fuel Oil Nro. 6	19	378	330	308	276	192
Carbón	3899	5510	5984	5975	7225	11000
Hidro + BESS	70	68	68	62	57	71
Diesel + Fuel Oil	43	41	31	92	114	69
Carbón + Petcoke	2710	2516	2496	2464	1512	0
Gas Natural	6404	3147	1713	3003	4042	4104
Diesel	92	2285	3879	3003	1874	361
Petcoke	0	0	0	0	0	92
Renewables Not Hydro	0	0	0	0	0	0
Nuclear	0	0	0	0	0	0
GWh Annual	**13,236.01**	**13,945.78**	**14,502.34**	**14,906.77**	**15,100.08**	**15,889.14**

SING MIX	2,006.00	2,007.00	2,008.00	2,009.00	2,010.00	2,011.00
low cost/must run resources	69.74	68.17	67.84	61.87	56.87	71.24
Other	13,166.28	13,877.61	14,434.51	14,844.90	15,043.21	15,817.90
GWh Annual	**13,236.01**	**13,945.78**	**14,502.34**	**14,906.77**	**15,100.08**	**15,889.14**

SING MIX	2006	2007	2008	2009	2010	2011
low cost/must run resources	0.53%	0.49%	0.47%	0.42%	0.38%	0.45%
Other	99.47%	99.51%	99.53%	99.58%	99.62%	99.55%

Source: SING website[25]

For the case of the CPA's located in the SIC the method chosen to be used to calculate the OM emission factor (EFgrid,OM,y) will be the (b) Simple Adjusted OM.

In both cases the OM will be determined applying *ex ante* option, using a 3-year generation-weighted average based on the most recent data available at the time of submission to the DOE for validation.

Step 4 - Calculate the operating margin emission factor according to the selected method

The ***(a) Simple OM*** (applicable to the SING) will be calculated according to the following:

The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO2 emission factor of each power unit;3 or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:

(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e. if Option I has been chosen in Step 2).

All the conditions above are true for the case of the SING, therefore Option B - Calculation based on total fuel consumption and electricity generation of the system - will be used:

Under this option, the simple OM emission factor is calculated based on the net electricity supplied to the

[25] http://cdec2.cdec-sing.cl/portal/page?_pageid=33,4121&_dad=portal&_schema=PORTAL#

grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{i} \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y} \right)}{EG_{y}}$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year y (tCO2/MWh)
$FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)
EG_{y} = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i = All fossil fuel types combusted in power sources in the project electricity system in year y
y = The relevant year as per the data vintage chosen in Step 3

As mentioned before for the case of the SIC the ***(b) Simple adjusted OM*** approach will be taken. Its calculation will be carried out as follows:

The simple adjusted OM emission factor ($EF_{grid,OM-adj,y}$) is a variation of the simple OM, where the power plants/units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m). It is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM-adj,y} = \left(1 - \lambda_{y}\right) \times \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} + \lambda_{y} \times \frac{\sum_{k} EG_{k,y} \times EF_{EL,k,y}}{\sum_{k} EG_{k,y}}$$

Where:

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO2 emission factor in year y (tCO2/MWh)
λ_{y} = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EG_{k,y}$ = Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)
$EF_{EL,m,y}$ = CO2 emission factor of power unit m in year y (tCO2/MWh)
$EF_{EL,k,y}$ = CO2 emission factor of power unit k in year y (tCO2/MWh)
m = All grid power units serving the grid in year y except low-cost/must-run power units

k = All low-cost/must run grid power units serving the grid in year y
y = The relevant year as per the data vintage chosen in Step 3

The parameter λ_y is defined as follows:

$$\lambda_y\,(\%) = \frac{\text{Number of hours low - cost / must - run sources are on the margin in year y}}{\text{8760 hours per year}}$$

Lambda (λy) should be calculated as follows:

Step (i) Plot a load duration curve. Collect chronological load data (typically in MW) for each hour of the year y, and sort the load data from the highest to the lowest MW level. Plot MW against 8760 hours in the year, in descending order.

Step (ii) Collect electricity generation data from each power plant/unit. Calculate the total annual generation (in MWh) from low-cost/must-run power plants/units (i.e. Σk EGk,y).

Step (iii) Fill the load duration curve. Plot a horizontal line across the load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from lowcost/ must-run power plants/units (i.e. Σk EGk,y).

Step (iv) Determine the .Number of hours for which low-cost/must-run sources are on the margin in year y. First, locate the intersection of the horizontal line plotted in Step (iii) and the load duration curve plotted in Step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and λy is equal to zero. In determining λy only grid power units (and no off-grid power plants) should be considered.

Step 5 - Calculate the build margin (BM) emission factor:

The build margin will be calculated using ex-ante option. The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units, *m*, during the most recent year, *y*, for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

EFgrid,BM,y = Build margin CO2 emission factor in year y (tCO2/MWh)
EGm,y = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
EFEL,m,y = CO2 emission factor of power unit m in year y (tCO2/MWh)
m = Power units included in the build margin
y = Most recent historical year for which electricity generation data is available

To calculate the emission factor for each plant, the following formula can be used (Step 4 Option A2):

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}}$$

Where:

EFEL,m,y = CO2 emission factor of power unit m in year y (tCO2/MWh)
EFCO2,m,i,y = Average CO2 emission factor of fuel type i used in power unit m in year y (tCO2/GJ)
ηm,y = Average net energy conversion efficiency of power unit m in year y (ratio)
m = All power units serving the grid in year y except low-cost/must-run power units
y = The relevant year as per the data vintage chosen in Step 3

The sample group *m* will be determined as per the procedure in the "Tool to calculate the emission factor for an electricity system v.03.0.0".

Step 6: Calculate the combined margin emission factor:

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

For the calculation of the CM in the CPA option (a) Weighted average CM will be used as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh) .
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh.)
w_{OM} = Weighting of operating margin emissions factor (%).
w_{BM} = Weighting of build margin emissions factor (%).

As the CPAs will be solar PV power plants, the value applied for w_{OM} is 0.75 and w_{BM} is 0.25.

Leakage

According to the applicable methodology, leakage emissions may arise due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport) but are negligible. No leakage emissions are considered.

$L_y = 0$.

B.6.2. Data and parameters that are to be reported ex-ante
(Copy this table for each data and parameter.)

Here are presented parameters for both the SING and the SIC. Note that each CPA will need to report a subset of these parameters depending on the grid (SIC or SING), in which the electricity is injected.

Data / Parameter	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$
Unit	MWH
Description	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h* in three years prior to project
Source of data used	CDEC-SING[26] and CDEC-SIC[27]
Value applied	Varies
Choice of data or measurement methods and procedures	Tool to calculate the emission factor for an electricity system.
Purpose of data	Used to calculate the emissions factor of the grid. Used in Option where project developers calculate the operating and build margin on an ex-ante basis (ie: where data is collected three years prior to the project beginning). .
Additional comment	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$ are required for the SIC, while just EG_y is required for the SING

Data / Parameter	$FC_{i,m,y}$, $FC_{i,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* (or in the project electricity system in case of $FC_{i,y}$) in three years prior to project
Source of data used	CDEC-SING[28]and CDEC-SIC[29]
Value applied	Varies
Choice of data or measurement methods and procedures	Tool to calculate the emission factor for an electricity system.
Purpose of data	Used to calculate the emissions factor of the grid. Used in Option where project developers calculate the operating and build margin on an ex-ante basis (ie: where data is collected three years prior to the project beginning). .
Additional comment	Required for both the SIC and SING

Data / Parameter	$NCVi,y$
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type *i* in three years prior to project
Source of data used	(c) use of regional or national defaults available in the National Energy Balances[30]
Value applied	Varies
Choice of data or	Tool to calculate the emission factor for an electricity system.

[26] http://cdec2.cdec-sing.cl/pls/portal/CDEC.MENU_GENE_ENERGIA.SHOW
[27] https://www.cdec-sic.cl/index_en.php
[28] http://cdec2.cdec-sing.cl/pls/portal/CDEC.MENU_COSU_TEORICO_COMB.show
[29] https://www.cdec-sic.cl/index_en.php
[30] http://antiguo.minenergia.cl/minwww/opencms/14_portal_informacion/06_Estadisticas/Balances_Energ.html

measurement methods and procedures	
Purpose of data	Used to calculate the emissions factor of the grid. Used in Option where project developers calculate the operating and build margin on an ex-ante basis (ie: where data is collected three years prior to the project beginning).
Additional comment	Required for both the SIC and SING

Data / Parameter	***EFCO2,i,y , EFCO2,m,i,y***
Unit	tCO2/TJ
Description	CO2 emission factor of fossil fuel type *i* used in power unit *m* in three years prior to project.
Source of data used	(d) IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value applied	Varies
Choice of data or measurement methods and procedures	Tool to calculate the emission factor for an electricity system.
Purpose of data	Used to calculate the emissions factor of the grid. Used in Option where project developers calculate the operating and build margin on an ex-ante basis (ie: where data is collected three years prior to the project beginning).
Additional comment	***EFCO2,m,i,y*** required for the SIC and ***EFCO2,i,y required for*** SING

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net energy conversion efficiency of power unit *m* of the set of power plants considered in the BM in year *y*
Source of data used	Default values provided in Annex 1 of "Tool to calculate the emission factor of an electricity system"
Value applied	Varies
Choice of data or measurement methods and procedures	Tool to calculate the emission factor for an electricity system.
Purpose of data	Used to calculate the emission factor of a power unit (EFEL,m,y), based on the conversion efficiency. This is required of the calculation of the BM for both the SIC and SING and the EFgrid,OM-adj,y for the SIC
Additional comment	In order to establish which kind of technology corresponds to a certain power plant, the project description of the power plant will be consulted. The project description is usually available in the environmental service[31]

Data / Parameter	Λ_y
Unit	-
Description	Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y
Source of data used	
Value applied	Varies
Choice of data or	Tool to calculate the emission factor for an electricity system.

[31] http://www.sea.gob.cl/

measurement methods and procedures	
Purpose of data	Used to calculate the EFgrid,OM-adj,y for the CPA's in the SIC
Additional comment	Required for the SIC

Data / Parameter	**CM, BM, OM**
Unit	-
Description	Combined margin, build margin & operating margin emission factor
Source of data used	Calculation using previous data
Value applied	Varies
Choice of data or measurement methods and procedures	
Purpose of data	Used to calculate the CERs from the project
Additional comment	

B.6.3. Ex-ante calculations of emission reductions

Project emissions: According to the methodology, project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(3)}$$

Where:

PE_y = Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

However, for all projects coming under this PoA, there will be no fossil fuel consumption. And because hydropower and geothermal plants are not considered under this PoA, these project emissions do not have to be considered. Thus, PE = 0.

Baseline Emissions: According to the methodology, baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y,}$$

Where:

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(4)}$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)

BE_y = Baseline emissions in year *y* (t CO_2/yr)

PE_y = Project emissions in year *y* (t CO_2e/yr)

As established before $PE_y = 0$, therefore:

$ER_y = BE_y = EG_{facility,y} . EF_{grid,CM,y}$

B.7. Application of the monitoring methodology and description of the monitoring plan

B.7.1. Data and parameters to be monitored by each generic CPA

(Copy this table for each data and parameter).

Data/Parameter	$EG_{facility,y}$
Unit	MWh
Description	Quantity of net electricity generation supplied by the solar PV project plant to the grid in year *y*
Source of data	Project activity site
Value(s) applied	Varies
Measurement methods and procedures	Continuous measurement and at least monthly recording
Monitoring Frequency	Continuous
QA/QC procedures to be applied	Cross check measurement results with records for sold electricity (Invoice).
Purpose of data	To determine emission reductions
Additional comment	

B.7.2. Description of the monitoring plan for a generic CPA

The authority and responsibility of project management will be at CPA level. CPA implementers will be the direct operators of the solar PV generating facility, and will maintain the equipment, as well as monitor and meter the output. The CME will ensure that all aspects of the methodology and UNFCCC guidelines are followed, so verification reports are completed and issued in a timely fashion. The CME, for example, will calculate and determine the emissions factor of the grid, using data from CDEC or other relevant authority and ensure this data is collected in exact accordance with the *Tool to calculate the emissions factor for an electricity system*.

The CPA PDD will contain the following information:

1. Monitoring Period: The monitoring period starts from the date of commissioning of the first activity under the CPA or the date of registration of the proposed CPA under the PoA (whichever occurs last).

2. Monitoring management structure: In order to obtain effective monitored data, the CPA operator will identify the responsible persons for monitoring, data collection and archiving on site. The management structure will be presented in the CPA PDD. The main data for calculating emission reductions of the project activity is the net electricity supplied to grid by the PV plant in year y monitored by electricity meters. The data of for electricity generated may be crosschecked against the relevant monthly electricity sale receipts (and purchases) and/or records from the grid.

3. Calibration of Meters: The calibration frequency is at least once a year or as specified by the equipment supplier.

4. Metering: The CPA operator will be responsible to meter the following monitoring the quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*. The main meter of the power plant will be located at the interconnection point, where the electricity is injected to the grid.In case it fails the grid operator will be contacted. The grid operator can estimate the amount of electricity injected to the grid precisely by readings of other meters of the system and balance estimations.

5. Data collection: Data will be collected by each CPA operator on site. The data will be entered into an excel spreadsheet for which the template will be provided to the CPA operator. The information from the excel spreadsheet will be transferred into the database on a monthly basis. The CPA operator will collect the relevant evidences for power delivered to the grid by the PV facility. The CME will conduct an audit on each CPA prior to each monitoring period to ensure that all the relevant data is collected and that the necessary support documentation is collected and stored adequately for verification purposes. All data for the CPA will be archived for a minimum period of 2 years after the end of the crediting period for the CPA. Finally, the CME will confirm that all persons that participate in the monitoring process will be suitably qualified and trained in the operation and maintenance of the CPA project

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Appendix 1: Contact information on entity/individual responsible for the PoA

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Appendix 2: Affirmation regarding public funding

No public funding will be used for this PoA

Appendix 3: Application of methodology(ies)

Appendix 4: Further background information on ex ante calculation of emission reductions

Appendix 5: Further background information on the monitoring plan

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, Annex 12).
01	EB33, Annex 41 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		