Project design document form for CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Use of biomass as an alternative fuel for the production of Calcium Oxide
Version number of the PDD	14
Completion date of the PDD	30/03/2015
Project participant(s)	Calidra de Occidente S. A. de C. V. Carbon Solutions de México S.A. de C.V.
Host Party	Mexico
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral scopes: Scope 1: Energy Industries (renewable/non renewable sources). Scope 4: Manufacturing industries. Selected methodology(ies): AM0036: Fuel switch from fossil fuels to biomass residues in heat generation equipment (version 4.0.0)."
Estimated amount of annual average GHG emission reductions	51,166

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Calidra de Occidente S. A. de C. V. produces high quality Calcium Oxide (CaO) in a high energy consumption process. Calidra de Occidente S. A. de C. V. seeks to integrate the use of renewable energies in the calcination stage of its process by using the energy from forestry and agroindustrial residues instead of the one from fossil fuels; as a result, there will be a greenhouse gases emission reduction from the combustion process.

This scheme will provide of energy certainty to the company, will boost the use of renewable energy sources and improve the rural economy of the region through the active participation of the different economic and social sectors involved.

The proposed project activity consists in the utilization of biomass residues (forestry residues and agroindustrial residues as agave bagasse, sugar cane bagasse and forage maize) with no current use as an alternative fuel for the heat generation equipment of the plant of Calidra de Occidente S. A. de C. V. in the production process of Calcium Oxide (CaO). With this project activity, the emission of a vast quantity of greenhouse gases product of the combustion of fossil fuels (petcoke with a minor percentage of fuel oil and diesel) will be avoided.

In synthesis, to reach the reduction of fossil fuels used at Calidra de Occidente S. A. de C. V. plant, the project developer will invest in new technology, promotion of new practices and developing new social arrangements to create job opportunities in waste collection activities.

Environmental and social benefits other than GHG emission reductions

In addition to lower GHG emissions, other environmental and social benefits would include:

- Decrease in the use of fossil fuels as energy sources and consequently reduction of the dependence on fossil fuels.
- Local economy is benefited due to the employment creation during the construction phase. Furthermore the project activity also will generate employment for the handling and transport implied by the use of forestry and agroindustrial residues in the CaO plant.
- Biomass, municipal and industrial waste suppliers participate and contribute to protecting the environment. This leads to the acquisition of an ecological culture that at the end will make them improve their products handling, storage and transportation systems.
- Additional income for the local biomass suppliers.
- The project activity enhances the waste management. The alternative fuels that are planned to be used in the project are normally sent to confinement, landfilled, dumped or left to decay or burnt in an uncontrolled manner without utilizing them for energy purposes; the project implementation would dispose these waste in a sustainable manner in the CaO plant and recover their energy content; in addition, it will likely encourage indirectly the development of waste management infrastructure.
- The project will be an illustrative example of sustainable development that can help develop a greater environmental conscience for both, the workforce of the plant and the local community.

A.2. Location of project activity

A.2.1. Host Party

>>
Mexico

A.2.2. Region/State/Province etc.

>>
Jalisco

A.2.3. City/Town/Community etc.

>>
Tecolotlán

A.2.4. Physical/Geographical location

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The project activity will be located within Calidra de Occidente S.A. de C.V. facilities with the following coordinates: 20.1954 and -103.9883 [1] (in geographical coordinates 20°11'43.52" N, 103°59'17.96" W).

Figure 1. Project Location.

[1] Coordinate based on the location of the kiln 1 (400 tpd) of the project activity.

A.3. Technologies and/or measures

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The Calidra de Occidente S. A. de C. V. CaO plant was bought in December of 2007 by Calidra Group (known before as plan Calteco), which is the parent company of Calidra de Occidente S. A. de C. V.

The scenario prior to the implementation of the proposed CDM project activity consisted in a CaO plant with an extraction capacity of 400 tph, a crushing capacity of 350 tph and three different calcinations areas:

- The first comprises 6 forced draught traditional kilns (2 of 90 tpd and 6 of 80 tpd)
- The second has 2 vertical kilns of 150 tpd each
- The third had only one Maerz kiln of 400 tpd (the one to be retrofitted as part of the project activity to be capable of using forestry and agroindustrial residues as fuels)

Historically only fossil fuels have been used to cover the energy requirements (pet coke, fuel oil and diesel).

The here proposed project activity includes two Maerz kilns: the existing 400 tpd (that started operations on December of 2009) to be retrofitted for the use of forestry and agroindustrial residues, and the new Maerz kiln of 600 tpd capacity (that started operations on April of 2012) bought with the option of using forestry and agroindustrial residues. These equipments are two-shaft PFR vertical kilns as the ones shown in the following figure.

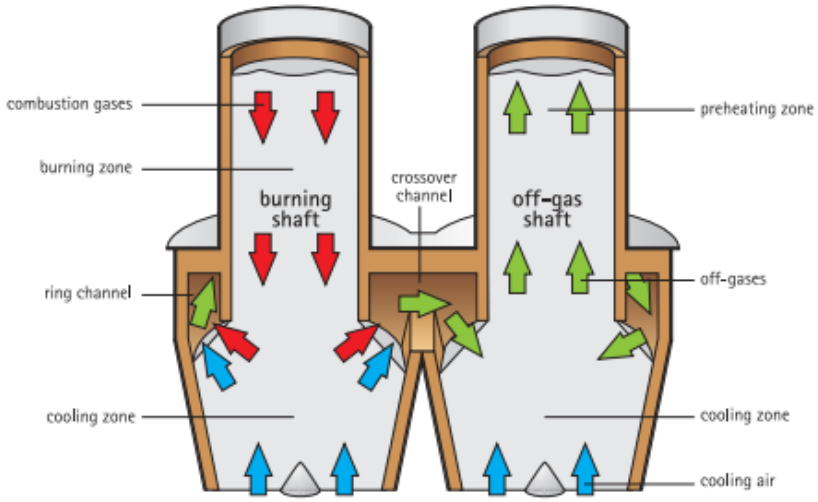

Figure 2. Two-shaft PFR Maerz lime kiln.

One shaft operates in the burning mode and simultaneously, the second shaft operates in the non-burning or exhaust mode. Each shaft spends an equal amount of time in both the burning and non-burning modes of operation. Each shaft cycles through the burning and non-burning mode at intervals of approximately 12 minutes. The changeover from burning to non-burning is called “reversal period”. During each reversal period a measured amount of stone is charged to the kiln. Calcined product is discharged from both shafts continuously throughout the burning cycle by discharge tables into a pressurised hopper. Cooling air is continuously introduced at the bottom of both shafts to reduce the temperature of the product prior to being discharged into the lime storage hopper. During reversal periods, when the kiln is depressurised, the product is discharged from the storage hopper onto vibrating feeders and conveyor belts.

PFR-Kilns have achieved efficiencies of 85% or higher. The typical heat consumption (based on the net calorific value of the fuel) is in the range of 3350 to 3600 kJ (800 to 860 kcal)/kg or 2.88 to 3.09 million Btu per ton of lime depending on chemical analysis and grain size of the stone and the

type of fuel. Electric energy consumption depends on the stone size, the fuel used and the kiln's elevation above sea level. Consumption figures range between 25 and 35 kWh/ton of product.

Fuel is supplied to only one of the two shafts. The fuel is introduced through multiple lance tubes that vertically extend to the bottom of the preheating zone. The lower end of the lance tubes marks the changeover to burning zone from the preheating zone. Fuel is injected through these lances and evenly distributed over the cross sectional area of the shaft. This lances feeding system is the one that is required for the kiln of 400 tpd as part of the retrofitting and is illustrated in the following figure.

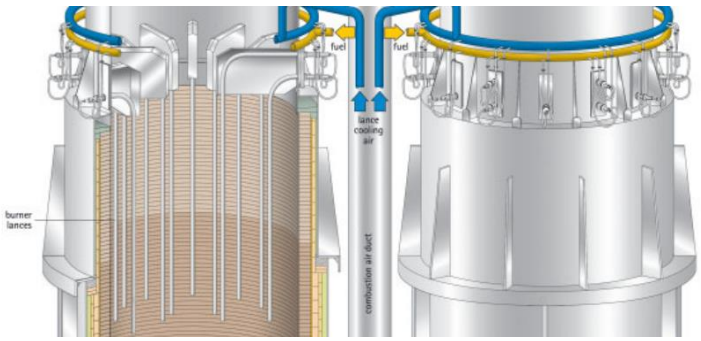

Figure 3. Lances fuel feeding system.

The operator interface system is programmed to provide the following information:

- Indication of system operating conditions in a process flow chart.
- Input/output of process data and measured values.
- Output of alarm messages
- Output of short term trends
- Storage of data on hard disk for long term trends
- Output of production reports
- Print function of all charts/graphs/pictures and reports.

All process parameters are calculated in a program module according to the input data. The kiln operator can for example make the following selections:

- Production rate.
- Amount of stone per cycle.
- Heat consumption.
- Excess combustion air factor.
- Cooling air volume.

The agave bagasse, residue from the production process of tequila, is one of the main agroindustrial residues considered for the project, but also forestry residues are considered. Currently, the agave bagasse of the region is commonly considered a waste and is usually sent to landfills where it decays aerobically and it usually represents a risk to the environment because of the possibility of self ignition (this represents the baseline, for further information refer to section B.4 and B.7).

The heat value and moisture are the main characteristics of the forestry and agroindustrial residues, in fact, the last one is fundamental due to its influence in the decrease of the heat value and the increase of the quantity of forestry and agroindustrial residues needed.

The specific requirements for the forestry and agroindustrial residues used in the Maerz kilns are the following:

- Moisture: < 8%
- Granulometry: 100% < 3mm y 85% < 1.5 mm

For the use of forestry and agroindustrial residues, the following pre treatment steps must be followed:

- Transportation: The agroindustry and forestry residues will be transported from the suppliers location to Calidra de Occidente S.A. de C.V.
- Discharge: A lift truck will discharge the biomass residues and place the bales in a conveyor so they can be wrecked.
- Drying: A drying system will be used to reduce the moisture of the biomass until specific conditions before being pulverized.
- Pulverization: The dried material will enter to the pulverization equipment just before entering to a storage silo to be used as a fuel in the kiln.
- Kiln injection: The dried and pulverized biomass residues will be used as an alternate fuel for the CaO production.

Specifically for the forestry residues the pre-treatment is slightly different. The chipped residues will be bought from the suppliers, taken into the CaO plant and placed into a hopper. After this point, the residues will be transported to a rotary dryer where its moisture can be reduced from levels of 30-50% to less than 8%. After dried, it gets storage in a silo to be pulverized in a mill and to be transported through a pneumatic system to a discharge silo that is connected to a weighting hopper and finally is pneumatically injected to the kiln to be used as a fuel.

In resume, among the most important equipments (mostly foreign technology), the following will be required for the storage, download, drying, grinding and transportation of the biomass residues considered for the project activity:

- Warehouse for the biomass residues (all biomass residues will be stored under aerobic conditions).
- Discharging hopper system.
- Reception hopper.
- Cover and winch.
- Conveyor belt.
- Drying system.
- Screw conveyor.
- Hammer mill.
- Blower.
- Pneumatic piping.
- Cyclone.
- Dust collector.
- Silo.

According to the *"Tool to determine the remaining lifetime of equipment"* version 01:

"The tool provides guidance to determine the remaining lifetime of baseline or project equipment. The tool may, for example, be used for project activities which involve the replacement of existing equipment with new equipment or which retrofit existing equipment as part of energy efficiency improvement activities."

"*Project participants may use one of the following options to determine the remaining lifetime of the equipment:*

a) Use manufacturer's information on the technical lifetime of equipment and compare to the date of first commissioning;
b) Obtain an expert evaluation;
c) *Use default values.*"

According to option a) of the latest paragraph, project participants may use manufacturer´s information on the technical lifetime of equipment and compare it to commissioning date. Supplier´s information suggests that the biomass residues feeding system can operate 20 years as minimum from commissioning date. Since the project activity has not started yet, the 20 year period will begin when this system starts operation.

Regarding the 400 tpd kiln to be retrofitted and which started operations in 2009, manufacturer´s information state that "*the firsts Maerz PFR-kilns were built more than 35 years ago and are still operating*"[2], which means that it will still have 30 years of remaining lifetime that will easily cover the lifetime of the project activity.

In relation with the new 600 tpd kiln commissioned in 2012 and taking into consideration the average lifetime of 35 years mentioned above for Maerz Kilns, this kiln will have a remaining lifetime of 32 years.

As it can be seen in the following figure, the energy and mass balance will only change by the inclusion of the biomass residues to be burn in the kilns as a consequence of the project activity and the reduction of fossil fuels to be used as fuel taking in consideration the one that would be used in the baseline (all of the variables added to the figure can be found in the section B.7.1 and will be monitored during the crediting period). The quantity of raw material per ton of CaO will remain the same as well as the CaO production rate and product quality.

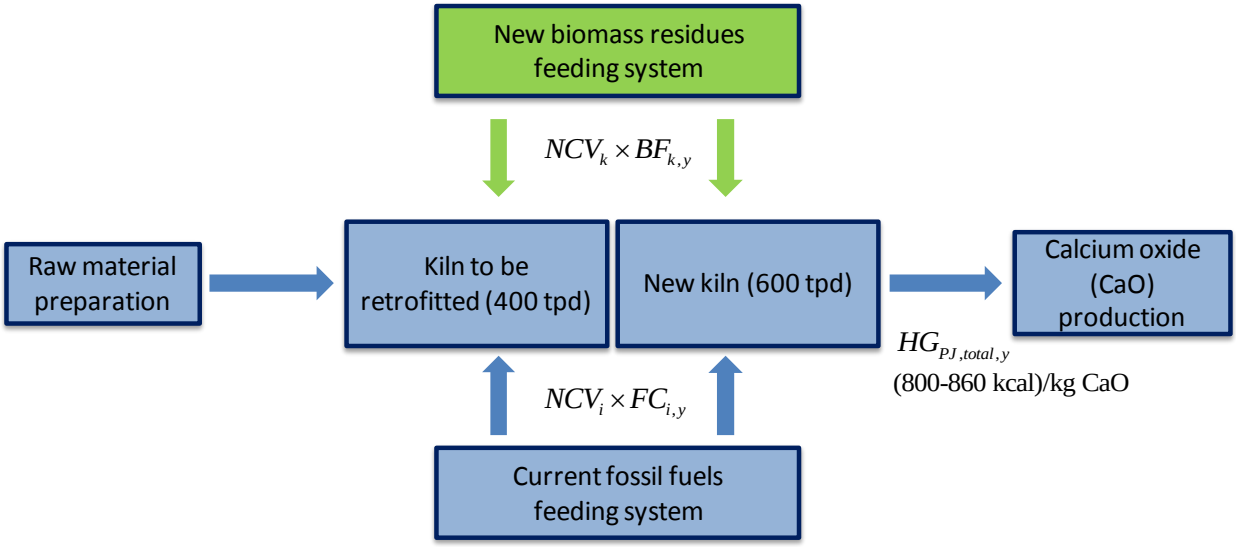

Figure 2. Addition of the biomass residues to be used as fuel to the energy and mass balance of the current CaO process.

Both, the kiln to be retrofitted and the new one are expected to maintain the same level of service (the same production rate and energy consumption). The CaO produced by Calidra de Occidente S. A. de C. V. must comply with strict quality standards and reach specific chemical characteristics to comply with the costumers requirement, being the main reason why the characteristics of the final product will remain invariable in relation to the current which will be defined in section B.4 as the baseline.

[2] Brochure of: "The MAERZ® Parallel Flow Regenerative Lime Kiln". Section 8, Page 17. Available at: http://www.maerz.com/downloads/downloads_brochures/pfr.pdf

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Mexico (host)	Calidra de Occidente S. A. de C. V. (Private entity) Carbon Solutions de México S. A. de C. V. (Private entity)	No

A.5. Public funding of project activity

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There is no public funding from parties included in Annex I involved in this project.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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- AM0036: "Fuel switch from fossil fuels to biomass residues in heat generation equipment" (Version 4.0.0, Valid from March 2nd onwards);
  http://cdm.unfccc.int/filestorage/7/3/V/73VOW05YXMRA21BQL89KTH6GUIEJNC/EB66_repan38_AM0036_ver4.0.0.pdf?t=dE18bTQ2OXZufDB-vEqyjLV7JMFQ5rXUPgW9

- "Tool for the demonstration and assessment of additionality" (Version 07.0.0, valid from 23 November 2012 onwards) ;
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

- "Emissions from solid waste disposal sites" (Version 06.0.1, valid from March 2nd 2012 onwards);
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf

- "Tool to calculate the emission factor for an electricity system" (Version 04.0.0, valid from October 4th 2013 onwards);
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

- "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02, valid from August 2nd 2008 onwards);
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

- "Tool to determine the baseline efficiency of thermal or electric energy generation systems" (Version 01, valid from July 28th of 2009 onwards);
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf

- "Tool to determine the remaining lifetime of equipment" (Version 01, valid from October 16th of 2009 onwards);
  https://docs.google.com/viewer?url=http%3A%2F%2Fcdm.unfccc.int%2Fmethodologies%2FPAmethodologies%2Ftools%2Fam-tool-10-v1.pdf

- "Project and leakage emissions from road transportation of freight" (version 1.1.0, valid from November 23rd 2012 onwards);
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf

- "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of a crediting period version" (Version 03.0.1, valid from March 2nd of 2012 onwards);
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

B.2. Applicability of methodology and standardized baseline

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The methodology is applicable to project activities that switch from use of fossil fuels to biomass residues in heat generation equipment.

The methodology is applicable to project activities described in the following table:

Scenario	Description
1	**Retrofit of existing heat generation equipment.** The project activity is the retrofit of existing heat generation equipment. The retrofit is made to the equipment to enable (a) the use of biomass residues or (b) an increase in the use of biomass residues beyond historical levels, which would not be technically possible in any of the existing heat generation equipment without a retrofit or replacement.
2	**Replacement of existing heat generation equipment.** The project activity involves the replacement of existing heat generation equipment by new heat generation equipment that fire(s) biomass residues and, where applicable, fossil fuels. The replacement shall (a) enable the use of biomass residues or (b) enable an increase in the use of biomass residues beyond historical levels, which would not be technically possible in any of the existing heat generation equipment without a retrofit or replacement.
3	**Installation of new heat generation equipment.** The project activity is to increase the heat generation capacity by installation of new heat generation equipment that fire(s) biomass residues and, where applicable. The use of biomass residues or an increase in the use of biomass residues beyond historical levels would not be technically possible without a retrofit or replacement of the existing heat generation equipment or the installation of new heat generation equipment. The procedure to determine the most plausible baseline scenario results in that the same fossil fuel type(s) as used in the existing heat generation equipment would be used in the new heat generation equipment in the absence of the CDM project activity.
4	**Installation of new heat generation equipment and retrofit and/or replacement of existing heat generation equipment.** The project activity involves: (a) An increase in the heat generation capacity by installation of new heat generation equipment that fire(s) biomass residues and, where applicable fossil fuels; and (b) The retrofit of existing heat generation equipment and/or the replacement of existing heat generation equipment by new heat generation equipment that fire(s) biomass residues and, where applicable fossil fuels. The use of biomass residues or an increase in the use of biomass residues beyond historical levels would not be technically possible without a retrofit or replacement of the existing heat generation equipment or the installation of new heat generation equipment. The procedure to determine the most plausible baseline scenario results in that the same fossil fuel type(s) as used in the existing heat generation equipment would be used in the new heat generation equipment in the absence of the CDM project activity.

Table 1. Project activities eligible for use of the methodology AM0036.

The proposed project activity qualifies for the 4th scenario due to the retrofitting of existing heat generation equipment and the installation of new equipment with the adequate technology to use biomass residues.

"The biomass residues used in the project activity may be produced on-site (e.g. if the project activity is based on the operation of a power plant located in an (agro-)industrial plant generating the biomass residues), or they can be obtained off-site from the nearby area, specific suppliers or purchased from a market".

In this case, the biomass residues are obtained from suppliers from the nearby area.

"The heat generated in the heat generation equipment is:

- *Not used for power generation; or*
- *If power is generated using the heat generated by the heat generation equipment, it is not increased as a result of the project activity, i.e.:*
  a) *The power generation capacity installed remains unchanged due to the implementation of the project activity and is maintained at the pre-project level throughout the crediting period; and*
  b) *The annual power generation during the crediting period is not more than 10% larger than the highest annual power generation in the most recent three years prior to the implementation of the project activity".*

The heat generated in the kilns included in this project activity is not and will not be used for power generation, since it will be transferred directly for the clinker manufacturing process.

"The use of biomass residues or increasing the use of biomass residues beyond historical levels is technically not possible at the project site without a significant capital investment in:

- *Either the retrofit or replacement of existing heat generation equipment or the installation of new heat generation equipment; or*
- *Establishing a new dedicated biomass supply chain for the purpose of the project activity (e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes).*

As will be reviewed in step 2 of section B.5, a significant capital investment is required for the retrofit of the 400 tpd kiln, the acquisition of a new 600 tpd kiln capable of using forestry and agroindustrial residues and for the acquisition of the biomass residues conditioning equipment needed for it to be used as fuel.

"Existing heat generation equipment at the project site has either not used any biomass or has used only biomass residues (but no other type of biomass) for heat generation during the most recent three years prior to the implementation of the project activity".

Neither biomass nor biomass residues have been used in the existing heat generation equipment during the most recent three year period prior to the implementation of the project activity.

"No biomass types other than biomass residues, as defined above, are used in the heat generation equipment during the crediting period. Fossil fuels may be co-fired in the heat generation equipment, however the amount of fossil fuels co-fired shall not exceed 50% of the total fuel fired on an energy basis. Refuse Derived Fuel (RDF) and Refuse Plastic Fuel (RPF) can also be co-fired in the equipment, but for the purpose of this methodology they shall be considered as fossil fuels."

The project activity has been developed considering a substitution of fossil fuels with biomass residues a range from 50% to 70% on energy basis (60% has been chosen as the average expected value for the whole crediting period and is the one to be used for the analysis of the proposed project activity).

"For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g., sugar, rice, logs, etc.) or in other substantial changes (e.g., product change) in this process".

No substantial changes are expected to occur in the process derived from the use of biomass residues, neither in the processing capacity of raw input nor in the product's final specifications.

"The biomass residues used at the project site, i.e. the site where the project activity is implemented, are not be stored for more than one year".

The biomass residues stock estimate will be enough for only two months, therefore the biomass residues used by the project activity will never reach the one year limit mentioned by this applicability condition.

"No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g., esterification of waste oils) are not eligible under this methodology".

The biomass residues will not be affected significantly by any major process prior to combustion. The biomass residues will be transported by trucks to the project site. Both, energy use in the mechanical treatment and fossil fuel use in the transportation will be taken into account as project emissions.

"The biomass residues are directly generated at the project site or transported to the project site by trucks".

The forestry and agroindustrial residues will be transported to the project site by trucks.

In case of project activities that involve the replacement or retrofit of existing heat generation equipment, emission reductions may only be accounted until the time when the existing equipment would have reached the end of its technical time in the crediting period, i.e. after the point in time when the existing equipment would have to be replaced due to the expiry of its technical lifetime in the baseline scenario, emission reductions cannot be accounted. For the purpose of demonstrating this applicability condition, project participants should determine and document the remaining lifetime of each unit of the existing heat generation equipment in accordance with the "Tool to determine the remaining lifetime of equipment". In the case of several existing units with a different remaining lifetime, the shortest lifetime among the units should be used to determine the point in time until which CERs can be claimed.

For the current project activity, equipments will be needed as part of the forestry and agroindustrial residues feeding system, which has a lifetime of 20 years as minimum (refer to the section A.3). Additionally, the kilns included in the project activity have an operational lifetime of 35 years and taking into consideration the commissioning date of the oldest (the 400 tpd kiln), which is December of 2009, its remaining lifetime will be at least of 31 years. In conclusion, latest information allows the project to apply for the 7 years crediting period and the option to renew it twice.

"Furthermore, this methodology is only applicable if the most plausible baseline scenario(s):

- *For heat generation is either case H2 or case H5; and*
- *For the use of biomass residues is case B1, B2, B3, B4 and/or B5. If case B5 is the most plausible scenario, the methodology is only applicable if:*
  - *a) The plant where the biomass residues would be used as feedstock in the absence of the project activity can be clearly identified throughout the crediting periods;*
  - *b) The fuels used as substitutes for the biomass residues at that plant can be monitored by project participants."*

As it is mentioned for this condition, for the heat generation equipment the most plausible baseline scenario is H5, while for the use of forestry and agroindustrial residues the most plausible scenarios are B1 and B3 (further details in section B.4).

The applicability conditions outlined in the latest approved version of the tool "Emissions from solid waste disposal sites", in addition to the above listed applicability conditions, apply if:

- *CH4 emissions, from the treatment of biomass residues, in the baseline are included;*
- *Where case B2 is identified as the most plausible baseline scenario for the use of biomass residues.*

For this project activity no CH4 emissions from the treatment of forestry and agroindustrial residues are taken into account and B2 is not the most plausible scenario.

In addition, the applicability conditions of all other tools apply.

The applicability conditions of all the tools mentioned in the methodology AM0036 version 04.0.0 are taken into account in the current project activity.

B.3. Project boundary

For determining GHG emissions of the project activity the following emissions sources are included:

- CO2 emissions from on-site fossil fuel and electricity consumption attributable to the project activity. This may include fossil fuels or electricity used for on-site transportation or preparation of the biomass residues, e.g. the operation of shredders or other processing equipment, but shall not include fossil fuels co-fired in the heat generation equipment;
- CO2 emissions from off-site transportation of forestry and agroindustrial residues that are combusted in the project activity.

For the purpose of determining the baseline of the proposed project activity, project participants include the following emission sources:

- CO2 emissions from fossil fuel fired for heat generation in the heat generation equipment that are displaced by heat generation with forestry and agroindustrial residues.

The spatial extent of the project boundary encompasses:

- The lime kilns.
- The equipment to be used for the pre treatment of the forestry and agroindustrial residues and for its feeding into the kilns:
    - Discharge hopper system
    - Reception hopper
    - Cover and winch
    - Conveyor belt
    - Magnet
    - Drying system
    - Screw conveyor
    - Refiner mill
    - Blowers
    - Pneumatic piping
    - Cyclon
    - Dust collector
    - Silo
    - Biomass injection system.
    - Piping for biomass injection through spears;

- The vehicles used for transportation of forestry and agroindustrial residues to the project site;

The methodology states that "*Where the most likely baseline scenario for the use of the biomass residues is that the biomass residues would be dumped or left to decay under aerobic or anaerobic conditions (cases B1 or B2) or would be burnt in an uncontrolled manner without utilizing it for energy purposes (case B3), project participants may decide whether to include CH4 emissions from the treatment of biomass residues in the baseline and from combustion of biomass residues*

in the heat generation equipment in the project boundary", additionally states that the *"project participants shall either include CH4 emissions for both project and baseline emissions or exclude them in both cases, and document their choice in the CDM-PDD"*, for this case the project participants have decided to exclude them in both cases.

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Fossil fuel combustion for heat generation	CO_2	Yes	Important emission source.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of the biomass residues	CO_2	No	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	Project participants decided to exclude this emission source as well as the CH4 emissions from combustion of biomass residues for heat generation in the project scenario for simplification in calculation.
		N_2O	No	Excluded for simplification. This is conservative.
Project scenario	On-site fossil fuel and electricity consumption	CO_2	Yes	Important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Off-site transportation of biomass residues	CO_2	Yes	Important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Combustion of biomass residues for heat generation	CO_2	No	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	No	This emission source will be excluded as well as the CH4 emissions from uncontrolled burning or decay of the biomass residues in the baseline scenario for simplification in calculation.
		N_2O	No	Excluded for simplification. This emission source is assumed to be small.
	Biomass storage	CO_2	No	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	No	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small.
		N_2O	No	Excluded for simplification. This emissions source is assumed to be very small.

Table 2. Baseline and project activity boundaries.

For this project activity the spatial extent of the project boundary encompasses:

- The heat generation equipment and related equipment at the project site (which has been described above);
- The means for transportation of forestry and agroindustrial residues to the project site (e.g. vehicles);

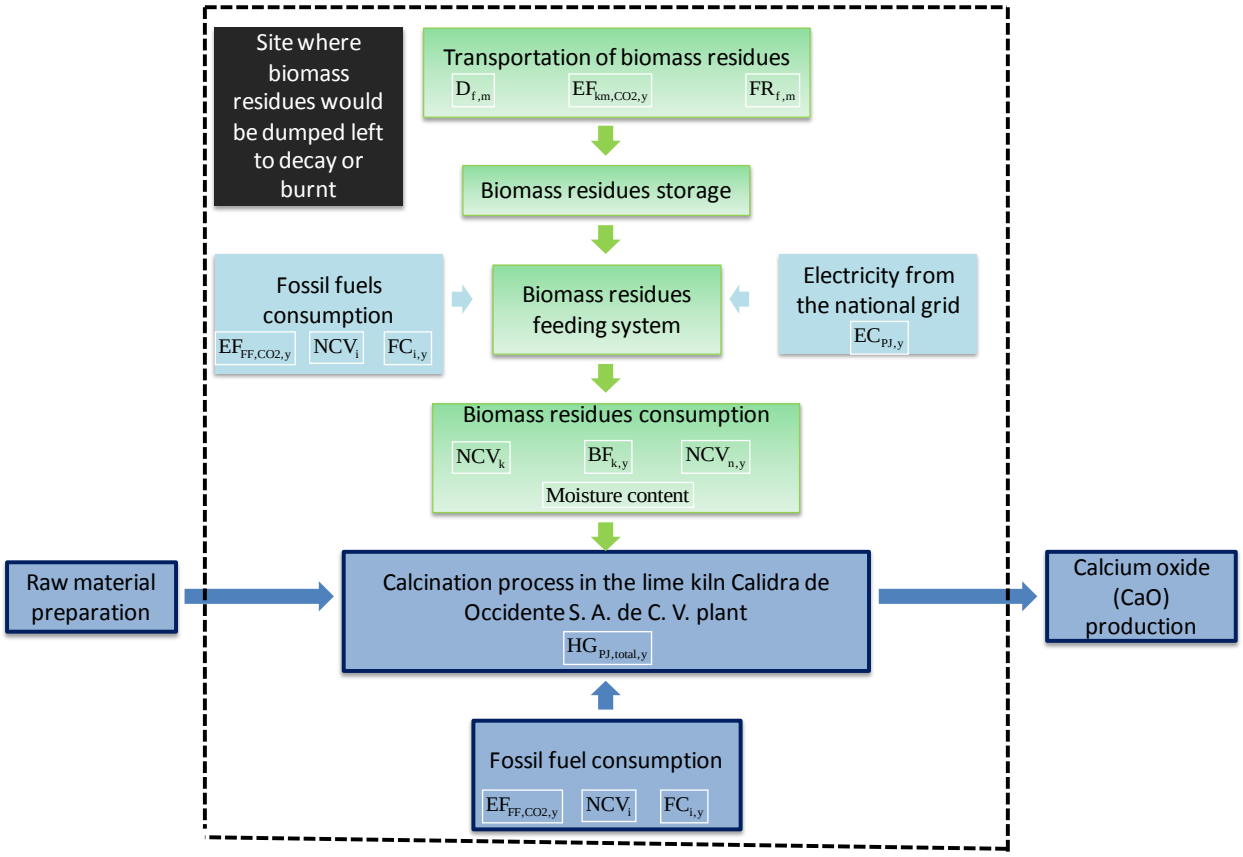

Figure 3. Flow diagram of the boundaries of the project activity.

B.4. Establishment and description of baseline scenario

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As mentioned by the methodology AM0036 version 04.0.0, for the identification of the most plausible baseline scenario, project participants shall use the following step-wise procedure:

Step1: Identification of alternative scenarios to the proposed CDM project activity that is consistent with current laws and regulations

The alternatives to be analyzed for heat generation include:

H1: The proposed project activity not undertaken as a CDM project activity (heat generation with biomass residues).

H2: Continued operation of the existing heat generation equipment using the same fuel mix or less biomass residues as in the past.

H3: Continued operation of the existing unit(s) using a different fuel (mix).

H4: Improvement of the performance of the existing heat generation equipment.

H5: Continued operation of the existing unit(s) using the same fuel mix or less biomass residues as in the past AND installation of new heat generation equipment that is/are fired with the same fuel type(s) and the same fuel mix (or a lower share of biomass) as the existing equipment.

H6: Replacement of the existing heat generation equipment with new heat generation equipment.

The alternatives to be analyzed for the use of forestry residues include:

B1: The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.

B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields;

B3: The biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes;
B4: The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation);
B5: The biomass residues are used as feedstock in a process (e.g., in the pulp and paper industry);
B6: The biomass residues are used as fertilizer;
B7: The proposed project activity not undertaken as a CDM project activity (use of the biomass residues for heat generation);
B8: Any other use of the biomass residues.

The alternatives to be analyzed for the use of agroindustrial residues include:

B1: The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.
B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields;
B3: The biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes;
B4: The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation);
B5: The biomass residues are used as feedstock in a process (e.g., in the pulp and paper industry);
B6: The biomass residues are used as fertilizer;
B7: The proposed project activity not undertaken as a CDM project activity (use of the biomass residues for heat generation);
B8: Any other use of the biomass residues.

Remarks:

- No biomass or biomass residues have been used in the most recent three year period.
- The most plausible baseline scenario will be determined separately for each type of biomass residues (forestry residues and agroindustrial residues).

The analysis of the plausible alternative scenarios to the proposed project activity are the following:

For heat generation:

Alternative	Plausible?	Justification/Explanation
H1	Yes	This alternative is technically plausible, since it corresponds to the project activity, nevertheless, further ahead (section B.5) will be proved that the incentives of the CDM are required for the project activity's financial feasibility, being then additional.
H2	No	The installation of the new kiln responds to a demand increase and in case that the project activity were not implemented the only possible scenario would be the continuation of fossil fuels utilization as it has been done with the other kilns in the plant and as described in alternative H5.
H3	No	Switching from one fossil fuel to another would not lead to significant emission reductions.
H4	No	The current heat generation equipments have received proper maintenance and run according to supplier´s specifications at its maximum efficiency.
H5	Yes	This alternative corresponds to the baseline

		scenario due to the following: - In the absence of the project activity, the fuels that would be consumed by both kilns (the 400 tpd maerz kiln and the new 600 tpd maerz kiln) would be the same fossil fuels use in the past in the plant (petcoke, fuel oil and diesel), with no use of biomass residues. - No current national regulation requires a change in the fuel mix used in the plant in the past, being allowed to keep the consumption of the same fossil fuel mix. - The common practice in Calcium Oxide production plants in Mexico, as the one of the project activity, does not use biomass residues nowadays, using exclusively fossil fuels.
H6	No	The substitution of the current equipments would imply an unnecessary effort in comparison of what is demanded by the project activity, which only requires the retrofit of the current installed kiln instead of the replacement of the whole equipment.

For the use of forestry residues:

Alternative	Plausible?	Justification/Explanation
B1	Yes	These residues are either burnt in an uncontrolled manner or left to decay in aerobic conditions.
B2	No	These residues are either burnt in an uncontrolled manner or left to decay in aerobic conditions.
B3	Yes	These residues are either burnt in an uncontrolled manner or left to decay in aerobic conditions.
B4	No	There is no current use for these residues, as it is further analyzed in the leakage section.
B5	No	There is no current use for these residues, as it is further analyzed in the leakage section.
B6	No	These residues are burnt in an uncontrolled manner. Also, it is not used as a fertilizer due to the extra machinery required.
B7	Yes	This alternative is technically plausible, since it corresponds to the project activity, nevertheless, further ahead (section B.5) will be proved that the incentives of the CDM are required for the project activity's financial feasibility, being then additional.
B8	No	These residues are burnt in an uncontrolled manner.

For the use of agroindustrial residues:

Alternative	Plausible?	Justification/Explanation
B1	Yes	These residues are abandoned in open air spaces and left to decay.
B2	No	These residues are abandoned in open air spaces and left to decay, then no anaerobic conditions are reach.
B3	Yes	These residues are burnt in an uncontrolled manner.
B4	No	There is no current use for these residues, as it is further analyzed in the leakage section.
B5	No	There is no current use for these residues, as it is further analyzed in the leakage section.

B6	No	These residues are abandoned in open air spaces and left to decay.
B7	Yes	This alternative is technically plausible, since it corresponds to the project activity, nevertheless, further ahead (section B.5) will be proved that the incentives of the CDM are required for the project activity's financial feasibility, being then additional.
B8	No	These residues are abandoned in open air spaces and left to decay or burnt in an uncontrolled manner.

According to the methodology: *"The alternatives to the project activity shall be in compliance with all applicable legal and regulatory requirements..."*

Also mentions that: *"if an alternative does not comply with all applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that noncompliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration"*.

The remaining alternatives to the project activity (H1 and H5) that have not been discarded for heat generation comply with the national and local applicable legislation and regulations since corresponds to the practice conducted nowadays by Calidra de Occidente S. A. de C. V. The alternative H5 is the unique financially feasible remaining alternative, being why it corresponds to the baseline for the emissions reduction calculation. The applicable regulations refer to the Climate change and Environmental Protection General Law (LGEEPA), specifically to the articles 109 BIS 1 and 111 BIS. These articles state the following:

109 BIS 1: The Ministry (SEMARNAT) will have to establish the mechanisms and procedures required with the purpose that the interested entities conduct a unique process, in those cases in which for the operation and function of industrial, commercial or services facilities is required to obtain different permits, licenses or authorizations that should be given by the same authority.

111 BIS: For the operation and function of stationary sources of federal jurisdiction that emit or can emit bad odors, gases or solid or liquid particles to the atmosphere, it will be required the authorization of the Ministry (SEMARNAT).

For the objectives of this law, it will be considered as stationary sources of federal jurisdiction, the chemical, oil and petrochemical, of paint and ink, car, pulp and paper, metallurgical, glass, electric energy generation, asbestos, cement and lime and hazardous materials industries.

The regulation to this effect issued will determine the specific subsectors that belong to each one of the industries listed above, which establishment will be subject to the provisions of the federal legislation regarding to the pollutant emissions to the atmosphere.

Currently, Calidra de Occidente S. A. de C: V. has the Unique Environmental Licence require from SEMARNAT to comply with the LGEEPA. Latest has been issued in January 17th of 2012 through the document N° SGPARN 014.02.02.079/2012 and with the environmental registration number COC741408811. Since the project activity has not yet been implemented, the update of the Unique Environmental Licence has not been finished and is expected to be obtained at the beginning of 2015.

On the other hand, the remaining financially feasible alternatives that include the use of forestry and agroindustrial residues (B1and B3) also comply with the national and local applicable

legislation and regulations since they correspond to the current project practice in the region. The same regulation (LGEEPA) states the following:

- Hazardous material: Elements, substances, compounds, residues or mixes of the latest that, independently of its physical state, represents an environmental, health or natural resources risk due to its corrosive, reactive, explosive, toxic, inflammable or biological infectious characteristics.
- Hazardous residues: All the residues, in any physical state, that due to its corrosive, reactive, explosive, toxic, inflammable or biological infectious characteristics, represent a danger for the ecologic or environmental balance.

Since the forestry and agroindustrial residues included in the project activity do not qualify as hazardous materials or residues, additional permits are not required.

Since the starting date of the project has been established in March 18th of 2011 the 2008-2010 period has been chosen as the most recent three years period applicable for the analysis of the historical data for determining the baseline emissions and estimate the emissions reduction calculation. All of the information regarding production, fuel consumption and the rest of the parameters considered ex-ante correspond to the period mentioned above.

Outcome of step 1:

Since scenarios H1 for heat generation and B7 for the use of forestry and agroindustrial residues correspond to the project scenario, the remaining plausible alternative scenarios to the project activity are the H5 for heat generation and scenarios B1 and B3 for the use of forestry and agroindustrial residues.

Step 2: Barrier analysis to eliminate alternatives to the project activity that face prohibitive barriers

The barrier analysis will not be conducted since the investment analysis has been chosen as the appropriate method to prove the additionality of this project activity. Please refer to section B.5.

B.5. Demonstration of additionality

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Timeline of events of the project

New kiln related activities

Date	Event	Support/Reference
20/10/2010	Turnkey project quotation (management decision date evidence).	Copy of the quotation.
18/03/2011	Signature of the contract for the foundation's construction for the 600 tpd kiln. Starting date of the project activity.	Copy of the contract.
27/07/2011	The Prior CDM consideration form was sent to the UNFCCC secretariat.	Copy of the e-mail
27/07/2011	The Prior CDM Consideration Form was sent to the Mexican DNA (SEMARNAT, Ministry of Environment and Natural Resources).	Copy of the e-mail.
27/07/2011	Mexican DNA confirmation of reception of the Prior CDM Consideration Form.	Copy of the e-mail.
17/08/2011	UNFCCC Secretariat confirmation of the reception of the Prior CDM Consideration Form.	Copy of the e-mail.
20/09/2011	Biomass residues availability studies are carried out and the corresponding report is obtained.	Copy of the report.
30/04/2012	Date of issuance of the Letter of Approval by the host country.	Copy of the Letter of Approval.
April of 2012	Commissioning date of the kiln.	Letter from the supplier (Maerz).

Retrofit activities

Date	Event	Support/Reference
20/10/2010	Turnkey project quotation (management decision date evidence).	Copy of the quotation.
27/07/2011	The Prior CDM consideration form was sent to the UNFCCC secretariat.	Copy of the e-mail
27/07/2011	The Prior CDM Consideration Form was sent to the Mexican DNA (SEMARNAT, Ministry of Environment and Natural Resources).	Copy of the e-mail.
27/07/2011	Mexican DNA confirmation of reception of the Prior CDM Consideration Form.	Copy of the e-mail.
17/08/2011	UNFCCC Secretariat confirmation of the reception of the Prior CDM Consideration Form.	Copy of the e-mail.
20/09/2011	Biomass residues availability studies are carried out and the corresponding report is obtained.	Copy of the report.
30/04/2012	Date of issuance of the Letter of Approval by the host country.	Copy of the Letter of Approval.
Pending	Purchase and installation of the burner (for the 400 tpd kiln) and the required transport system for the feeding of biomass residues.	Pending

The first installed Maerz kiln started operations on December of 2009 and is not capable of using biomass residues without the installation of the proper burner and the required transport system for the feeding of biomass residues. On the other hand, the second kiln (new 600 tpd) has started on April 2012 and has been bought fully equipped to be able to consume biomass residues; nevertheless, it also requires the biomass pre-treatment equipment and the transport system included as part of this project activity. In absence of the project activity no biomass residue would be able to be consumed since no equipment for its pre-treatment, transport and feeding to the kilns could be installed, being why the same fuels would be used in the plant, more likely in the same proportion.

As can be verified in the latest timelines, the consideration of the CDM has been taken into account since the beginning of the development of the project activity, taking into consideration that the Prior CDM Consideration Form was sent within the timeframe stated in the procedures taking as a reference the earliest date at which either the implementation or construction or real action began, which is the signature of the contract for the foundation's construction for the 600 tpd kiln, being then selected as starting date of the project activity.

The proposed project has always considered the CDM incentives due to the financial barriers that the project faces (which will be demonstrated in the investment analysis).

Analysis of the additionality of the project

To demonstrate its additionality, the approved "Tool for demonstration and assessment of additionality" version 07.0.0 has been used, following all steps defined. These steps will demonstrate that the proposed project activity does not correspond to the baseline scenario.

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

This step serves for the demonstration of additionality by means of the first-of-its-kind.

If the proposed CDM project activity(ies) apply measure(s) that are listed in the definitions section above, the latest version of the "Guidelines on additionality of first-of-its-kind project activities" available on the UNFCCC website shall be applied to demonstrate that the project activity is the first-of-its-kind.

Project participants have decided not to prove the additionality of this project by means of the first of its kind since it requires the project to choose "a maximum of 10 years with no option of renewal" as stated in the section 5.c of the "Guidelines on additionality of first-of-its-kind project activities" version 02.0, which differs to the chosen crediting period of this proposed project activity, 7 years crediting period renewable twice. The project will prove its additionality by the investment analysis performed in step 2.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations.

For further details about the identification of alternative scenarios to the project activity, please refer to the outcome of step 1 within section B.4.

Sub-step 1a. Define alternatives to the project activity

The definition of alternative scenarios to the project activity has been made in the step 1 of the section B.4. and is continued in step 3 of this section. The remaining alternatives to the proposed project activity are the following:

For heat generation:

H5: Continued operation of the existing unit(s) using the same fuel mix or less biomass residues as in the past AND installation of new heat generation equipment that is/are fired with the same fuel type(s) and the same fuel mix (or a lower share of biomass) as the existing equipment.

For the use of forestry and agroindustrial residues:

B1: The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.

B3: The biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes;

The alternative H5 for heat generation and the alternatives B1 and B3 for the use of forestry and agroindustrial residues for heat generation do not require any extra investment, no retrofit would be performed, the same historical fuel mix would be used and no emission reductions would be produced whatsoever, being then the baseline of the project activity.

Sub-step 1b. Consistency with mandatory laws and regulations

As mentioned in section B.4, all of the identified alternatives for heat generation and forestry and agroindustrial residues are consistent with current laws and regulations.

Step 2. Investment analysis

As mentioned in section B.4, the investment analysis has been used as the mean to prove the additionality of the proposed project activity.

According with the guidance in Step 2 of the "Tool for the demonstration and assessment of additionality" version 07.0.0:

"Determine whether the proposed project activity is not:

a) The most economically or financially attractive; or

b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs)".

The "Guidelines on the assessment of investment analysis" version 05 available on the UNFCCC website has been taken into account at the moment of applying this step.

To conduct the investment analysis, the following sub-steps are followed:

Sub-step 2a. Determine appropriate analysis method.

It must be determined whether to apply simple cost analysis, investment comparison analysis or benchmark analysis. If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).

For this case, there are not additional incomes but savings due to the implementation of the project activity, then the Option I is discarded. Additionally, since no other alternative project was considered in addition to the proposed project activity, which means that the unique decision was to proceed or not with its implementation, the chosen investment analysis method was the benchmark analysis (Option III).

Sub-step 2b. Apply benchmark analysis.

Identify the financial/economic indicator, such as IRR, most suitable for the project type and decision context.

"When applying Option II or Option III, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer".

"Discount rates and benchmarks shall be derived from:

(a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data".

The "Guidelines on the assessment of investment analysis" version 05, defines 12.2% as a default value for the expected return on equity after taxes for Mexico and has been chosen as benchmark for comparison purposes against the IRR of the project in order to demonstrate its additionality.

Sub-step 2c. Calculation and comparison of financial indicators

The information considered in this investment analysis corresponds to the investments and expenses required for enabling both kilns (the 400 tpd and the new 600 tpd) for the use of forestry and agroindustrial residues, without which the historical fuel mix used in the plant would be the same for future years.

Relevant data considered for analysis are:

- Investment: 6,852,921.45 USD. [3]
- Exchange rate: 12.54 MXN/USD.[4]
- Exchange rate: 0.7269 EUR/USD.[5]
- Benchmark: 12.2%.[6]
- Price of CERs: 18.92 USD/CER.[7]
- Price of petcoke: 102.75 USD/ton
- Price of fuel oil: 361.10 USD/ton.
- Price of diesel: 0.71 USD/lt.
- Price of residues: 43.84 USD/ton.

[3] Turnkey project´s quotation.
[4] 2010 MXN to USD exchange rate from x-change rates web page: http://www.x-rates.com/.
[5] 2010 EUR to USD exchange rate from x-change rates web page: http://www.x-rates.com/.
[6] UNFCCC "Guidelines on the assessment of investment analysis" V.5, page 10.
[7] CER's price (October 2010).

- Transport costs: 7.97 USD/ton of biomass residue.
- Minimum operator's salary: 4.83 USD/day.
- Financing: 50% equity, 50% credit.

The equity IRRs with and without considering CERs revenues for the proposed project activity was the following:

Scenario	%
Equity IRR without CERs	NA
Equity IRR with CERs	3.27

Table 3. Economic results. [8]

The IRR calculations clearly show that the equity IRR of the project activity (NA) is below the chosen financial benchmark (12.2%), demonstrating that the net savings from the fossil fuels substitution with forestry and agroindustrial residues is not enough to justify and overcome the required investment.

The CER's income was considered for 21 years of project duration because of the CDM renewable credit period of 7 years selected; this assumption represents high risk due the uncertainty of the renovation of the Kyoto Protocol post 2012.

The result of the analysis shows that the equity IRR of the project without CDM incentives is clearly lower than the chosen benchmark. Considering the financial incentives of the CDM as a part of the investment analysis, the equity IRR is significantly improved.

This section allows us to conclude that the project considered as a CDM project activity, and the attendant benefits and incentives derived from CER´s revenues will help the project to overcome the financial hurdles described.

Sub-step 2d. Sensitivity Analysis

As an important part of the investment barrier, it is considered the sensibility analysis. In this sense, in the point 20 of the "Guidelines on the assessment of investment analysis" version 05 (EB 62) it is mentioned the following:

"Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude)".

In the point 21 it is also mentioned:

"As a general point of departure variations in the sensitivity analysis should be at least cover a range of 10%, unless this is not deemed appropriate in the context of the specific project circumstances".

To accomplish the latest requirements, the results of the sensibility analysis are the following:

[8] NA refers to "Not Available" this means that the spreadsheet program used for all calculations does not deliver an IRR value. This happens in some cases where the project is financially highly unattractive (or highly attractive), e.g. if the operating costs of the project are higher than those of the baseline option; in this case it is obvious that any initial investment cannot be recovered.

Parameter/Variation	-20%	-10%	+10%	+20%
Investment	NA	NA	NA	NA
Fossil fuels Price	NA	NA	NA	NA
Biomass Price	NA	NA	NA	NA
Project activity costs	NA	NA	NA	NA

Table 4. Sensitivity analysis results. [9]

The project is in accordance with the requirements of this step and it is demonstrated that the project activity is additional; this conclusion is supported by the following facts:

- The equity IRR without the CERs incentives (NA) is far from the benchmark (12.2%).
- In the sensitivity analysis can be seen that under no circumstance the project the project can even get closer to the benchmark because the cash flow for most of the years in most of the scenarios are negative, making impossible for the program to converge in one solution.

In addition to the sensibility analysis, a break-even analysis has been conducted in order to obtain the values of the variables listed above that allow the project to reach the benchmark, being then possible to check how difficult would it be to implement the project without the support of the CDM incentives. The results are the following:

Parameter	% of variation	Equity IRR
Investment	-219.87%	12.20%
Fossil fuels price	48.95%	12.20%
Forestry and agroindustrial residues price	-60.94%	12.20%
Project activity costs	-130.98%	12.20%

Table 5. Break-even analysis.

According to the latest results, the benchmark could only be reached under any of the following scenarios:

- If the investment decreases 219.87%, which results impossible since it represents that there should be an income instead of an expense for this concept.
- If the fossil fuels price increases 48.95%. Latest scenario is also impossible since it requires the rest of the variables to be kept constant, which results unlikely because this increase would also impact in the price of forestry and agroindustrial residues and other costs of the project as freight service from supplier´s site to the plant.
- If the forestry and agroindustrial residues price decreases 60.94%. This result unrealistic because this has been found as the best price available for biomass in the region for material that guarantees the minimum required quality so it can be used as fuel.
- If project activity costs decreases in almost 130.98%. This also results unrealistic since these costs have been determined based on expenses necessary for the project to be implemented every year, no unrealistic or additional costs to the necessary have been included whatsoever.

In synthesis, the development of the project activity without the CERs (which corresponded to the scenarios H1 for heat generation and B7 for forestry and agroindustrial residues as identified in

[9] NA refers to “Not Available” this means that the spreadsheet program used for all calculations does not deliver an IRR value. This happens in some cases where the project is financially highly unattractive (or highly attractive), e.g. if the operating costs of the project are higher than those of the baseline option; in this case it is obvious that any initial investment cannot be recovered.

step 1 of section B.4) does not result a financially feasible alternative. Based on the results of the investment analysis, it can be concluded that the project is additional.

Step 3. Barrier analysis

After performing the Investment Analysis, it was proved that the incentives of the CDM are required to overcome the financial hurdles faced by the project activity. Therefore, also the alternatives that imply the execution of the project activity without being registered as CDM (H1 for heat generation and B7 for the use of biomass for heat generation) have been discarded. Since the chosen method to prove the additionality of this project is the investment analysis, no barrier analysis has been performed.

Step 4. Common practice analysis

As stated in page 13 of the methodological "Tool for the demonstration and assessment of additionality" version 07.0.0: "*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). Identify and discuss the existing common practice through the following sub-steps. If the proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above proceed to Sub-step 4a; otherwise, proceed to Sub-step 4b*".

The current project activity applies for the following measure:

"*(i) Fuel and feedstock switch (example: switch from naphtha to natural gas for energy generation, or switch from limestone to gypsum in cement clinker production);*"

Then for the common practice analysis, the assessment on common practice will proceed according it sub-step 4a.

Sub-step 4a:The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above

The latest available version of the "Guidelines on common practice" will be applied (version 02.0).

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

The installed capacity of Calidra de Occidente S. A. de C. V. CaO plant is 1,180 tpd, which means that the applicable output range for this analysis goes from 590 tpd to 1,770 tpd.

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;

(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.

As per information obtained from the National Association of Lime Producers (ANFACAL), officially recognized organism in Mexico, the number of plants with an installed capacity within the applicable output range is 8. Nevertheless, all of the latest plants use fossil fuels as it is common practice in the country, none of them has officially recognized the use of biomass residues as alternative fuel and all of them produce goods with comparable quality as the proposed project plant. According to the latest it is possible to conclude that there are not similar projects as the proposed by Calidra de Occidente.

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 activity undergoing validation. Note their number Nall.

As stated above, none of the projects included in the step 2 are undergoing any stage of the registration process as CDM project activities, but do not qualify as similar project activities, then:

$$N_{all} = 0$$

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.

According to the outcome of step 2, where N_{all} is equal to zero, then:

$$N_{diff} = 0$$

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.

According to the results of previous steps:

$$F = 1 - \frac{N_{all}}{N_{diff}} = 1 - \frac{0}{0} = 1 - \text{Indeterminate} = \text{Indeterminate}$$

The proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and

(b) Nall-Ndiff is greater than 3.

The outcome from step 5 is that the parameter F is indeterminate, which is the mathematical result from the operation of 0 divided by 0, which in other words means that there are not similar projects to the one here proposed, and then it is not a common practice.

Sub-step 4b: The proposed CDM project activity(ies) does not apply any of the measures that are listed in the definitions section above

Since the project activity applied for the measure "*(i) Fuel and feedstock switch (example: switch from naphtha to natural gas for energy generation, or switch from limestone to gypsum in cement clinker production);*", sub-step 4b is not applicable for the common practice analysis of this project.

As outcome of step 4 can be concluded that the project activity is not a common practice. The project results to be additional according to the outcome of step 2 (Investment analysis).

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Emissions reductions will be calculated through approved methodology AM0036 version 04.0.0.

Baseline emissions

Baseline emissions include CO2 emissions from fossil fuel combustion in the heat generation equipment in the absence of the project activity and, if included in the project boundary, CH4 emissions from the treatment of biomass residues in the absence of the project activity:

$$BE_y = BE_{HG,y} + BE_{BF,y} \quad \textbf{(1)}$$

Where:

- BE_y = Baseline emissions during the year *y* (tCO_2e/yr)
- $BE_{HG,y}$ = Baseline emissions from fossil fuel combustion for heat generation in the heat generation equipment in year *y* (tCO_2/yr)
- $BE_{BF,y}$ = Baseline emissions due to uncontrolled burning or decay of the biomass residues in year *y* (tCO_2e/yr)

No CH4 emissions from the treatment of forestry and agroindustrial residues in the absence of the project activity will be taken into account for the current project activity.

(a) Baseline emissions from fossil fuel combustion for heat generation ($BE_{HG,y}$)

Baseline emissions from fossil fuel combustion in the heat generation equipment are determined by multiplying the heat generated with fossil fuels that are displaced by biomass residues with the CO2 emission factor of the least carbon-intensive fossil fuels that would be used in the absence of the project activity and by dividing by the average net efficiency of heat generation in the heat generation equipment, as follows:

$$BE_{HG,y} = \frac{HG_{PJ,biomass,y} \cdot EF_{FF,CO2,y}}{\eta_{heat,FF}} \quad \textbf{(2)}$$

Where:

- $BE_{HG,y}$ = Baseline emissions from fossil fuel combustion for heat generation in the heat generation equipment in year *y* (tCO_2e/yr)
- $HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of the project activity during the year *y* (GJ/yr)
- $EF_{FF,CO2,y}$ = CO_2 emission factor of the fossil fuel type displaced by biomass residues for the year *y* (tCO_2e/GJ)
- $\eta_{heat,FF}$ = Average net efficiency of the heat generation equipment if fired with fossil fuels in the baseline (ratio)

Determination of $EF_{FF,CO2,y}$

For the purpose of determining $EF_{FF,CO2,y}$, as a conservative approach, the least carbon intensive fuel type (the fuel type with the lowest CO2 emission factor per GJ) is used among the fossil types used in the heat generation equipment at the project site during the most recent three years prior to the implementation of the project activity and the fossil fuel types used in the heat generation equipment at the project site during the year *y*.

The average net efficiency of the heat generation equipment if fired with fossil fuels in the baseline is determined using the "Tool to determine the baseline efficiency of thermal or electric energy generation systems" version 01.

Determination of $HG_{PJ,biomass,y}$

The determination of $HG_{PJ,biomass,y}$ depends on whether only fossil fuels would be used for heat generation in the absence of the project activity (case A) or whether along with fossil fuels some biomass residues also would be used in the absence of the project activity (case B).

The guidance under case A should be followed if:

- No biomass has been used for heat generation at the project site during the most recent three years prior to the implementation of the project activity; and
- The most plausible baseline scenario is that heat would continue to be generated only with fossil fuels.

The guidance under case B should be followed if:

- Biomass residues have already been used in heat generation equipment for heat generation at the project site prior to the implementation of the project activity; and
- The most plausible baseline scenario is that heat would continue to be generated partly with fossil fuels and partly with biomass residues.

For the proposed project activity the case A applies.

Case A: No use of biomass for heat generation in the absence of the project activity

In this case, $HG_{PJ,biomass,y}$ corresponds to the total quantity of heat generated from firing biomass residues ($HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y}$).

$HG_{PJ,biomass,total,y}$ is determined based on the fraction of biomass residues that are used for heat generation in the heat generation equipment, taking into account all biomass residue types k and fossil fuel types i fired in the project heat generation equipment during a year y, as follows:

$$HG_{PJ,biomass,total,y} = HG_{PJ,total,y} \cdot \frac{\sum_k BF_{k,y} \cdot NCV_k}{\sum_k BF_{k,y} \cdot NCV_k + \sum_i FC_{i,y} \cdot NCV_i} \quad \textbf{(3)}$$

Where:

$HG_{PJ,biomass,total,y}$	=	Total heat generated from firing biomass residues in all heat generation equipment at the project site during the year *y* (GJ/yr)
$HG_{PJ,total,y}$	=	Total heat generated in the heat generation equipment at the project site, using both biomass residues and fossil fuels, during the year *y* (GJ/yr)
$BF_{k,y}$	=	Quantity of biomass residue type *k* fired in all units of heat generation equipment at the project site during the year *y* (tons of dry matter or liter)[10]
NCV_k	=	Net calorific value of the biomass residue type *k* (GJ/ton of dry matter or GJ/liter)
$FC_{i,y}$	=	Quantity of fossil fuel type *i* fired in all heat generation equipment at the project site during the year *y* (mass or volume unit)[11]

[10] Use tons of dry matter for solid biomass residues and litter for liquid biomass residues.

[11] Preferably use a mass unit for solid fuels and a volume unit for liquid and gaseous fuels.

NCV_i = Net calorific value of the fossil fuel type *i* (GJ/mass or volume unit)

(b) Baseline emissions due to uncontrolled burning or decay of the biomass residues

As in this case, where in the project boundary are included baseline emissions due to uncontrolled burning or decay of the biomass residues ($BE_{BF,y}$), it should be determined consistent with the most plausible baseline scenario for the use of the biomass residues, following the procedures for the respective baseline scenario, as outlined below. Where different baseline scenarios apply to different types or quantities of biomass residues, the procedures as outlined below should be applied respectively to the different quantities and types of biomass residues.

"For this purpose, determine for each biomass residue type k the quantity of biomass residue used for heat generation as a result of the project activity ($BF_{PJ,k,y}$) as follows:

- *If no biomass has been used for heat generation at the project site during the most recent three years prior to the implementation of the project activity and if the most plausible baseline scenario is that heat would continue to be generated only with fossil fuels, use $BF_{PJ,k,y} = BF_{k,y}$ for all biomass residue types k;*
- *If only one type of biomass residue k has been used for heat generation at the project site prior to the implementation of the project activity and if only this type of biomass residue is used during the year y after implementation of the project activity, use for $BF_{PJ,k,y}$ the product of the quantity of biomass residue type k fired in all heat generation equipment at the project site during the year y ($BF_{k,y}$) and the fraction of heat generated with biomass residues as a result of the project activity."*

In this case no biomass residues have been used whatsoever, then $BF_{PJ,k,y} = BF_{k,y}$.

Uncontrolled burning or aerobic decay of the biomass residues (cases B1 and B3)

If the most likely baseline scenario for the use of the biomass residues is either that the biomass residues would be dumped or left to decay under mainly aerobic conditions (B1) or burnt in an uncontrolled manner without utilizing them for energy purposes (B3), baseline emissions are calculated assuming, for both scenarios viz., natural decay and uncontrolled burning, that the biomass residues would be burnt in an uncontrolled manner.

Baseline emissions are calculated by multiplying the quantity of biomass residues that would not be used in the absence of the project activity with the net calorific value and an appropriate emission factor, as follows:

$$BE_{BF,y} = GWP_{CH4} \cdot \sum_k BF_{PJ,k,y} \cdot NCV_k \cdot EF_{burningCH4,k,y} \quad \textbf{(4)}$$

Where:

$BE_{BF,y}$ = Baseline emissions due to uncontrolled burning or decay of the biomass residues in year *y* (tCO_2e/yr)

GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

$BF_{PJ,k,y}$ = Quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or liter)[10]

NCV_k = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter or GJ/liter)

$EF_{burning,CH4,k,y}$ = CH_4 emission factor for uncontrolled burning of the biomass residue type *k* during the year *y* (tCH_4/GJ)

k = Types of biomass residues for which the identified baseline scenario is B1 or B3

"To determine the CH4 emission factor, project participants may undertake measurements or use referenced default values. In the absence of more accurate information, it is recommended to use 0.0027 t CH4 per ton of biomass as default value for the product of NCV_k and $EF_{burning,CH4,k,y}$[12]".

Even when for the proposed project activity B1 scenario can be applied, the project participants have decided not to take into account CH4 emissions due to uncontrolled burning, then $BE_{BF,y}$= 0.

Project emissions

Project emissions include CO2 emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity ($PE_{CO2,FF,y}$ and $PE_{CO2,EC,y}$), CO2 emissions from off-site transportation of biomass residues that are combusted in the heat generation equipment to the project site ($PE_{CO2,TR,y}$), and, if included in the project boundary, CH4 emissions from combustion of biomass residues for heat generation ($PE_{CH4,BF,y}$):

$$PE_y = PE_{CO2,FF,y} + PE_{CO2,EC,y} + PE_{CO2,TR,y} + GWP_{CH4} \cdot PE_{CH4,BF,y} \quad \textbf{(5)}$$

Where:

PE_y	=	Project emissions during the year *y* (tCO_2/yr)
$PE_{CO2,FF,y}$	=	CO_2 emissions from on-site fossil fuel combustion attributable to the project activity (tCO_2/yr)
$PE_{CO2,EC,y}$	=	CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr)
$PE_{CO2,TR,y}$	=	CO_2 emissions from off-site transportation of biomass residues to the project site (tCO_2/yr)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
$PE_{CH4,BF,y}$	=	CH_4 emissions from combustion of biomass residues in the heat generation equipment (tCH_4/yr)

(a) CO2 emissions from on-site fossil fuel combustion ($PE_{CO2,FF,y}$)

CO2 emissions from on-site fossil fuel combustion that is attributable to the project activity ($PE_{CO2,FF,y}$) are calculated in accordance with the latest approved version of the "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*". The parameter $PE_{CO2,FF,y}$ corresponds to $PE_{FC,j,y}$ in the tool, where *j* should include all processes of fuel combustion that are attributable to the project activity, such as for on-site transportation or treatment of the biomass residues. This should not include fossil fuels co-fired in the project heat generation equipment. For this project activity, CO2 emissions from on-site fossil fuel and electricity consumption attributable to the project activity does not include fossil fuels co-fired in the heat generation equipment as stated by the methodology AM0036.

CO2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO2 emission coefficient of those fuels, as follows:

$$PE_{CO2,FF,y} = \sum_i FC_{i,y} \times COEF_{i,y} \quad \textbf{(6)}$$

Where:

[12] 2006 IPCC Guidelines, Volume 4, Table 2.5, default value for agroindustrial residues.

$PE_{CO2,FF,y}$ = CO_2 emissions from on-site fossil fuel combustion attributable to the project activity (tCO_2/yr);

$FC_{i,y}$ = Is the quantity of fuel type *i* combusted during the year *y* (mass or volume unit/yr);

$COEF_{i,y}$ = Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)

i = Are the fuel types combusted in process *j* during the year *y*

For the current project activity, the project participants have chosen to calculate the CO_2 emission coefficient $COEF_{i,y}$ through the Option B of the "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*", represented by the following equation :

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \quad \textbf{(7)}$$

Where:

$COEF_{i,y}$ = Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit).

$NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit).

$EF_{CO2,i,y}$ = Is the weighted average CO2 emission factor of fuel type *i* in year *y* (tCO2/GJ).

i = Are the fuel types combusted in process *j* during the year *y*

(b) CO2 emissions from on-site electricity consumption ($PE_{CO2,EC,y}$)

CO2 emissions from on-site electricity consumption ($PE_{CO2,EC,y}$) are calculated by multiplying the electricity consumption by an appropriate grid emission factor, as follows:

$$PE_{CO2,EC,y} = EC_{PJ,y} \times EF_{grid,y} \quad \textbf{(8)}$$

Where:

$PE_{CO2,EC,y}$ = CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr)

$EC_{PJ,y}$ = On-site electricity consumption attributable to the project activity during the year *y* (MWh)

$EF_{grid,y}$ = CO_2 emission factor for electricity used from the grid (tCO_2/MWh)

The CO2 emission factor for electricity used from the grid ($EF_{grid,y}$) shall be determined in accordance with the "Tool to calculate the emission factor for an electricity system" version 04.0.0.

(c) CO2 emissions from transportation of biomass residues to the project site ($PE_{CO2,TR,y}$)

In cases where the biomass residues are not generated directly at the project site, project participants shall determine CO2 emissions resulting from transportation of the biomass residues to the project plant using the latest version of the tool "Project and leakage emissions from road transportation of freight". $PE_{TR,m}$ in the tool corresponds to the parameter $PE_{CO2,TR,y}$ in this methodology and the monitoring period m is one year.

According to the latest version of the tool "Project and leakage emissions from road transportation of freight": *"Project participants may use two options to determine project or leakage emissions from road transportation of freight: monitoring fuel consumption (Option A) or using conservative default values (Option B)".*

For this project activity the option B has been chosen in order to have a conservative approach and simplify calculations.

As stated in latest tool:

This option relies on conservative default emission factors to estimate project or leakage emissions from road transportation of freight. These default values are established for two vehicle classes: light vehicles and heavy vehicles.

Under this option, the following data shall be monitored separately for each freight transportation activity to estimate the emissions:

- *The quantity of freight transported ($FR_{f,m}$);*
- *The origin and destination of the freight transported and the road distance between the origin and*
- *the destination (Df,m); and*
- *The vehicle class used.*

Project or leakage emissions are determined as follows:

$$\left.\begin{matrix} PE_{TR,m} \\ LE_{TR,m} \end{matrix}\right\} = \sum_f D_{f,m}.FR_{f,m}.EF_{CO2,f}.10^{-6} \quad \textbf{(9)}$$

Where:

$PE_{TR,m}$	=	Project emissions from road transportation of freight monitoring period m (t CO2).
$LE_{TR,m}$	=	Leakage emissions from road transportation of freight monitoring period m (t CO2).
$D_{f,m}$	=	Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m (km).
$FR_{f,m}$	=	Total mass of freight transported in freight transportation activity f in monitoring period m (t).
$EF_{CO2,f}$	=	Default CO2 emission factor for freight transportation activity f (g CO2 / t km).
f	=	Freight transportation activities conducted in the project activity in monitoring period m.

The values of latest parameters can be found in section B.7.1., meanwhile CO2 emissions calculation from transportation of forestry and agroindustrial residues to the project site can be found in section B.6.3 along with the rest of project emissions and additional information regarding transportation can be found in Appendix 4.

(d) CH4 emissions from combustion of biomass residues in the heat generation equipment ($PE_{CH4,BF,y}$)

If this source has been included in the project boundary, emissions are calculated as follows:

$$\mathrm{PE_{CH4,BF,y}} = \mathrm{EF_{CH4,BF}} \cdot \sum_k \mathrm{BF_{PJ,k,y}} \cdot \mathrm{NCV_k} \quad \textbf{(10)}$$

Where:

$PE_{CH4,BF,y}$ = CH_4 emissions from combustion of biomass residues in the heat generation equipment (tCH_4/yr)

$EF_{CH4,BF}$ = CH_4 emission factor for the combustion of the biomass residues in the heat generation equipment (tCH_4/GJ)

$BF_{PJ,k,y}$ = Quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or litre)[10]

NCV_k = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter or GJ/litre)

For calculation simplification, project participants have decided not to include CH4 emissions due to burning or decay of forestry and agroindustrial residues for the baseline or due to combustion of forestry and agroindustrial residues for heat generation for the project activity.

Leakage

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as a result of the project activity. Changes in carbon stocks in the LULUCF sector are expected to be insignificant since this methodology is limited to biomass residues, as defined in the applicability conditions above.

The actual leakage emissions in each of these cases may differ significantly and depend on the specific situation of each project activity. For that reason, a simplified approach is used in this methodology: it is assumed that an equivalent amount of fossil fuels, on energy basis, would be used if biomass residues are diverted from other users, no matter what the use of biomass residues would be in the baseline scenario.

Therefore, for the categories of biomass residues whose baseline scenario has been identified as B4, B5, B6, B7 or B8, project participants shall calculate leakage emissions as follows:

$$LE_y = EF_{CO2,LE} \cdot \sum_k BF_{PJ,k,y} . NCV_k \quad \textbf{(11)}$$

Where:

LE_y = Leakage emissions in year y (tCO2/yr)

$EF_{CO2,LE}$ = CO2 emission factor of the most carbon intensive fossil fuel used in the country (tCO2/GJ)

$BF_{PJ,k,y}$ = Quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or litre)

NCV_k = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter or GJ/litre)

k = Categories of biomass residues for which B4, B5, B6, B7 or B8, has been identified as the baseline scenario

The determination of $BF_{PJ,k,y}$ shall be based on the monitored amounts of biomass residues used in power plants included in the project boundary.

In the case that negative overall emission reductions arise in a year through application of the leakage emissions, CERs are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the year concerned. For example, if negative emission reductions of 30 tCO2e occur in the year t and positive emission reductions of 100 tCO2e occur in the year t+1, only 70 CERs are issued for the year t+1.

Since no categories of forestry and agroindustrial residues for which B4, B5, B6, B7 or B8, have been identified as the baseline scenario for the proposed project activity, k and therefore $EF_{CO2,LE}$ are equal to zero and no leakage can be accounted in the emissions reduction calculation.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(12)}$$

Where:

ER_y = Emission reductions during the year y (tCO_2/yr).
BE_y = Baseline emissions during the year y (tCO_2/yr).
PE_y = Project emissions during the year y (tCO_2/yr).
LE_y = Leakage emissions during the year y (tCO_2/yr).

B.6.2. Data and parameters fixed ex ante

Data / Parameter	GWP_{CH4}
Unit	tCO2e/tCH4
Description	GWPCH4 = Global Warming Potential of methane valid for the commitment period (tCO2/tCH4).
Source of data	IPCC Fourth Assessment Report: Climate Change 2007. Global Warming Potential for a 100 years' time horizon.
Value(s) applied	25 for the second commitment period of the Kyoto´s protocol.
Choice of data or Measurement methods and procedures	Will be updated according to any future COP/MOP decisions.
Purpose of data	Calculation of baseline and project emissions.
Additional comment	-

Data / Parameter	$\eta_{heat,FF}$
Unit	ratio
Description	Average net efficiency of the heat generation equipment if fired with fossil fuels in the baseline.
Source of data	Efficiency of 100% is assumed as a conservative value.
Value(s) applied	100 %.
Choice of data or Measurement methods and procedures	100% has been chosen as a conservative default value.
Purpose of data	Calculation of baseline emissions.
Additional comment	-

Data / Parameter	FCi,n/FCi,n-1/FCi,n-2
Unit	Mass unit
Description	Quantity of fossil fuel type *i* fired in all heat generation equipment at the project site during the historical year n, *n-1* or *n-2*, where n corresponds to the year prior to implementation of the project activity.
Source of data	On-site measurements
Value(s) applied	

	2008	2009	2010	Unit
Petcoke	0	0	11,285	tons
Fuel oil	0	0	0	tons
Diesel	0	0	17	tons

Choice of data or Measurement methods and procedures	Weight meters are used for the measure of petcoke and flow meters are used for fuel oil and diesel.
Purpose of data	Calculation of baseline emissions.[13]
Additional comment	-

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO2/MWh
Description	Grid emission factor
Source of data	This data corresponds to an ex-ante emission factor. Further detail can be found in Appendix 4.
Value(s) applied	0.513
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of project emissions.
Additional comment	-

Data / Parameter	$EF_{CO2,f}$
Unit	g CO2/t km
Description	Default CO2 emission factor for freight transportation activity f.
Source of data	Emission factors applicable for the truck types used for the forestry and agroindustrial residues transportation will be chosen from the CDM Methodological tool "Project and leakage emissions from road transportation of freight" version 1.1.0 in a conservative manner.
Value(s) applied	129 g CO2/t km
Choice of data or Measurement methods and procedures	As per the methodological tool "Project and leakage emissions from road transportation of freight" version 1.1.0, the default CO2 emission factor takes into account the emissions generated by loaded outbound trips and empty return trips.
Purpose of data	Calculation of baseline and project emissions.
Additional comment	-

[13] This parameter is only required in case of choosing "Case B" for the calculation of the parameter $HG_{PJ,biomass,y}$, used for the calculation of the baseline emissions. This information has been included in this section in order to justify the selection of "Case A" for the calculation of such parameter, taking into consideration that there is no registry of biomass or biomass residues use in the project's site.

B.6.3. Ex ante calculation of emission reductions

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The equations used in the calculation of emission reductions are given in detail in the section B.6.1.

Baseline emissions

As decided by the project participants, for the current project activity no baseline emissions due to uncontrolled burning or decay of biomass residues are taken into account, then for the baseline emissions, only emissions from fossil combustion for heat generation will be considered, then:

$$BE_y = BE_{HG,y}$$

Therefore, for baseline emissions calculation the following equation is used:

The information used for baseline emission calculations can be found in Annex 3. The baseline emissions are the following:

Parameter	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Units
Heat generated with incremental biomass residues (HG_PJ,biomass,y)	756,127	756,127	756,127	756,127	756,127	756,127	756,127	**GJ**
Emission factor of the fossil fuel displaced (EF_FF,CO2,y)	0.0726	0.0726	0.0726	0.0726	0.0726	0.0726	0.0726	**tCO2e/ GJ**
Average net efficiency of the heat generation equipment (h_heat,FF)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**ratio**
Baseline emissions from fossil fuel combustion (BE_HG,y)	54,894	54,894	54,894	54,894	54,894	54,894	54,894	**tCO2**
Baseline emissions due to uncontrolled burning or decay of biomass residues (BE_BF,y)	0	0	0	0	0	0	0	**tCO2e**
Baseline emissions (BE_y)	54,894	54,894	54,894	54,894	54,894	54,894	54,894	**tCO2**

Project emissions

As it is mentioned in section B.6.1, project emissions must include CO2 emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity ($PE_{CO2,FF,y}$ and $PE_{CO2,EC,y}$), CO2 emissions from off-site transportation of biomass residues that are combusted in the heat generation equipment to the project site ($PE_{CO2,TR,y}$), and, if included in the project boundary, CH4 emissions from combustion of biomass residues for heat generation ($PE_{CH4,BF,y}$).

As mentioned in page 6 of the methodology:

"Where the most likely baseline scenario for the use of the biomass residues is that the biomass residues would be dumped or left to decay under aerobic or anaerobic conditions (B1 or B2) or would be burnt in an uncontrolled manner without utilizing it for energy purposes (case B3), project participants decide whether to include CH4 emissions from the treatment of biomass residues in the baseline and from combustion of biomass residues in the heat generation equipment in the project boundary. Project participants shall either include CH4 emissions for both project and baseline emissions or exclude them in both cases, and document their choice in the CDM-PDD".

CH4 emissions for the baseline and for the project activity have been excluded for calculation simplification. The project emission reductions calculation is the following:

Parameter	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Units
Quantity of fuel type i combusted in process j during year y (FC_i,j,y)	18	18	18	18	18	18	18	**tons**
CO2 emission coeficient of fuel type i in year y (COEF_i,y)	3.217	3.217	3.217	3.217	3.217	3.217	3.217	**tCO2/ton**
Emissions from on-site fossil fuel combustion (PE_CO2,FF,y)	58	58	58	58	58	58	58	**tCO2**
On-site electricity consumption attributable to the project activity (EC_PJ,y)	5,383	5,383	5,383	5,383	5,383	5,383	5,383	**MWh**
Emission factor for electricity used from the grid (EF_grid,y)	0.513	0.513	0.513	0.513	0.513	0.513	0.513	**tCO2/MWh**
Emissions from on-site electricity consumption (PE_CO2,EC,y)	2,762	2,762	2,762	2,762	2,762	2,762	2,762	**tCO2**
Average return trip distance (from and to) between the biomass fuel supply sites and the site of the project plant	150	150	150	150	150	150	150	**km**
Default CO2 emission factor for freight transportation activity f	129	129	129	129	129	129	129	**g CO2/t km**
Emissions from off-site transportation of biomass residues (PE_CO2,TR,y)	908	908	908	908	908	908	908	**tCO2**
Global Warming Potential of methane (GWP_CH4)	25	25	25	25	25	25	25	**tCO2e/tCH4**
CH4 emissions from combustion of biomass residues in the heat generation equipment (PE_CH4,BF,y)	0	0	0	0	0	0	0	**tCH4**
Project Emissions (PE_y)	3,728	3,728	3,728	3,728	3,728	3,728	3,728	**tCO2**

Detail information used for the emission reduction calculation and the emission factor calculation for the electricity system can be found in the Appendix 4.

Leakage

As it is mentioned in section B.6.1., the main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as a result of the project activity. Nevertheless, the forestry and agroindustrial residues used in this project activity have not a current use, being burned in an uncontrolled manner or left to decay in landfills in aerobic fashion without using its energy contain. This material does not only represent a waste of energy but a fire potential risk due to the ease for it to self ignites.

According to the forestry residues availability study carried over by the project participant to companies that can be found in a 100 km radius from Calidra de Occidente CaO plant, 12,930 m3 of these residues are generated every year, which taking into consideration a mean wood density of 0.6 ton/m3[14] is traduced in 7,758 ton/yr of forestry residues without current use. This project is estimating the use of approximately 4,500 ton/yr, the 58% of the residues available.

On the other hand, according to official statistics from the Agroalimentary and Fishery Information Service (Sistema de Información Agroalimentaria y Pesquera, SIAP), related to the Secretary of

[14] FAO corporate document repository. Methods for estimating biomass density from existing data. Available at: http://www.fao.org/docrep/w4095e/w4095e06.htm

Agriculture, Rural Development, Fisheries and Food (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, SAGARPA) in Jalisco in 2010 there was a production of 702,308.93 of Agave, which with an unused biomass factor of 0.2 (20% of the agave is unused material) can be traduced in 140,461.786 ton/yr residues of agave bagasse. The same calculation has been done for the sugar cane bagasse and the forage maize with a correspondent production of 6,221,412.79 ton/yr and 3,130,168.64 ton/yr and the respective residue to product ratio of 0.29 and 0.273[15] giving an extra 2,658,745.75 ton/yr production of agroindustrial residues for the region. The total of forestry and agroindustrial residues generated annually in the region is approximately 2,800,000 tons and the project is expected to use less than 55,000 ton/yr, less than 2% of the available forestry and agroindustrial residues generated every year.

For the methodology used, the quantity of available forestry and agroindustrial residues is more than 25% larger than the quantity of forestry and agroindustrial residues utilized (including the project plant), then there is a surplus of the biomass residues that with an appropriate treatment can be used by this project activity, and finally LE_y is considered to be 0.

Parameter	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Units
CO2 emission factor of the most carbon intensive fuel used in the country (EF_CO2,LE)	0	0	0	0	0	0	0	**tCO2/GJ**
Quantity of biomass residues for heat generation for wich leakeage can not be ruled out (BF_LE,n,y)	0	0	0	0	0	0	0	**tons**
Net calorific value of biomass residues (NCV_n)	18,706 ,664	18,706 ,664	18,706 ,664	18,706 ,664	18,706 ,664	18,706 ,664	18,706 ,664	**GJ/ton**
Leakage emission during year y (LE_y)	0	0	0	0	0	0	0	**tCO2/yr**

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 1	54,894	3,728	0	51,166
Year 2	54,894	3,728	0	51,166
Year 3	54,894	3,728	0	51,166
Year 4	54,894	3,728	0	51,166
Year 5	54,894	3,728	0	51,166
Year 6	54,894	3,728	0	51,166
Year 7	54,894	3,728	0	51,166
Total	384,258	26,096	0	358,162
Total number of crediting years	7			
Annual average over the crediting period	54,894	3,728	0	51,166

[15] FAO Corporate document repository. Agroindustrial and Forest Residues Generation, Utilization and Availability. Available at: http://www.fao.org/docrep/006/AD576E/ad576e00.pdf

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EF_{FF,CO2,y}$
Unit	tCO2e/GJ
Description	CO2 emission factor of the fossil fuel type displaced by biomass residues for the year y
Source of data	Conservative IPCC default emission factors are chosen.
Value(s) applied	72,600 Kg CO2/TJ as per least carbon intensive fuel type (Diesel)
Measurement methods and procedures	The lower value of the effective CO2 emission factor for combustion has been used as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Monitoring frequency	Annually
QA/QC procedures	The review the appropriateness of the annual data will be carried out.
Purpose of data	Calculation of baseline emissions.
Additional comment	For the purpose of determining $EF_{FF,CO2,y}$, as a conservative approach, the least carbon intensive fuel type should be used among the fossil fuels types used at the project site during the most recent 3 years prior to the implementation of the project activity and the fossil fuels used in the equipment at the project site due the year y. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$HG_{PJ,total,y}$
Unit	GJ/yr
Description	Total heat generated in all heat generation equipment at the project site, using both biomass residues and fossil fuels, during the year *y*.
Source of data	On-site measurements and calculations.
Value(s) applied	1,260,213
Measurement methods and procedures	The measurement of this parameter will be conducted by the software integrated in the Maerz kilns. This software monitors all the inlet and outlet streams, conducts an energy-mass balance to finally calculate the specific energy generation per Kg of burnt lime. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	Continuously, aggregated annually.
QA/QC procedures	The consistency of metered net heat generation will be cross-checked with the quantity of biomass and/or fossil fuels fired. Proper preventive and corrective maintenance will be performed to the Maerz kilns according to supplier's specifications.
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$BF_{k,y}$
Unit	Tons of dry matter
Description	Quantity of biomass residue type *k* fired in all units of heat generation equipment at the project site during the year *y.*
Source of data	On-site measurements.
Value(s) applied	Forestry residues: 3,368 tons Agroindustrial residues: 43,538 tons
Measurement methods and procedures	Weight or volume meters will be used. Calibrated meters will be used and an adjustment will be made according to the moisture content in order to determine the quantity of dry biomass. For the monitoring of biomass residues it is expected to use a weighting hopper with 1000 kg capacity and an accuracy of ±0.5 kg. The specifications of the weighting hopper are the ones considered for validation purposes of this project activity, the specifications could vary for the definitive equipment installed for the monitoring and verification stage. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	Continuously, aggregated at least annually.
QA/QC procedures	This data will be crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes. The meters will be recalibrated according to manufacturer specifications, but at least once each 3 years.
Purpose of data	Calculation of baseline emissions.
Additional comment	The quantity of biomass combusted should be collected separately for all types of biomass. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

<table>
<tr><td>Data / Parameter</td><td>Moisture content of the biomass residues.</td></tr>
<tr><td>Unit</td><td>% Water content.</td></tr>
<tr><td>Description</td><td>Moisture content of each biomass residue type k.</td></tr>
<tr><td>Source of data</td><td>On-site measurements.</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Biomass residues</th><th>Moisture interval</th></tr>
<tr><td>Forestry residues</td><td>40%-60%</td></tr>
<tr><td>Agroindustrial residues</td><td>30%-50%</td></tr>
</table>
</td></tr>
<tr><td>Measurement methods and procedures</td><td>-</td></tr>
<tr><td>Monitoring frequency</td><td>The moisture content will be monitored for each batch of biomass of homogeneous quality.

The weighted average will be calculated for each monitoring period and used in the calculations.

The monitoring team will be in charge of the gathering of this information for the correspondent verification period.</td></tr>
<tr><td>QA/QC procedures</td><td>The instruments will be calibrated periodically according to the program established by the internal procedures of the project developer and to the manufacturer´s standards, but at least once each three years.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions.</td></tr>
<tr><td>Additional comment</td><td>In case of dry biomass, monitoring of this parameter will not be necessary.

Data will be reported annually and archived electronically 2 years after the end of the crediting period.</td></tr>
</table>

Data / Parameter	$FC_{i,y}$
Unit	Mass or volume unit.
Description	Quantity of fossil fuel type *i* fired in all heat generation equipment at the project site during the year *y.*
Source of data	On-site measurements.
Value(s) applied	14,039 tons of petcoke 157 tons of fuel oil 6 tons of diesel
Measurement methods and procedures	The fossil fuels used for this parameter are the ones of the historical data. Mass or volume based measurements will be used (scales for solid fuels and flow meter for fluids) for the monitoring period. For the monitoring of petcoke it is expected to use a weighting hopper with 1000 kg capacity and an accuracy of ±0.5 kg. For the monitoring of fluids, it is expected to install flow meters with a measurement range from 150 to 2,500 l/min with an accuracy of ±1%. The specifications of the weighting hopper and the flow meters are the ones considered for validation purposes of this project activity, the specifications could vary for the definitive equipment installed for the monitoring and verification stage. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	Continuously, aggregated annually.
QA/QC procedures	Cross-check the measurements with an annual balance based on purchased quantities and stock changes. Instruments will be recalibrated at appropriate intervals according to manufacturer specifications, but at least once in 3 years.
Purpose of data	Calculation of baseline emissions.
Additional comment	The quantity of fossil fuels combusted should be collected separately for all types of fossil fuels. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$FC_{i,y}$
Unit	Mass or volume unit.
Description	Quantity of fuel type i combusted during the year y attributable to the project activity.
Source of data	On-site measurements.
Value(s) applied	18 tons of diesel.
Measurement methods and procedures	Mass or volume based measurements will be used (scales for solid fuels and flow meter for fluids). For the diesel monitoring, it is expected to be installed a flow meter with a measurement range from 150 to 2,500 l/min with an accuracy of ±1%. The latest specifications are the ones considered for validation purposes of this project activity, the final specifications could vary for the definitive equipment installed for the monitoring and verification stage. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	Continuously, aggregated annually.
QA/QC procedures	Cross-check the measurements with an annual balance based on purchased quantities and stock changes. Instruments will be recalibrated at appropriate intervals according to manufacturer specifications, but at least once each 3 years.
Purpose of data	Calculation of project emissions.
Additional comment	Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$NCV_{i,y}$
Unit	GJ/mass or volume unit.
Description	Weighted average net calorific value of fuel type *i* in year *y*.
Source of data	During the monitoring period either measurement in reputed laboratories will be conducted or reliable local or national data or IPCC default net calorific values will be used if they are deemed to reasonably represent local circumstances. A laboratory analysis value has been used for petcoke since it is available, meanwhile, country specific values are available at the moment of validation for fuel oil and diesel, being the values included for this variable in the next line.
Value(s) applied	35.4 GJ/Ton (8,470 Kcal/kg) for petcoke[16] 40.1 GJ/Ton (9,589 Kcal/kg) for fuel oil[17] 41.9 GJ/Ton (10,007 Kcal/kg) for diesel[18]
Measurement methods and procedures	Measurements will be carried out at reputed laboratories and according to relevant international standards.
Monitoring frequency	In case of measurements: At least every six months, taking at least three samples for each measurement (please refer to section B.7.2 for more detailed information), from which weighted average annual values will be calculated In case of other data sources: The appropriateness of the data will be reviewed annually. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
QA/QC procedures	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, additional information will be collected or additional measurements will be conducted.
Purpose of data	Calculation of baseline and project emissions.
Additional comment	Parameter included in the "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*" for the calculation of the CO2 emission coefficient of fuel type i in year y. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

[16] Petcoke analysis certificate.
[17] Fossil fuel properties from the National Comission for the Efficient Use of Energy (CONUEE, from Spanish).
[18] Fossil fuel properties from the National Comission for the Efficient Use of Energy (CONUEE, from Spanish).

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO2e/GJ
Description	Weighted average CO2 emission factor of fuel type i in year y
Source of data	Conservative IPCC default emission factors are chosen.
Value(s) applied	0.1150 tCO2e/GJ for Petcoke (Upper value). 0.0829 tCO2e/GJ for Petcoke (Lower value). 0.0788 tCO2e/GJ for Fuel oil (Upper value). 0.0755 tCO2e/GJ for Fuel oil (Lower value). 0.0748 tCO2e/GJ for Diesel (Upper value). 0.0726 tCO2e/GJ for Diesel (Lower value).
Measurement methods and procedures	The upper values (for project emissions) and lower values (for baseline emissions) of the effective CO2 emission factors for combustion have been used as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Monitoring frequency	Annually
QA/QC procedures	The review the appropriateness of the annual data will be carried out.
Purpose of data	Calculation of baseline emissions (by using the lower values) and project emissions (by using the upper values).
Additional comment	Parameter included in the "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*" for the calculation of the CO2 emission coefficient of fuel type i in year y. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$EC_{PJ,y}$
Unit	MWh.
Description	On-site electricity consumption attributable to the project activity during the year *y*.
Source of data	On-site measurements.
Value(s) applied	5,383
Measurement methods and procedures	This parameter will be monitored with calibrated electricity meters. The equipment expected to be installed (power monitoring device SENTRON PAC 3200) has the following measuring accuracy: - Voltage: 0.3% - Current: 0.2% - Power: 0.5% - Frequency: 0.05% - Power factor: 0.5% - Active energy: Class 0.5S acc. to IEC 62053-22:2003-01. - Reactive energy: Class 2 acc. to IEC 62053-22:2003-01. The specifications listed above are the ones considered for validation purposes of the project activity, this could vary from the definitive meters installed for the monitoring and the correspondent verification stage. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	Continuously, aggregated at least annually.
QA/QC procedures	Cross-check measurement results with invoices for purchased electricity if available. Instruments will be recalibrated at appropriate intervals according to manufacturer specifications, but at least once in 3 years.
Purpose of data	Calculate project emissions.
Additional comment	Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	NCV_i
Unit	GJ/mass or volume unit.
Description	Net calorific value of fossil fuel type *i.*
Source of data	During the monitoring period either measurement in reputed laboratories will be conducted or reliable local or national data or IPCC default net calorific values will be used if they are deemed to reasonably represent local circumstances. A laboratory analysis value has been used for petcoke since it is available, meanwhile, country specific values are available at the moment of validation for fuel oil and diesel, being the values included for this variable in the next line.
Value(s) applied	35.4 GJ/Ton (8,470 Kcal/kg) for petcoke[19] 40.1 GJ/Ton (9,589 Kcal/kg) for fuel oil[20] 41.9 GJ/Ton (10,007 Kcal/kg) for diesel[21]
Measurement methods and procedures	Measurements will be carried out at reputed laboratories and according to relevant international standards.
Monitoring frequency	In case of measurements: At least every six months, taking at least three samples for each measurement (please refer to section B.7.2 for more detailed information). In case of other data sources: The appropriateness of the data will be reviewed annually. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
QA/QC procedures	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, additional information will be collected or additional measurements will be conducted.
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be reported annually and archived electronically 2 years after the end of the crediting period.

[19] Petcoke analysis certificate.
[20] Fossil fuel properties from the National Comission for the Efficient Use of Energy (CONUEE, from Spanish).
[21] Fossil fuel properties from the National Comission for the Efficient Use of Energy (CONUEE, from Spanish).

Data / Parameter	NCV_k
Unit	GJ/ton of dry matter
Description	Net calorific value of biomass residue type *k*
Source of data	Measurements
Value(s) applied	Forestry residues: 4,471 Kcal/Kg Agroindustrial residues: 3,805 Kcal/Kg
Measurement methods and procedures	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Measure/calculate the NCV based on dry biomass.
Monitoring frequency	In case of performing own measurements: these will be conducted at least every six months, taking at least three samples for each measurement (please refer to section B.7.2 for more detailed information). The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
QA/QC procedures	Consistency of the measurements will be checked by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be carried out.
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	-
Unit	Tons.
Description	Quantity of biomass residues of type *k* or *m* that are utilized (e.g., for energy generation or as feedstock) in the defined geographical region.
Source of data	Surveys or statistics.
Value(s) applied	-
Measurement methods and procedures	-
Monitoring frequency	Annually.
QA/QC procedures	-
Purpose of data	Calculation of leakage.
Additional comment	Monitoring of this parameter is applicable if approach L2 is used to rule out leakage or if approach L4 is used in combination with approach L2 to rule out leakage for the substituted biomass residue type m. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	-
Unit	Tons.
Description	Quantity of available biomass residues of type *k* or *m* in the region.
Source of data	Surveys or statistics.
Value(s) applied	-
Measurement methods and procedures	-
Monitoring frequency	Annually.
QA/QC procedures	-
Purpose of data	Calculation of leakage.
Additional comment	Monitoring of this parameter is applicable if approach L2 is used to rule out leakage or if approach L4 is used in combination with approach L2 to rule out leakage for the substituted biomass residue type m. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$NCV_{n,y}$
Unit	GJ/tonnes on dry-basis
Description	Net calorific value of biomass residues of category *n* in year *y*.
Source of data	On-site measurements.
Value(s) applied	Forestry residues: 4,471 Kcal/Kg Agroindustrial residues: 3,805 Kcal/Kg
Measurement methods and procedures	Measurements shall be carried out at reputed laboratories and according to relevant international standards. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	In case of measurements: At least every six months, taking at least three samples for each measurement (please refer to section B.7.2 for more detailed information). In case of other data sources: Review the appropriateness of the data annually.
QA/QC procedures	Consistency of the measurements will be checked by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conducted. The NCV will be determined on dry biomass basis.
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$D_{f,m}$
Unit	km
Description	Return trip road distance between the origin and destination of freight transportation activity f in monitoring period *m*.
Source of data	Records of vehicle operator or records by project participants.
Value(s) applied	150
Measurement methods and procedures	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources). The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	To be updated whenever the road distance changes.
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comment	According to the methodological tool "Project and leakage emissions from road transportation of freight" version 1.1.0. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

Data / Parameter	$FR_{f,m}$
Unit	Tons
Description	Total mass of freight transported in freight transportation activity *f* in monitoring period *m*.
Source of data	Records by project participants or records by truck operators.
Value(s) applied	46,906
Measurement methods and procedures	For the monitoring it is expected to use scales with capacity of 80,000 Kg with and accuracy of ±10 Kg. Since the project activity has not been implemented yet, latest specifications are considered for validation purposes of this project activity, nevertheless could vary from the correspondents to the definitive scale installed for the monitoring of the project and verification stage. The monitoring team will be in charge of the gathering of this information for the correspondent verification period.
Monitoring frequency	Continuously.
QA/QC procedures	Cross-check will be performed against the invoices of purchased forestry or agroindustrial residues or invoices from the hired freight company. Instruments will be recalibrated at appropriate intervals according to manufacturer specifications, but at least once in 3 years.
Purpose of data	Calculation of project emissions.
Additional comment	According to the Methodological tool "Project and leakage emissions from road transportation of freight" version 1.1.0. The total mass transported will be recorded on wet or dry basis, depending on which conditions the forestry and agroindustrial residues had been purchased. Data will be reported annually and archived electronically 2 years after the end of the crediting period.

B.7.2. Sampling plan

>>

As mentioned in the paragraph 9 of the Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities version 03.0: "*Requirements for sampling are defined either in the applicable CDM methodology or in paragraphs below, with the applicable methodology having precedence*".

The sampling procedure is described for the three variables to be sampled ($NCV_{n,y}$, NCV_i and NCV_k) within the applicable methodology (AM0036 v.4), requiring to take three samples for each measurement, being also required one measurement each 6 months. The measurement of NCV_i and $NCV_{n,y}$ is optional, meanwhile, is mandatory for the NCV_k to be conducted in reputed laboratories and according to relevant international standards.

B.7.3. Other elements of monitoring plan

>>

The project activity will be operated and managed by the project proponents. All data pertaining to GHG emission reduction calculations will be monitored and recorded through trained personnel as per the management system present at the project site. For the project activity among 5 persons are expected to be hired. This new personnel will receive the proper training in relation with security, the current management system to register and control the information related to the project activity and instructions about the operation and control of the equipments for pre treatment and feeding of the forestry and agroindustrial residues to the process.

Currently, Calidra de Occidente is improving and migrating its management system to Microsoft Dynamics AX 2009, which will allow them to have a more accurate and strict control of the data. The CDM project will use this new management system to ease its operation, data gathering and monitoring, letting it be in line with the requirements of the CDM methodology applied in the PDD and the proposed monitoring plan.

All data will be archived until 2 years after the completion of the crediting period. This figure describes the operational and management structure that will monitor emissions reductions generated by the project activity.

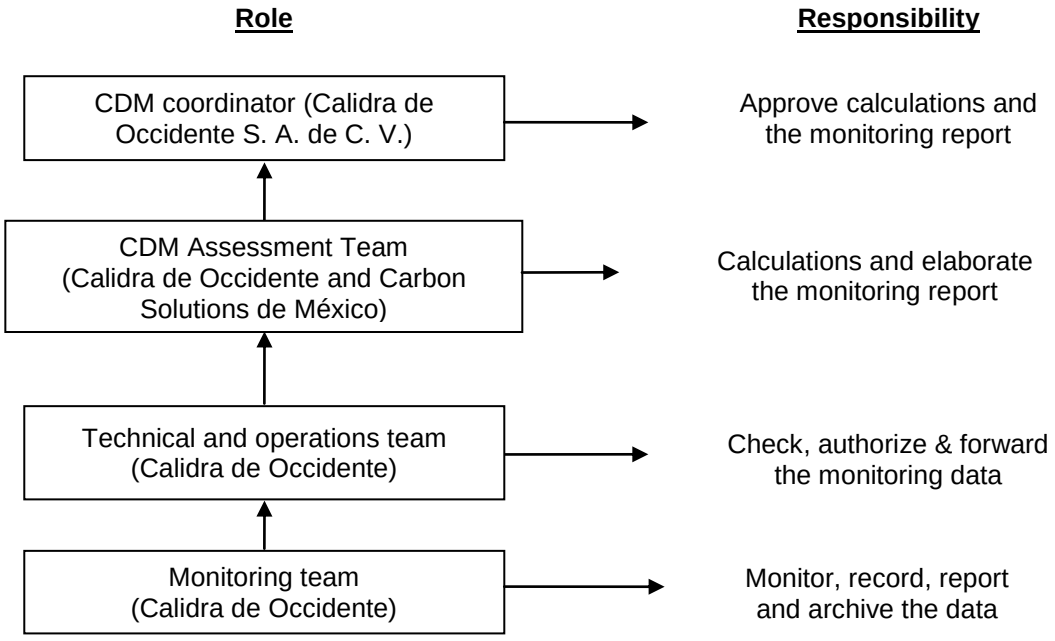

Figure 4. Operational and management structure for the monitoring plan.

The Monitoring team, integrated by engineers designated by Calidra de Occidente S. A. de C. V. will be in charge of monitor the variables established in section B.7.1, will record the data, elaborate the reports and archived them.

Once the reports have been elaborated, the Technical and operations team designated by Calidra de Occidente S. A. de C. V. will check the information and, in case that the considerations taken for each variable are accomplished, will authorized them and send it to the CDM Assessment team, integrated by personnel from Calidra de Occidente and Carbon Solutions, to conduct the calculations and elaborate the monitoring report.

Finally, the CDM coordinator designated by Calidra de Occidente will be in charge of approving the calculations and the monitoring report, which will finally serve for proving the emission reductions calculations.

Quality control

Data will be compared from month to month in order to identify any possible deviation. Any value identified as being unusual in this manner will be rechecked, review and corrected taking the most conservative approach. Where preceding or following values are not available, reference values may be taken from local or national appropriate data (e.g. 2006 IPCC Guidelines for National Greenhouse Gas Inventories). Measurements of the fuels combusted (fossil and forestry and agroindustrial residues) will be conducted in calibrated scales, in case of identifying any significant deviation in relation with previous data, a correction will be conducted for the deviated measured applying the maximum error in a conservative manner.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
09/12/2011

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
18/03/2011

The starting date of a CDM project activity is the earliest of the date(s) on which the implementation or construction or real action of a project activity begins/has begun. The signature of the contract for the foundation's construction for the 600 tpd kiln corresponds to the first real action for the project activity, then this date has been defined as the starting date of the project.

C.1.2. Expected operational lifetime of project activity

>>
20 years and 0 months from commissioning.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
The project activity will use a renewable crediting period, being this the first 7 years crediting period.

C.2.2. Start date of crediting period

>>
01/07/2015

C.2.3. Length of crediting period

The crediting period for the project activity is 7 years and 0 months, renewable twice.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
As explained in section B.4, the forestry and agroindustrial residues to be used as part of the project activity do not qualify as a hazardous material or hazardous residue, being why no additional permits to the ones needed for the normal operation of the quicklime plant are required. Nevertheless, for the project activity to become operational, it will be required the update of the Unique Environmental License issued by SEMARNAT.

The previous version of the Unique Environmental Licence (Licencia Ambiental Unica, LAU) of Calidra de Occidente S. A. de C. V. was issued in January 17th of 2012 through the document N° SGPARN 014.02.02.079/2012 and with the environmental registration number COC741408811. The updated version of such license is in process and is expected to be obtained by the third quarter of 2013.

It is important to remark that the applicable law (LGEEPA) does not require an specific Environmental Impact Assessment for the current project activity, only requires it for the whole quicklime process in order to obtain the operation permits. The project activity will not cause any significant negative impact in the environment, being the only negative impacts the project emissions taken into consideration for the emission reductions calculation.

D.2. Environmental impact assessment

>>
No significant environmental impacts are identified product of the project activity.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
In order to include the opinion of stakeholders in the development of the project activity, Calidra de Occidente S.A. de C.V. organized two consultation sessions, the first on December 5th of 2011 and the second on December 7th of the same year. Invitations were sent through email to stakeholders representatives of different organisms from the municipality of Tecolotlán and the state of Jalisco, receiving their confirmation through the same mean. The project was presented to the following organisms:

- Municipal Presidency of Tecolotlán.
- Secretary of Environment for Sustainable Development (SEMADES)
- Secretary of Rural Development
- Secretary of Agriculture, Livestock, Rural Development, Fishing and Food (SAGARPA)
- Federal Delegation of SEMARNAT in Jalisco
- Local stakeholders (workers, land owners, farm workers, employees and people of the municipalities de Tecolotlán and Amatitán).

In addition, a national stakeholder's consultation was carried over the past November 29th of 2011, in which Calidra de Occidente S. A. de C. V. presented the project in detail to the Designated National Authority of the CDM in Mexico (Interministerial Commission on Climate Change or ICCC).

In both, local and national stakeholder's consultation, a quiz was given and answer by all of the representatives of all of the organisms invited. At the end of each session time was given for a Q&A section, where positive commentaries were received.

E.2. Summary of comments received

>>

The following commentaries are the most representatives of this consultation process:

- Marco Ruelas: Is a very important project with short term results and a long term future. Government must participate so it can help the Project to be implemented as fast as possible.
- Jorge Gil: Is very important to have this alternative, climate change must be fight back.
- Maria de los Angeles Hernandez: It will be have to be checked the new risks to be faced, meaning the gases that could be generated due to the acidity of the agave bagasse. That is the only matter because as part of the sustainable development is good to know the potential risks to health that could be faced.
- Hector López: I think is a good alternative for the locality to reduce the pollution produced by the residues.

Overall, positive commentaries were received about the project regarding the positive impact in the environment and in the economy of the region. Some doubts about the project implementation were also posed and answered during the stakeholder consultation.

E.3. Report on consideration of comments received

>>

Most of the comments received by the stakeholders were positive. No suggestions concerning the project activity were received.

SECTION F. Approval and authorization

>>

The approval from the DNA of Mexico, the ICCC, has already been obtained for both project participants (Calidra de Occidente S. A. de C. V. and Carbon Solutions de México S. A. de C. V. through the document #301/2012 signed by the Substitute President of the ICCC, Dr. Fernando Tudela Abad on April 30th of 2012.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Calidra de Occidente S. A. de C. V.
Street/P.O. Box	Av. López Mateos Sur #5060 int 1A Col. Miguel de la Madrid Hurtado.
Building	-
City	Zapopan
State/Region	Jalisco
Postcode	45239
Country	Mexico
Telephone	01 (333) 134 51 00
Fax	01 (333) 318 878 56
E-mail	ahernandez@calidra.com.mx
Website	http://calidra.com/
Contact person	José Antonio Hernández Liñan
Title	Authorized representative
Salutation	Mr.
Last name	Hernández Liñan
Middle name	Antonio
First name	José
Department	-
Mobile	-
Direct fax	01 (333) 318 878 56
Direct tel.	01 (333) 134 51 00
Personal e-mail	ahernandez@calidra.com.mx

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Carbon Solutions de México S. A. de C. V.
Street/P.O. Box	Av. Lázaro Cárdenas, No. 1007 PTE.
Building	Int CEO-M
City	San Pedro Garza García
State/Region	Nuevo León
Postcode	66266
Country	Mexico
Telephone	+52 (81) 8220 9080
Fax	+52 (81) 8220 9010
E-mail	infocdm@co2-solutions.com

Website	www.co2-solutions.com
Contact person	Alfonso Lanseros Valdés
Title	Partner consultant
Salutation	Mr.
Last name	Lanseros Valdés
Middle name	-
First name	Alfonso
Department	CDM Development
Mobile	-
Direct fax	+52 (81) 8220 9080
Direct tel.	+52 (81) 8220 9010
Personal e-mail	alv@co2-solutions.com

Appendix 2. Affirmation regarding public funding

No public funding from Annex I parties are involved in this project activity.

Appendix 3. Applicability of methodology and standardized baseline

No further background information on the applicability of the selected methodology.

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

National grid ex-ante emission factor

The Mexican ex-ante emission factor calculation is based on the "Tool to calculate the emission factor for an electricity system" ver. 04.0.0.

The simple OM method has been selected from the four options proposed in the tool, as low-cost/must-run resources in Mexico represent less than 50% of the total electricity generation (below 20%). The simple OM emission factor is calculated ex-ante as chosen by the project participants.

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 excluding low-cost/must-run power plants/units.

Simple OM factor may be calculated by two options:

- Option A: Based on the net electricity generation and a CO2 emission factor of each power unit
- 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.

Information required for the Option A is not available. Option B is selected because total net electricity generation of all power plants serving the system as well as the fuel types and total fuel consumption of the project electricity system are available.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

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 the year y (mass or volume unit).
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (tCO2/GJ)
$EF_{CO2,i,y}$	=	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 the year *y* (MWh)
i	=	All 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

The $EF_{CO2,i,y}$ (in tCO2/TJ) value can be found in the IPCC Guidelines for Greenhouse Gas Inventories[22]. Data for $FC_{i,y}$ and EG_y can be found in TJ/day in the three energy sector outlook reports from SENER for 2008, 2009 and 2010[23], so the total annual consumption per fuel source can be calculated multiplying by 365.

[22] Intergovernmental Panel on Climate Change (IPCC). "2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: Energy" http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

[23] Energy Secretary (SENER). "Prospectiva del sector eléctrico 2008-2017", "Prospectiva del sector eléctrico 2009-2024", "Prospectiva del sector eléctrico 2010-2025". Available at: http://www.sener.gob.mx/portal/publicaciones.html

The net calorific value of each fossil fuel type ($NCV_{i,y}$) can be found in the CONUEE´s (National Commission for the Efficient Use of Energy) web page .

The following information has been used for the Operating Margin calculation:

a. Emissions of CO2 per fuel type:

	2007			
	Fuel share	**Fuel consumption (TJ)**	**CO2 Emission Factor (tCO2/TJ)**	**Emissions CO2 (tCO2)**
Fuel Oil	28.90%	477,531	75.5	36,053,560
Natural Gas	52.00%	859,225	54.3	46,655,896
Diesel	0.50%	8,262	72.6	599,805
Coal (national)	18.50%	305,686	87.3	26,686,359
Coal (imported)		0		
Total		**1,652,355**		**109,995,620**

	2008		
	Fuel consumption (m3/day or tonne/year)	**CO2 Emission Factor (tCO2/TJ)**	**Emissions CO2 (tCO2)**
Fuel Oil	29,000	75.5	32,863,990
Natural Gas	71,900,000	54.3	57,183,285
Diesel	700	72.6	664,095
Coal (national)	9,100,000	87.3	15,415,914
Coal (imported)	1,700,000		3,752,398
Total	**1,717,099**		**109,879,683**

	2009		
	Fuel consumption (m3/day or tonne/year)	**CO2 Emission Factor (tCO2/TJ)**	**Emissions CO2 (tCO2)**
Fuel Oil	26,500	75.5	30,030,888
Natural Gas	76,600,000	54.3	60,921,274
Diesel	1,100	72.6	1,043,577
Coal (national)	8,500,000	87.3	14,399,480
Coal (imported)	5,200,000		11,477,925
Total	**1,830,492**		**117,873,144**

b. Energy generation per source

	2007		2008		2009	
	Power share	MWh	Power share	MWh	Power share	MWh
Dual	5.75%	12,161,569	2.92%	6,282,013	5.23%	11,220,372
Combined cycle	44.15%	93,359,025	45.72%	98,414,858	48.45%	103,910,914
Gas turbine	1.15%	2,424,130	1.19%	2,557,344	1.59%	3,407,439
Coal	7.78%	16,458,809	7.54%	16,235,759	7.18%	15,405,089
Internal	0.49%	1,035,666	0.52%	1,126,254	0.53%	1,132,164
Nuclear	4.48%	9,475,567	4.16%	8,947,967	4.47%	9,580,057
Standard Thermoelectric	21.28%	44,992,805	18.37%	39,542,092	18.34%	39,331,056
Renewables (Hydro, Geo, Wind …)	14.92%	31,546,429	19.59%	42,168,800	14.22%	30,501,822
Total Generation (MWh)		232,552,000		235,871,000		235,107,000
Self-consumption (MWh)		21,098,000		20,595,000		20,619,000
Net Electricity Generation	**100%**	**211,454,000**	**100%**	**215,276,000**	**100%**	**214,488,000**

c. Net energy exchange

	2007	2008	2009
Exports (MWh)	1,451,000	1,452,000	1,249,000
Imports (MWh)	277,000	351,000	346,000
Net Exchange (MWh)	**1,174,000**	**1,101,000**	**903,000**

d. Operating Margin per year

	2007	2008	2009
OM (tCO2/MWh)	0.644	0.668	0.675

e. Weighted Operating Margin

Weighted OM (tCO2/MWh)
0.662

An ex-ante build margin emission factor has been chosen by the project participants. The BM emission factor has been calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh).

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh).

$EF_{EL,m,y}$ = 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 power generation data is available.

For the BM factor calculation power units are included one by one starting from the one with the shortest operational life until completing the 20% of the total amount of energy generated by the grid, not taking into account power units constructed as CDM projects or with an operation time superior to 10 years.

The final BM factor is the following:

Build Margin	0.362	**tCO2/MWh**

The combined margin emissions factor is calculated 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 CO2 emission factor in year *y* (tCO2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year *y* (tCO2/MWh)

w_{OM} = Weighting of operating margin emissions factor (per cent)

w_{BM} = Weighting of build margin emissions factor (per cent)

The tool specifies that for wind and solar projects the default weights are 0.75 for w_{OM} and 0.25 for w_{BM}, and for all other projects the correspondent values are 0.5 for w_{OM} and w_{BM} . Then latest values are used for the Combine Margin emission factor calculation as follows:

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y}$$

Combine Margin emission factor	0.513	**tCO2/MWh**

Baseline information

A complete spreadsheet will be provided to the Designated Operational Entity.

Historical CaO Production				
	2008	**2009**	**2010**	**Units**
Maerz kilns production	0	0	109,689	tons

Historical Maerz Kiln Fuel Consumption				
	2008	**2009**	**2010**	**Units**
Petcoke	0	0	11,285	tons
Fuel oil	0	0	0	tons
Diesel	0	0	17	tons

Fossil fuels properties			
Fuel	**Property**	**Value**	**Units**
Petcoke	Net Calorific Value	35.4	TJ/Gg
		35.4	GJ/Ton
		8,470	kcal/kg
	Emission factor	115,000	kg CO2/TJ (upper value)
		82,900	kg CO2/TJ (lower value)
Fuel oil	Net Calorific Value	40.1	TJ/Gg
		9,589	kcal/kg
		40,122	KJ/Kg
	Density	0.982	Kg/l
	Emission factor	78,800	kg CO2/TJ (upper value)
		75,500	kg CO2/TJ (lower value)
Diesel	Net Calorific Value	41.9	TJ/Gg
		10,007	kcal/kg
		41,868	KJ/Kg
	Density	0.865	Kg/l
	Emission factor	74,800	kg CO2/TJ (upper value)
		72,600	kg CO2/TJ (lower value)

Project CaO production projection								
Parameter	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Units**
CaO production (only for retroffited and new kilns)	340,000	340,000	340,000	340,000	340,000	340,000	340,000	tons

Biomass residues properties				
Fuel Type	**Net Calorific Value (J/g)**	**Net Calorific Value (MJ/kg)**	**Net Calorific Value (kcal/kg)**	**Emission factor (ton CO2/TJ)**
Forestry residues	18,707	18.71	4,471	0.0
Agroindustrial residues	15,920	15.92	3,805	0.0

Electricity Data								
Parameter	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Units**
Electricity cost	102.25	102.25	102.25	102.25	102.25	102.25	102.25	USD/MWh
Grid Emission Factor	0.513	0.513	0.513	0.513	0.513	0.513	0.513	tCO2e/MWh
Grid Transmission and Distribution Loss	20	20	20	20	20	20	20	%

Transportation Data								
Parameter	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Units**
Average return-trip distance	150	150	150	150	150	150	150	km
EF_CO2,f	129	129	129	129	129	129	129	g CO2/t km

Diesel for on-site transportation		
Properties	**Value**	**Units**
Forklift truck capacity	2.5	tons
Fuel consumption	2.5	lts/hour
Average yearly quantity of biomass to transport	46,141.3	tons
Number of runs for the biomass residues needed	54.4	runs/day
Estimated consumption	60	lts/day
Density	865	Kg/m3
Heat value	43	TJ/Gg
Emission factor	74,800	Kg CO2/TJ (diesel upper value)
Price	$8.96	MXN/lt
	$0.71	USD/lt

Appendix 5. Further background information on monitoring plan

There is no further information on monitoring plan.

Appendix 6. Summary of post registration changes

The proposed project is under validation and no post registration changes have been requested.