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The Gold Standard Suppressed Demand Methodology Small-scale Methodology for Low GHG Food Preservation

This methodology was prepared by South South North with inputs from The Gold Standard Foundation

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I. Applicability

1. The methodology comprises of project activities that (i) provide food preservation with lower associated greenhouse gases emissions and (ii) expand the food preservation beyond pre-project levels. Among others, the following activities are explicitly included in this methodology:

   - Installation of new equipment based on renewable energy and/or energy efficient technology to provide the energy required for all or part of the food preservation process for new[1] or existing project sites (including capacity expansion). Examples of such technologies are: solar drying; solar cooking; biogas cooking or drying; solar cooling for refrigeration and freezing; etc. Examples of food products to be treated include crop, fruit, fish and other perishable foods for later consumption. The food preservation technologies may be hybrid systems to allow for drying to occur using fossil fuels if and when renewable energy is not available or to augment renewable energy availability;
   - Installation of new equipment based on waste heat/waste gas energy technology to provide the energy required for all or part of the food preservation process for new or existing project sites;
   - Increased energy efficiency in food preservation equipment compared to the baseline;
   - Increased amount of food preserved: the project activity is the preservation of food which would otherwise have neither been preserved nor consumed (e.g. drying of fruits otherwise left unharvested);
   - Increased duration over which food is preserved: the food preservation is improved compared to what would have occurred without project intervention (e.g. food preserved over 6 months instead of 4 weeks);

2. For the purpose of the methodology, the following definitions apply:

   Food preservation: Food preservation consists of activities of food processing and/or food storage. Such activities aim at (i) making the food available over longer periods of time (ii) reducing food spoilage and/or (iii) improving quality ($Qual_P > Qual_{BL}$) of dried food.

   Food processing: In this methodology, food processing refers to the steps during which the food is processed (e.g. chemically, thermally and/or mechanically) before its storage.

   Food storage: Food storage is the art of maintaining the quality of agricultural materials and preventing them from deterioration for specific periods of time, beyond their normal shelf life.

   Food security: "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"[2]

   Food storage wastes: Amount of the commodity in question lost through wastage (waste) during the year, at all stages between the level at which production is recorded and the household utilizes the food, i.e. storage and transportation. Losses occurring before and during harvest are excluded.

   Project site: Location where a food preservation activity is undertaken in the project.

[1] Green field facilities shall not involve introduction of fossil fuel based technologies. Co-firing of fossil fuels is allowed as per the guidelines given in the Annex C.

[2] Source of the definition: FAO. 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit 13-17 November 1996. Rome.

3. The methodology is applicable under the following conditions:

   a. The preserved food can be sold locally or outside the project boundary[3]. The Local Stakeholder Consultation will enable projects to decide whether they can export the preserved food outside of the project boundary. If demand is established as part of the Local Stakeholder Consultation then it will be compulsory for 75% of the preserved food to be supplied within the project boundary. In the case when preserved food is exported without meeting local demand, then credits would only be issued for the quantity supplied locally and up to 25% of that exported. In situations where more than 25% of the preserved food is exported outside the project boundary, emission reductions can be claimed for the entire amount exported but only if it can be demonstrated that there was no local demand[4]. The evaluation and related measures, and the procedures will be presented and discussed at the Local Stakeholder Consultation and documented in the Sustainable Development Matrix and the Sustainability Monitoring Plan.

   b. The project activity does not reduce the quantity, quality and durability of the preserved food (e.g. dried food products k at site j in year y, the quality must be equal or better in the project than in the baseline ($Qual_P > Qual_{BL}$)). When national or international product standards apply to the food product(s) (e.g. for exported products), product quality shall be as defined in such standards, otherwise the relevant norms are to be followed.

   c. The geographical/physical boundaries of the baseline electricity grid can be clearly identified and information pertaining to the grid and to estimate baseline emissions is publicly available. The use of the simplified approach from the recently approved methodology AM0103 is allowed. This approach will be favoured in countries with a low level of information to estimate the grid emission factor.

   d. Additional Gold Standard requirements for hydro projects (as listed in Annex C of the latest version of The Gold Standard Toolkit) are complied with.

   e. Additional Gold Standard requirements for electricity and/or heat, and liquid biofuels from biomass resources (as listed in Annex C of the latest version of The Gold Standard Toolkit) are complied with.

   f. If the project includes refrigeration and/or freezing – electric chillers provide the baseline cooling.

   g. The project is applicable to non-HFC refrigerants based preservation techniques.

   h. If the project activity establishes new facilities for refrigeration/freezing, all insulating material shall be HFC-free.

   i. If the energy-efficient equipment contains refrigerants, then the refrigerant used in the project case shall have no ozone depleting potential (ODP).

   j. No domestic wastes/mixed wastes are used as fuel.

   k. Emission reductions associated with the difference in carbon content between a non-renewable fuel and a less carbon intensive non-renewable fuel used as substitution measure is not allowed.

   l. The eligibility of project activities making use of palm oil and/or palm oil mill by-products or residues for electricity and/or heat generation, and/or for biofuel production shall be evaluated on a case-by-case basis by The Gold Standard Foundation, in the light of a Pre-Feasibility Assessment. Please refer to The Gold Standard - Annex C for details.

[3] Refer to Boundary section of the methodology for the exact definition of the project boundary
[4] This can be demonstrated for e.g. by carrying out surveys with food retailers in the local area.

m. Project activities that involve the distribution/installation/operation of large amounts of small devices (for example farm-level improved grain storage, small-scale fruit dryers, etc.), shall provide a clear description of the transfer of carbon credit ownership along the entire investment chain and provide evidence to demonstrate that the end-users are aware of and willing to give up their rights on the carbon credits.

n. The project activity does not involve the distribution and/or replacement of refrigerators at the household level.

o. Measures are limited to those that result in emission reductions of less than or equal to 60 ktCO_2 equivalent annually.

4. In addition to the above, if the project activity is a replacement/refurbishment of existing equipment, the following applies:

a. The identified baseline shall be as per the guidance provided in the baseline section of the methodology;

b. The requirements concerning a demonstration of the remaining lifetime of any baseline equipment that is replaced equipment shall be as described in the "General Guidelines to SSC CDM methodologies"[5]. If the remaining lifetime of the element processes increases due to the project activity, the crediting period shall be limited to the estimated remaining lifetime of the baseline equipment, i.e. the time when the affected element processes would have been replaced in the absence of the project activity.

5. Project activities consisting of the distribution of large amounts of small devices shall explain, in the Project Design Document (PDD), the proposed method of distributing/installing the devices, which shall allow for verification. In the case when training is required for the proper operation of large amounts of small devices, the PDD shall document how the adequate training has been provided.

6. <u>Suppressed demand</u>

The project results in one or more of the following improvements:

(i) Increase in the food processed for preservation along with a decrease of products unharvested or wasted raw food and/or increased durability of the preserved food products:

Emissions from the entire quantity of food preserved in a project scenario are used to calculate the baseline emissions based on the energy intensity of the baseline food preservation process (GJ/tonne or MWh/tonne). All food preserved for consumption can be consumed locally and/or exported in line with applicability condition (3a). Please refer to Annex 3 for the requirements that need to be satisfied in order to claim suppressed demand emissions.

As the food is of varying moisture contents, the food processed should be considered on a Dry Mass (DM) or bone-dry (BD) basis.

(ii) Increase in nutritional intake throughout the year increasing food security above a defined level:

In circumstances where food aid is provided to the area and it can be demonstrated that there is a reduction of food aid as a direct result of food preservation OR where food security does not exist for part

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[5] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid25.pdf

*or all of the year (refer to sub-step 1 b, Annex 3), the incremental decrease in emissions associated with the preservation of local food that would have been utilized at the project site to a MSL (*2100 kcals per person per day) *can be included in the suppressed demand calculations. Under this scenario all food preserved for consumption should be consumed locally within the project boundary without any export outside the project boundary.*

II. Boundary

7. The project boundary includes the area within a 50 km radius of the project installation. Distances farther than 50km can be justified as being part of the project boundary on a case-by-case basis (this shall be discussed as part of the Local Stakeholder Consultation meeting).

The project boundary encompasses the physical, geographical location of all equipment and systems involved in the project activity as well as those affected by it. Among others, this includes:

a. The sites where operations for food preservation are performed (e.g. drying, cutting, cooking, freezing, refrigeration, etc.).

b. The sites delivering energy to the project activity (e.g. electricity grid, chiller plant, etc.).

8. Project activities might apply to single central facilities for food preservation (food processing and/or food storage), or activities using similar processes on different sites (e.g. small-scale processing and/or storage on farms). Activities implemented on different sites may be bundled together as long as the combined total emission reductions do not exceed 60 ktCO_2e per year.

9. Areas of cultivation/harvest of food products to be preserved are not included in the project boundary.

III. Baseline

<u>Baseline identification for food drying:</u>

1. The baseline scenario is identified as the most realistic combination of technology and fuel, which would have provided the desired service level taking into account the local circumstances (e.g. barriers).
2. When the pre-project situation which reflects energy poverty or lack of infrastructure (in this case the lack of access to heat/electrical energy, limited capacity of food preservation for crops, fruit and/or fish products) cannot be considered as the baseline scenario as it does not allow for a realistic comparison with the project service level, suppressed demand approaches may be considered.

Drying of agricultural products: The identified baseline is either the existing pre-project situation or the most common combination of technology and fuel for the considered thermal treatment found in the nearest range of the project area (refer guidance in section 24). For existing facilities, the pre-project situation can be applied as the baseline taking into account the manufacturer's data on specific power/energy consumption. The baseline fuel type could be used to determine the baseline fuel emission factor if 2-years of historic data is available, otherwise refer to section 24 of the methodology. For existing units in operation for more than 2 years, the emission factor shall be based on the average of the emission factor of all fuels used in that

period. In case of Greenfield projects, the guidance on specific power/energy consumption and fuel emission factors as given in section 24 should be followed.

Baseline identification for refrigerated warehouses:

Please refer to Annex 2.

IV. Emission reductions

10. The baseline emissions are calculated as follows:

$$BE_y = BE_{drying,k,j,y} + BE_{fr,j,y} + BE_{pp,n,k,j,y} \quad \textbf{(1)}$$

Where:

$BE_{drying,k,j,y}$	Baseline emissions for food drying of product *k* at site *j* in year *y* (tCO_2/year)
$BE_{fr,j,y}$	Baseline emissions for freezing and/or refrigeration of food at site *j* in year *y* (tCO_2/year)
$BE_{pp,n,k,j,y}$	Baseline emissions for the food preservation process *n* of product *k* at location *j* in year *y* (tCO_2/year)

11. Baseline emissions related to the case of food security suppressed demand can explicitly be taken into account. These are emissions, which would have occurred for the same contribution to food security at the household, community, regional or national level. These emissions are determined in accordance with the procedure described in Annex 3.

12. Baseline emissions for food drying in year y are calculated as follows:

1) Baseline emissions for food drying

$$BE_{drying,k,j,y} = BE_{EL,k,j,y} + BE_{heat,k,j,y} \quad \textbf{(2)}$$

Where:

$BE_{drying,k,j,y}$	Baseline emissions for food drying of product k at site j in year y (tCO_2/year)
$BE_{EL,k,j,y}$	Baseline emissions from the power consumption for food drying process k at site j in year y (tCO_2/year)
$BE_{,heat,k,j,y}$	Baseline emissions from the heat consumption for food drying process k at site j (tCO_2/year)

13. Baseline emissions from the power consumption for food drying process at site j in year y ($BE_{power,k,j,y}$) are calculated as follows:

$$BE_{EL,k,j,y} = SEC_{BL,drying,k,j} * (1 + TDL_y) * EF_{EL,drying,j} * Q_{P,k,j,y,el} \quad \textbf{(3)}$$

Where:

$BE_{EL,,k,j,y}$ Baseline emissions from the power consumption for food drying process *k* at site j in year y (tCO_2/year)

$SEC_{BL,drying,k,j,}$ Specific baseline electricity consumption for drying fruit, crops or fish product *k* at site *j* (MWh/tonne)

$EF_{EL,drying,j}$ Emission factor for electricity generation for drying for source *j* (tCO_2/MWh)

TDL_y Transmission and distribution losses in year y

$Q_{P,k,j,y,el}$ Project quantity of agricultural product *k* at site *j* in year y (tonne/year) dried using power

Please take into consideration the guidance above in the 'suppressed demand' section while calculating baseline emission based on project quantity of food preserved according to the suppressed demand situation. For the quantity of preserved food under suppressed demand due to lack of food security, please refer Annex 3.

Baseline emissions from the heat consumption for food drying process at site j in year y ($BE_{heat,k,j,y}$) are calculated as follows:

$$BE_{heat,k,j,y} = \sum_{k,j} (Q_{p,k,j,y,heat}) * SFC_{BL,dryingk,j} * ((\sum_{j,k} \%WB_{BL,j} * NCV_{WB} * f_{NRB,y} * EF_{BL\_WB}) + (\sum_{FF,j,i,k} (FF_{BL,j}) * NCV_{FF,drying,BL,i} * EF_{FF,drying,BL,i})) \quad \textbf{(4)}$$

Where:

$BE_{heat,k,j,y}$ Baseline emissions from the heat consumption for food drying process *k* at site *j* (tCO_2/year)

$Q_{p,k,j,y,heat}$ Quantity of product *k* at site *j* in year y (tonnes/year) dried using heat

Please take into consideration the guidance above in the 'suppressed demand' section while calculating baseline emission based on project quantity of food preserved according to the suppressed demand situation. For the quantity of preserved food under suppressed demand due to lack of food security, please refer Annex 3.

$SFC_{BLdrying,k,I}$ Specific baseline fuel consumption for drying fruit, crops or fish product *k* at site *j* (GJ/tonne).

$\%WB_{BL}$ Share of woody biomass observed in the baseline for drying food product *k* at site *j* (%)

$FF_{BL,j}$ Share of fossil fuel observed in the baseline for drying food product k at site j (%)

NCV_{WB} Net calorific value of the non-renewable woody biomass or fossil fuels saved through energy efficiency improvements or fuel switching to a renewable fuel (GJ/tonne). The IPCC default for wood fuel, 15.6 GJ/tonne can be used.

$NCV_{FF,drying,BL,i}$ Net calorific value of fossil fuel i used in baseline in drying process (GJ/tonne).

$f_{NRB,y}$ Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable biomass using survey methods as per the guidance as provided by "Annex 1: Non-Renewable Biomass (NRB) Assessment" of The Gold Standard methodology "Technologies and Practices to Displace Decentralized Thermal Energy Consumption" following

either the quantitative NRB Assessment or the qualitative NRB Assessment or using most recently approved default values as published by UNFCCC[6]

$EF_{FF,drying,BL,i}$ CO_2 emission factor for the fossil fuel type *i* used in baseline in drying process (tCO_2/GJ).

EF_{BL_WB} Emission factor of non-renewable woody biomass (tCO_2/GJ); A default value of 0.0816 tCO_2/GJ can be used for biomass.

In order to facilitate projects, a default value for the specific heat consumption for the drying of crops, fruit, fish or other crop drying is provided in Annex 1 where further foods can be added in future. The drying of foods is one of the most common thermal processes for the preservation of agricultural products in Sub-Saharan Least Developed Countries (LDCs) and/or Low Income Countries (LICs).

2) Baseline emissions for refrigerated warehouses in year y are calculated as follows:

$$BE_{fr,j,y} = EC_{fr,j} * (1 + TDL_y) * EF_{EL,fr,j} \quad \textbf{(5)}$$

Where:

$BE_{fr,j,y}$ Baseline emissions for refrigerated food warehouses at site *j* in year *y* (tCO_2/year)

$EC_{fr,j,}$ Baseline electricity consumption for the refrigerated food warehouse at site *j* (MWh/year)

TDL_y Average annual technical grid losses (transmission and distribution) during year y for the grid serving the facility (fraction)

$EF_{EL,fr,j,}$ Emission factor for electricity generation for source j in year y (tCO_2/MWh)

14. $EC_{fr,j,y}$ shall be determined in accordance with the procedure described in Annex 2.

3) Baseline emissions for other preservation processes are calculated as follows:

$$BE_{pp,n,k,j,y} = \sum_n \sum_k \sum_j Q_{k,n,j,y} \{(SFC_{BL,n,k,j} * NCV_{BL,FF,n,k,j} * EF_{BL,FF,n,k,j}) + [SEC_{BL,n,k,j} * (1 + TDL_y) * EF_{BL,EL,n,k,j}]\} \quad \textbf{(6)}$$

15. Where:

$BE_{pp,n,k,i,y}$ Baseline emissions for the food preservation process *n* of product *k* at location *j* in year *y* (tCO_2/year)

$Q_{,k,n,j,y}$ Quantity of product *k* at location *j* treated in the food preservation process *n* in year *y* (tonne of product)

$SFC_{BL,n,k,j}$ Baseline specific fuel consumption for fuel used in the food preservation process *n* of product *k* at site *j* (tonne or m^3/tonne of product)

$NCV_{BL,FF,n,k,j}$ Net calorific value of the fossil fuel consumed in the food preservation process *n* of product *k* at site *j* in baseline (GJ/t)

[6] http://cdm.unfccc.int/DNA/fNRB/index.html

$EF_{BL,FF,n,k,j}$ CO_2 emission factor for the fossil fuel consumed in the food preservation process *n* of product *k* at site *j* in baseline (tCO_2/GJ)

$SEC_{BL,n,k,j}$ Specific baseline electricity consumption for the food preservation process *n* of product *k* at location *j* (MWh/tonne of product)

TDL_y Average annual technical grid losses (transmission and distribution) during year *y* for the grid serving the facility (fraction)

$EF_{BL,EL,n,k,j}$ Emission factor for electricity consumed in the food preservation process *n* of product *k* at site *j* in baseline (tCO_2/MWh)

For other food preservation processes, which have not been identified, a widely applicable formula is used in order to account for any possible energy related baseline emissions.

4) Baseline emissions accounting for suppressed demand for lack of food security (see annex 3)

Projects, which address the suppressed demand situation for lack of food security, should refer to the guidelines provided in Annex 3.

To determine whether target population in the project boundary are food stressed (i.e. nutrition is below the minimum service level), follow sub-step 1b, Annex 3.

Leakage

16. Leakages shall be considered in the following cases:

   a. If the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity;

   b. Emissions related to the operation of geothermal power plants installed by the project (e.g. non-condensable gases, electricity/fossil fuel consumption) – to be determined in accordance with the latest version of the approved methodology ACM0002;

   c. Emissions from water reservoirs of hydro power plants;

   d. Leakage shall be taken into account in cases where the project fuel is biomass and one of the following applies:

      i. It cannot be established that renewable biomass used in project activity is available in surplus

      ii. The biomass used leads to emissions for its processing or leads to methane emissions associated with its disposal

      iii. The biomass used is transported over a distance exceeding 200 km

   e. If all or part of the source of renewable energy in the project is plant oil and/or biodiesel, emissions related to the production of this fuel shall be taken into account in accordance with the calculation procedure for project and leakage emissions found respectively in AMS-III.T (for plant oil) and/or AMS-III.A.K (for biodiesel);

Project activity emissions

17. Project emissions from the use of fossil fuels either as a main source of energy or in a back-up system should be accounted for.

18. The project emissions due to consumption of fossil fuels and electricity can be calculated as follows:

$$PE_y = \sum_j \{(FC_{FF,i,j,y} * NCV_{FF,i,PJ} * EF_{FF,i,CO2,PJ}) + [EC_{PJ,j,y} * (1 + TDL_y) * EF_{EL,j,PJ}]\} \quad \textbf{(7)}$$

Where:

PE_y	Project emissions in the project activity in year *y* in tCO_2e
$FC_{FF,i,y}$	Amount of the fossil fuel type *i* consumed in the food preservation in the project activity in year *y* (mass or volume unit)
$NCV_{FF,i,PJ}$	Net calorific value of the fuel type *i* consumed in the food preservation in the project activity in year *y* (MJ/tonne)
$EF_{FF,i,CO2,PJ}$	CO_2 emission factor for the fossil fuel type *i* (CO_2/MJ)
$EC_{PJ,j,y}$	Quantity of grid electricity consumed by the project activity at site *j* in year *y* (MWh)
TDL_y	Average annual technical grid losses (transmission and distribution) during year *y* for the grid serving the facility (fraction)
$EF_{EL,j,PJ}$	Emission factor for electricity consumption by source *j* in year *y* (tCO_2/MWh)

V. Monitoring

19. If the equipment installed replaces existing equipment, the number and "power" of a representative sample of the replaced equipment shall be recorded in a way that allows for a physical verification by a designated operational entity (DOE).

20. When sampling is employed, the "Standard on sampling and surveys for CDM project activities and PoA"[7] shall be followed.

21. The applicable requirements (e.g. calibration) for the monitoring plan specified in the "General Guidelines for SSC CDM methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participant.

<u>Representative sampling methods</u>

22. A statistically valid sample of the locations where the systems are deployed, with consideration, in the sampling design, of occupancy and demographic differences can be used to determine parameter values used to determine emission reductions, as per the relevant requirements for sampling in the "General

[7] http://cdm.unfccc.int/Reference/Standards/meth/meth_stan05.pdf

guidelines for sampling and surveys for small-scale CDM project activities". When biennial inspection is chosen, a 95% confidence interval and a 5% margin of error requirement shall be achieved for the sampling parameter. On the other hand when the project proponent chooses to inspect annually, a 90% confidence interval and a 10% margin of error requirement shall be achieved for the sampled parameters. In cases where survey results indicate that 90/10 precision or 95/5 precision is not achieved, the lower bound of a 90% or 95% confidence interval of the parameter value may be chosen as an alternative to repeating the survey.

23. For establishing the baseline specific electricity and fuel emission factor of newly established facilities, unless a conservative benchmark is available, project proponents shall document the technical specification of the equipment and systems displaced or equipment/systems that would otherwise have been built.

24. For guidance to determine SFC_{BL} and SEC_{BL}

If available, data from publically available literature relevant for the host country shall be used. Otherwise a survey/sampling method shall be applied taking into account the following guidance:

The survey shall be conducted within the nearest food preservation facility to where the project is situated.

At least 5 existing plants/processes/facilities that have similar circumstances for the type of treatment of food and result in similar quantity (+/-50%) and the same or better quality $Qual_P > Qual_{BL}$ (where moisture content can be used as a proxy for drying quality) shall be included.

Values shall be determined for the preservation processes based on the following:

- Manufacturer/design information;
- Independent third party/expert information;
- Measurements applying national or international norms or standards if available;
- The average of all data shall be used;
- The result (i.e. the average) shall be multiplied by 0.89 to account for associated uncertainties;

Furthermore the guidance for sampling as described below shall be taken into account.

25. Monitoring shall consists of:

Metering of all the relevant parameters should be as per Table 1 and 2

26. In the case of project activities involving several facilities, the monitoring procedure as described above shall apply for each facility.

27. Relevant parameters shall be monitored as indicated in the Table 1 below. The applicable requirements specified in the "General Guidelines to SSC CDM methodologies" (e.g. calibration requirements, sampling requirements) are also an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participants.

28. Table 1: Parameters to be monitored

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
1.	$FC_{FF,i,j,y}$	Amount of the fossil fuel type *i* consumed in the food preservation at site *j* in the project activity in year *y*	Mass or volume unit	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
2.	$EF_{FF,i,CO2,PJ}$	CO_2 emission factor for the fossil fuel i used in project	tCO_2/MJ	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
3.	$EF_{EL,j,PJ}$	Emission factor for electricity consumption by source *j* in project activity	tCO_2/MWh	As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or the latest version of the approved methodology AM0103.	As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or the latest version of the approved methodology AM0103.
4.	$EC_{PJ,j,y}$	Quantity of grid electricity consumed by the project activity at site *j* in year *y*	MWh/y	Continuous monitoring, integrated hourly and at least monthly recording	Measurements are undertaken using calibrated energy meters
5.	TDL_y	Average annual technical grid losses (transmission and distribution) during year *y* for the grid fraction	%	Annually	This value shall be determined in accordance with the procedures described in the most recent version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
6.	$Q_{,k,n,j,y}$	Quantity of product *k* at location *j* treated using other food preservation process *n* in year *y*	Tonne of product per year	Annually	Weight based measurement
7.	$SFC_{BL,drying,k,i}$	Specific baseline fuel consumption for drying fruit, crops or fish product *k* at site *j.*	GJ/tonne	Once ex-ante	The value is to be established on representative samples. In the case of Mango drying for food security a default of 17MJ/person/day can be used (see annex 1)
8.	$\%WB_{BL,i,j}$	Share of woody biomass observed in the baseline for drying food product *k* at site *j* (%)	(-)	Once ex-ante	The value is to be established based on representative samples
9.	$f_{NRB,y}$	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable biomass	%	Once ex-ante	Survey methods or default values published by GS, UNFCCC, or National Governments
11.	$Qual_{BL\&P}$	The project and baseline moisture content of dried foods	% water	Prior to and monthly during project	Laboratory tests

No.	**Parameter**	**Description**	**Unit**	**Monitoring/recording Frequency**	**Measurement Methods and Procedures**
12.	$SEC_{BL,drying,k,j}$	Specific baseline electricity consumption for drying product *k* at site *j*	MWh/tonne	Once ex-ante	As per guidance given in section 24
13.	$Q_{P,k,j,y,el}$	Project quantity of product *k* at site *j* in year y from food drying using electricity	Tones of product per year	Annually	Weight based measurement
14.	NCV_{WB}	Net calorific value of the non-renewable woody biomass	GJ/tonne	-	The IPCC default for wood fuel, 15.6 GJ/tonne can be used
15.	$FF_{BL,j}$ (%)	Share of fossil fuel observed in the baseline for drying food product k at site j	%	Once ex-ante	The value is to be established based on representative samples
16.	$NCV_{BL,FF,n,k,j}$	Net calorific value of fossil fuel used in baseline food preservation process *n* of product *k* at site *j*	GJ/tonne	Annually	IPCC default values
17.	$SFC_{FF,n,k,j,BL,y}$	Baseline specific fuel consumption for fuel *i* used in the food preservation process *n* of product *k* at site *j*	tonne or m^3 / tonne of product	Once ex-ante	As per guidance given in section 24

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
18.	$NCV_{FF,i,PJ}$	Net calorific value of the fuel i consumed in the food preservation at site *j* in the project activity in year *y*	GJ/tonne	Annually	IPCC default values
19.	$SEC_{BL,n,k,j}$	Specific baseline electricity consumption for the food preservation process *n* of product *k* at location *j*	MWh/tonne of product	Once ex-ante	As per guidance given in section 24
20.	EF_{BL_WB}	Emission factor of non-renewable woody biomass	tCO_2/GJ	-	A default value of 0.0816 tCO_2/GJ can be used for biomass.
21.	$EF_{FF,BL,drying,j}$	CO_2 emission factor for the baseline fossil fuel used for food drying	tCO_2/MJ	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
22.	$NCV_{FF,drying,BL,j}$	Net calorific value of the baseline fossil fuel used for food drying	GJ/tonne	Annually	IPCC default values

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
23.	$EF_{BL,FF,n,k,j}$	CO_2 emission factor for the fossil fuel type *i* consumed in the food preservation process *n* of product *k* at site *j*	tCO_2/GJ	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
24.	$Q_{P,k,j,y,heat}$	Project quantity of product *k* at site *j* in year y from food drying using heat	Tones of product per year	Annually	Weight based measurement
25.	$EC_{fr,j,}$	Baseline electricity consumption for the refrigerated food warehouse at site *j* in year *y*	MWh/year	As per Annex 2	As per Annex 2
26.	$EF_{BL,EL,n,k,j}$	Emission factor for electricity consumed in the food preservation process *n* of product *k* at site *j* in baseline	$t\ CO_2/MWh$	As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or the latest version of the approved methodology AM0103.	As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or the latest version of the approved methodology AM0103.

Project activity under a Programme of Activities (PoA)

30. The methodology is applicable to a Programme of Activities, no additional leakage estimations are necessary other than that indicated under the leakage section above.

Annex 1

BASELINE DATA FOR FOOD DRYING

The table below lists food types and specifications relating to the raw or dried food and its nutrition values. The table draws from references located at the time of drafting the methodology and is the start of a data base for the inclusion of further food, differentiation of different crop, fruit, fish and nut types, required specifications, etc. This data and those recorded and verified in the field can be added to extend it.

Food type	Moisture content of fresh food (%)	Moisture content of "dry" food (%)	Specific heat consumption to dry in typical growing climate (MJ/kg fresh)	Nutritional density kcal/100 g raw	Energy required to dry fruit that is equivalent to 1800 kcals (MJ)
Mango	84% (7)	15 (14) - 22% (12)	4.68	64.8 (1) 60 – 79 (2)	14.4
Corn/Maize (kernels)	70% (9)			86 (4)(5)	
Banana	70% (13) 75% (6)-76% (7)			88 (7) -95 (1)	
Fish	80% (8)			100 – 200 (3)	
Pineapple	84% (7)			45 (1)- 50.3 (2)(7)	
Cashews	5-14% (10)			575 (3)	
Peanuts Crop type Fruit type Fish type Nut type Etc.	4-10% (11)			395 (3)	

References cited in the table:

1: kcal/100g fresh: http://www.secretsofhealthyeating.com/calories-in-fruit.html
2: kcal/100g fresh: http://en.wikipedia.org/wiki/Mango
3: kcal/100g fresh: http://www.healthyeatingclub.com/info/books-phds/books/foodfacts/html/data/data2a.html
4: http://www.nutrition-and-you.com/sweet-corn.html
5: http://en.wikipedia.org/wiki/Maize
6: http://wiki.answers.com/Q/What_percent_of_a_banana_is_water
7: http://www.thefruitpages.com/contents.shtml
8: http://wiki.answers.com/Q/What_percentage_of_water_is_in_a_fish
9: http://gardeningfromthegroundup.us/Sweet%20Corn.htm
10: http://www.kalbavicashews.com/raw_cashews.html

11: http://www.tis-gdv.de/tis_e/quellen/quellen.htm (ref: 1)
12: http://www.safruitfarms.com/Default.aspx?tabid=400
13: *www.idosi.org/wjas/wjas5(4)/11.pdf*
Simple Solar Drying System for Banana Fruit
A.A. Hassanain, World Journal of Agricultural Sciences 5 (4): 446-455, 2009 ISSN 1817-3047 © IDOSI Publications, 2009
14: www.unece.org/fileadmin/DAM/.../DriedMangoes_postsession.pdf
*15: www.infra.kth.se/fms/pdf/**energy**use.pdf*

Annex on food drying from above article

Drying is also a process for which there are relatively many observations. The theoretical value for evaporating one kg of water is 2.26 MJ. According to Pimentel (1996) who writes that the real energy use is 2-6 times higher than that, or 5.2-15.6 MJ. This statement can be compared to the other data reported on energy use per kg of water evaporated in Table 1.9, Appendix 6. From these data, it seems that the real energy use is 2-3 times the theoretical value proposed by Pimentel. The energy use per kg of dry crop (Table 1.10, Appendix 6) depends, of course, on the water content before and after drying. One example is 6.4 MJ per kg of output for drying beet pulp from 80 % to 10 % moisture content. Another example is 0.47 MJ per kg of output for drying soybeans from 17 % to 11 % moisture content. Five observations of manufacturing of potato flakes and granules tell that 15-42 MJ per kg of output may be used for these processes. For every kg of potato flakes, 5.3 kg of potatoes are needed. 10 Potatoes usually contain 0.75-0.78 kg of water per kg and dried mashed potatoes about 0.07 kg of water per kg. As 3.6-3.8 kg of water has to be evaporated for every kg of dry potatoes produced, energy use for drying potatoes only may be in the order 19-20 MJ per kg potato flakes.

*Ref: www.infra.kth.se/fms/pdf/**energy**use.pdf*

Sample calculation of heat required for drying to provide 1800kcal per person per day (taking storage losses into account)

The drying of mango requires the removal of water from the flesh of the mango. Heat is required to evaporate the water. The mango is pealed and sliced and fed into the drier.

$$E_{drying,mango} = E_{lhevap} * 1/\eta_{drying} * (MC_{rawmango} - MC_{drymango})$$

where:

$E_{drying,mango}$	=	Energy required to dry crops, in this case mango, from raw to dry (MJ/kg raw mango)
E_{lhevap}	=	Latent heat of evaporation of water in (MJ/kg) use 2.26MJ/kg
η_{drying}	=	The efficient of drying crops is from 0.16 to 0.5 depending upon the size of the material to be dried, the humidity of air, the insulation of the drier (fraction or %) in this case 0.33 is used. Drying is also a process for which there are relatively many observations. The theoretical value for evaporating one kg of water is 2.26 MJ according to

		Pimentel (1996) who also writes that the real energy use is 2-6 times higher than that, or 5.2-15.6 MJ/kg. This statement can be compared to the other data reported on energy use per kg of water evaporated in Table 1.9, Appendix 6. From these data, it seems that the real energy use is 2-3 times the theoretical value proposed by Pimentel. The energy use per kg of dry crop (Table 1.10, Appendix 6) depends, of course, on the water content before and after drying. One example is 6.4 MJ per kg of output for drying beet pulp from 80 % to 10 % moisture content. Another example is 0.47 MJ per kg of output for drying soybeans from 17 % to 11 % moisture content. Five observations of manufacturing of potato flakes and granules tell that 15-42 MJ per kg of output may be used for these processes. For every kg of potato flakes, 5.3 kg of potatoes are needed. 10 Potatoes usually contain 0.75-0.78 kg of water per kg and dried mashed potatoes about 0.07 kg of water per kg. As 3.6-3.8 kg of water has to be evaporated for every kg of dry potatoes produced, energy use for drying potatoes only may be in the order 19-20 MJ per kg potato flakes.
$MC_{rawmango}$	=	Moisture content of raw crop (%), in this case mango use 84%
$MC_{drymango}$	=	Moisture content of dry crop (%), in this case mango use 15%

$$SFC_{BL,mango,j} = 2.26 MJ/kgwater * 1/0.33 * (0.84 - 0.15)$$

For baseline calculations Specific baseline Fuel Consumption for mangos.

$$SFC_{BL,mango,j} = 4.68 GJ/tonne$$

Heat required to provide the minimum service level of 1800kcals/person/day

$$E_{1800kcal,mango} = E_{drying,mango} / N_{raw,mango} * 1800kcal$$

where:

$E_{1800kcal,mango}$	=	Energy required to dry 1800kcal of mango to 15% moisture content
$E_{drying,mango}$	=	Energy required to dry crops in this case mango from raw to dry (MJ/kg raw mango)
$N_{raw,mango}$	=	Nutrition value of raw mango (kcal/kg) the range is from 600 to 790kcal/kg raw mango depending upon type. Use 700kcal/kg

$$E_{1800kcal,mango} = 4.68 MJ/kg / 700 kcal/kg * 1800kcal$$
$$E_{1800kcal,mango} = 12.0 MJ$$

To provide sufficient lasting nutrition take into account the storage losses.

$$E_{MSL,mango} = E_{1800kcal,mango} * SL_{driedfood}$$

$E_{MSL,mango}$	=	Energy required to provide Minimum Service Level dry mango of 1800kcal of ray mango to 15% moisture content
$SL_{driedfood}$	=	Storage losses due to molding or pest infestation etc. can be between 10% and 30% (ref: Floyd Dowell, 2012, Storage Solutions to Improve Food Security for Small Farmers, USDA ARS Center for Grain and Animal Health Research Manhattan, Kansas, 2012.) In this case 20% is utilized

$$E_{MSL,mango} = 14.4MJ$$

If non-renewable biomass is used for drying the following emissions are calculated:

$$BE_{heat,MSL,j} = E_{MSL,mango} * EF_{BL,WB}$$

Where:

$BE_{heat,MSL,j}$	=	Baseline emissions for the heat provided in thermal processing of a minimum service level of mango at site *j* (tCO_2/year)
$EF_{BL,WB}$	=	Emission factor of non-renewable woody biomass (tCO_2/TJ); A default value of 81.6 tCO_2/TJ can be used for biomass

$$BE_{drying,MSL,j} = 14.4MJ * 81.6 tonneCO_2 / TJ$$

$BE_{drying,MSL,j} = 0.66 gramsCO_2 / kcal$ per 1800kcal mango or

$$BE_{drying,MSL,j} = 0.66 gramsCO_2 / kcal$$

Annex 2

GUIDELINES FOR DETERMINING THE BASELINE SPECIFIC ENERGY CONSUMPTION (SEC) FOR REFRIGERATED FOOD STORAGE

For projects which consist of renewable energy technology(ies) and/or energy efficiency improvements to provide all or part of the energy required to operate refrigerated food storage, the baseline specific electricity consumption can be determined using one of the following approaches:

Case 1: Retrofitting or replacement at an existing refrigerated food storage

The baseline is the continued use of an existing system and where the system must have been in operation for at least two years prior to the start date of the project activity. If data for SEC over the last 2 years cannot be presented, the benchmarks could be used instead if it can be demonstrated that its use is more conservative than the performance recorded for the available X (less than 2) years of historical data. In this case, the baseline electricity consumption is calculated as follows:

$$EC_{fr,j} = AVG\left(EC_{fr,j,y=n}; EC_{fr,j,y=n-1}\right) \quad \textbf{(8)}$$

Where:

$EC_{fr,j}$	Baseline electricity consumption for the refrigerated food storage at site *j* (MWh/year).
$EC_{fr,j,y=n}$	Baseline electricity consumption for the refrigerated food storage at site *j* in year *y=n* (MWh/t food product or MWh/m^3). This value should include electricity for service such as light but should exclude auxiliary services such as the electricity consumption from associated offices and forklifts. In the case when electricity for associated offices and forklifts is included, a discount of 10% should be applied on the historical value of $EC_{fr,j,y}$.

Case 2: New refrigerated food storage.

The baseline electricity consumption for new refrigerated food storage shall be determined as either:

$$EC_{fr,j} = SEC_{fr,BL,j} * Sto \quad \textbf{(9)}$$

or

$$EC_{fr,j,y} = EC_{fr,PJ,j,y} \quad \textbf{(10)}$$

The present methodology offers the possibility to determine the specific power consumption either (i) based on hypothetical values or (ii) based on the real measured power consumption in the project. Option (ii) might be of interest to projects, which do not seek any increase in energy efficiency but instead rely on electricity from electricity from renewable sources.

Where:

$EC_{fr,j}$	Baseline electricity consumption for the refrigerated food storage at site *j* in year *y* (MWh/year).
$SEC_{fr,BL,j}$	Baseline specific electricity consumption for the refrigerated food storage at site *j* (MWh/m^3). This value should include electricity for service such as light but should exclude auxiliary services such as the electricity consumption from associated offices and forklifts. In the case when electricity for associated offices and forklifts is included, a discount of 10% should be deducted from the historical value of $SEC_{fr,j,y}$.
Sto	Total refrigerated volume of the food at site *j* (m^3). *Please into consideration the guidance above in 'suppressed demand' section while calculating baseline emission based on project quantity of food preserved according to the suppressed demand situation. For the quantity of preserved food under suppressed demand due to lack of food security, please refer Annex 3.*
$EC_{fr,PJ,j,y}$	Measured project electricity consumption for the refrigerated food storage at site *j* in year *y* (MWh/year).

Where $SEC_{fr,BL,j}$ is determined according to one of the options 1 to 3 presented in the table below:

<table>
<tr><td>Option</td><td></td></tr>
<tr><td rowspan="3">1</td><td>Determination on a project-specific basis</td></tr>
<tr><td>SEC_{fr,BL,j,y} determined on a project specific basis based on reference refrigerated food storage facility(ies)</td></tr>
<tr><td>The baseline specific electricity consumption shall be based on reference refrigerated food storage facility(ies) representative of the common practice for similar capacity, in similar circumstances (same country or region as the project; same climatic conditions; similar operation, etc.) built over the last 2 years.

In cases where no such plant exists within the region, the reference plant should be based on:

i) plants built over the last 5 years; or

ii) other economically attractive technology and fuel types identified among those which provide the same service, that are technologically available, and that are in compliance with relevant regulations. The efficiency of the technology should be selected in a conservative manner, i.e. where several technologies could be used and are similarly economically attractive, the most efficient technology should be defined as the baseline scenario. In addition, the least carbon intensive fuel type should be chosen in case of multiple fuels being possible choices.

iii) Where the project is a Greenfield project, 2 years of data can be gathered from an existing system supplying the same service in the same region/area/climate zone, of smaller/lower volume/throughput, preserving the same food and using the same</td></tr>
</table>

	fuel/energy carrier, The identification of the reference refrigerated storage facility(ies) should exclude plants implemented as CDM project activities. Adapted from AMS-II.K
2	***Conservative default value for refrigerate storage facilities of more than 250m³***
	$SEC_{fr,BL,j,y}$=0.080 MWh/m^3/yr
	It should be proven – based on at least 6 representative months – that the use of the default is more conservative than the actual observed performance. This simple value is proposed as the simple and most conservative value, which can be derived from equation 3. For the justification of the value, please refer to the justification section on the use of option 3. Default data for smaller refrigeration systems should be presented by project participants from verified literature.
3	***Volume-adjusted value for refrigerate storage facilities of more than 250m³***
	$SEC_{fr,BL,j,y} = MIN\left(0.038978 * (Sto * 35.13)^{-0.2275} - 0.0001581 * 35.13 \quad ; \quad 0.080\right)$ in MWh/m^3/yr
	The proposed value is taken from the study prepared for the California Energy Commission/ Public Interest Energy Research Program, which reviewed levels of energy efficiency for 42 food frozen warehouses. The smallest of the warehouses in the sample on which regression analysis was undertaken was 9000 ft^3 equivalent to 350m^3. The value selected is the typical SEC derived from the regression analysis. – The value is capped at 0.080 MWh/m3/yr in order for values for small scale refrigerated storage facilities to still be realistic and conservative, in accordance with observation on Figure 1: *Specific Electricity Consumption (SEC) of refrigerated warehouses operating in New Zealand, UK, Netherlands and US.* – The value derived from California is conservative for the following reasons: (i) California has higher energy prices leading to a higher level of the technical economic optimum energy efficiency (ii) California has a pro-active energy efficiency policy leading to a real measured level of energy efficiency being closer to the technical economic optimum; (iii) The sites considered in California have a quite low “annually averaged temperature” around 15-16°C (see Table 3: Effect of four locations on SEC) while most developing countries in which projects will be implemented have a much higher annually averaged temperature – leading to a higher temperature differential – and lower efficiency of chillers to be used. – The value selected is adequate for warehouses in which all of the wares (foodstuff) are brought at a higher temperature than the refrigeration temperature. – Overall the value is lower than values found in other publications.

	Sources used: 2. California Energy Commission (2008), Energy Benchmarking of Warehouses for Frozen Foods, Department of Biological and Agricultural Engineering, University of California, Davis, CA 95616, United States. 3. California Energy Commission (2008), Benchmarking Study of the Refrigerated Warehousing Industry Sector in California, Department of Biological and Agricultural Engineering, University of California, Davis, CA 95616, United States.

Annex 3

GUIDELINE ON ACCOUNTING FOR SUPPRESSED DEMAND FOR FOOD NUTRITION AND/OR SHORTFALLS IN EXPORT DEMAND

Objective: The objective of this guideline is to allow for the adequate determination of the baseline emissions associated with a situation of suppressed demand. This is done in the following steps:

- Step 1: Procedure to determine cases of Suppressed Demand
  - Sub-step 1a: Definition of the Suppressed Demand
  - Sub-step 1b: Identification of situation of Suppressed Demand
  - Sub-step 1c: Evaluation whether the project addresses Suppressed Demand

- Step 2: Determination of the quantity to consider in Suppressed Demand

- Step 3: Calculation of the "Baseline emissions for the food security suppressed demand" ($BE_{FS,SD,y}$)
  - Sub-step 3a: Determine the most likely type of food, which would have been consumed instead
  - Sub-step 3b: Calculation

Step 1: Procedure to determine cases of Suppressed Demand

Sub- step 1a: Definition of Suppressed Demand

Type of suppressed demand: The considered type of suppressed demand is the lack of food security and/or where food preservation technology (if any) is insufficient to achieve adequate quantity or quality to address local needs and demands outside of the project.

Definition of food security: "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life".

Sub-step 1.b: Identification of situation of Suppressed Demand

A suppressed demand for food exists where food security does not exist for part or all of the year for the identified area in which the project is included. Project proponents shall therefore

(a) Select the geographic area in which the lack of food or food insecurity is to be determined
(b) Select an approach to demonstrate suppressed demand in the geographic area

(a) Selection of the geographic area in which the lack of the food security is to be determined
Among others, project proponents shall select one of the following geographic areas:

G1: Single country

G2: Province (or group of provinces) within the country

G3: Any other nationally defined administrative sub-division of the country

G4: A community whose geographic scope is determined unambiguously by the project proponent

(b) Selection of the approach to demonstrate the situation of suppressed demand

Among others, project proponents shall use one of the following approaches to establish suppressed demand in the geographic area:

D1: By establishing that the country scores below 35 points on the GFS (Global Food Security) index[8] at the time of validation of activity or programme, in any of the last 3 years. This can be established at a national, sub-national or project area level or by establishing a prevalence of undernourishment higher than 25% on the basis of FAO data. The threshold used for defining undernourishment shall be the MDER[9] (Minimum Dietary Energy Requirement) expressed in kcal/person/day. This can be done at a national or project level; or

D2: If the host country has made an appeal to the International Federation of Red Cross and Red Crescent Societies on prevalence of under-nourishment in last 3 years; or

D3: By establishing that the area ranks as "phase 2 (Stressed)" or higher on the IPC (Integrated food security Phase Classification), using the latest data[10], a survey conducted by the project participant or one or more existing secondary reliable or peer reviewed studies.

Sub-step 1c: Evaluation whether the project addresses suppressed demand

To demonstrate that the food security suppressed demand is addressed; projects would need to demonstrate that an increased amount of food is available for later consumption on one of the following bases:

A1: The project exports food resulting to an accumulation of currency reserves for the specific sake of food imports in periods of food shortage.

A2: The project applies a food preservation process to a defined quantity of food products to which no preservation process was applied in the pre-project situation, resulting in the decay of the foods. Such projects may include the expansion of the preservation capacity (quantity of food treated for

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[8] Many countries and areas within countries are prone to shortfalls in food at certain times and those are identified in the food security indices ref: http://foodsecurityindex.eiu.com/Index.
The Global Food Security (GFS) index ranks countries with respect to food security. The index is an aggregation of availability, affordability, quality and safety of food. Food security refers to a household's physical and economic access to sufficient, safe, and nutritious food that fulfils the dietary needs and food preferences of that household for living an active and healthy life (ref: FAO Agricultural and Development Economics Division (June 2006). Food Security. Retrieved June 8, 2012.)
These countries are eligible as are areas in countries where the shortfall exists. To address food security on a daily basis will require 3 to 4 months reserve (ref: http://www.fao.org/docrep/W4979E/w4979e0a.htm#size of reserve)) as a priority, but also to address preserved food for trade (including export).
For the sake of this methodology, any country scoring below 35 points on the GFS index is food insecure and projects or programmes in these countries has claim to emissions reductions in reducing the suppressed demand for food.

[9] The MDER (Minimum Dietary Energy Requirement) for the relevant country – as well as the prevalence of undernourishment on the basis of FAO data can be retrieved at: http://www.fao.org/economic/ess/ess-fs/fs-data/ess-fadata/en/

[10] The IPC scale and data can be retried from: http://www.fews.net/ml/en/info/pages/scale.aspx. The selected value of "scale 2" corresponds to the following defined criteria: "For at least 20 percent of households, food consumption is reduced but minimally adequate without having to engage in irreversible coping strategies. These households cannot fully meet livelihoods protection needs"

consumption at a later date) or in the preservation of types of food products to which no preservation process was previously applied.

A3: The project prolongs the food storage (as defined in the methodology) in terms of improved quality of the preservation over time. This reduces food storage wastes[11] (as defined in the methodology).

Explanation: the methodology includes expanding food preservation specifically by refrigeration volumes and/or drying capacity. The food product outputs may require different quality standards for local use and export markets. Relevant to preserved food availability is the quality of preserved food storage in terms of temperature for refrigeration and in terms of dust, insect, rodent etc. free dry storage for dried foods.

The following is relevant to the nutrition service level that the methodology addresses:

1. Fresh food for local consumption at the time of harvest (crops and fruit) and catching fish.
2. Food that is preserved to be consumed at times when there is no fresh food available with some local community level trade.
3. Food that is preserved for export from community, area, or country.

There is no preservation in (1) there will be preservation in (2) and (3). In the case where food is preserved exclusively for local consumption (2) a minimum service level of the minimum nutrition values shall be utilized as a default value in the calculation of energy required for drying and/or refrigeration. In the case where food is exported (3) an ex-post approach to emissions calculations in the baseline shall be utilized using either the actual energy utilized or the monitored quantity of food (either dried or raw) or default values for food preservation energy intensities.

The project leads to an increase in the food available by improving its preservation: Increased quality and quantity of food preserved will result in reducing suppressed demand for food in the pre-project situation or increasing dry or refrigerated food available either for local consumption or for trade. Two options present themselves

a) Either the quantity of food which was previously left to decay without any transformation for later use undergoes a preservation process; or

b) The quality of preservation of a food type is improved compared to pre-project situation leading to an overall larger consumption (less waste of food in storage)

For (a) The extra preservation of food can contribute to reducing the suppressed demand in local consumption of food, or can be preserved for trade (including export), which may require different specifications including moisture content and/or lower temperature.

For (b) the improved quality of preserved food will result in preserved food stocks lasting longer and being of a quality that makes the preserved food acceptable to export markets. Current preserved food losses are in the region of 10 to 30%, which implies more food needs to be produced to achieve proximity to food security.

[11] FAO definition: Amount of the commodity in question lost through wastage (waste) during the year at all stages between the level at which production is recorded and the household, i.e. storage and transportation. Losses occurring before and during harvest are excluded

Improved preservation and storage will reduce food losses due to rehydration and decay of dried food. Improved storage and refrigeration will also reduce losses due to insect and rodent infestation. The prolonged availability of food will contribute to reducing the suppressed demand in local consumption of food, or can result in increased trade (including export). Fewer losses will result in fewer emissions incurred in the drying process.

Step 2: Determination of the quantity to consider in the suppressed demand ***for the scenario with lack of food security in baseline situation***

The quantity to consider in the suppressed demand should correspond to food required to meet the desired nutrition value (2100kcal/person/day).

Step 3: Calculation of the "Baseline emissions for the food security suppressed demand"

Sub- step 3a: Determine the most likely type of food, which would have been consumed instead

Key components of the World Food Programme (WFP) food basket are: "a staple such as wheat flour or rice; lentils, chickpeas or other pulses; vegetable oil (fortified with vitamin A and D); sugar; and iodised salt. Often these are complemented with special blended foods, such as Corn Soya Blend, that have been fortified with important micronutrients." (ref: https://www.wfp.org/nutrition/WFP-foodbasket). The Sphere Minimum Standard for nutrition can be found at http://www.spherehandbook.org/en/appendix-6/.

The method to determine which food would have made up the shortfall in nutrition is to request local food aid agents to provide information on the types, quantity, quality, nutritional content, density and moisture content of food aid sent to the region of the project site. This typically would be a food basket of various components such as cereals, pulses, vegetable oil, corn/soya blends, sugar, salt etc. see sphere minimum standard ref: http://www.spherehandbook.org/en/appendix-6/. The project participant may make use of the energy and/or GHG intensity of the basket. A conservative default may be used where the energy/GHG intensity is that for the same nutrition value (1800 to 2300kCal/person/day) for the preservation of the primary food source in the project area. See table below.

The nutrition value, moisture content and density will allow for the emissions to be calculated on the basis of nutrition value (the default approach is where the shortfall is made up of local food production)

The table below provides an example of some typical food aid types:

Table 1: typical food aid specifications

Crop type	Emissions Intensity per unit of dry mass (EI_k) tCO$_2$e/tonne dry mass	Nutritional density kCal/tonne dry mass $*10^6$	Moisture content (1 year) stored for transportation % m/m	Emissions intensity per nutrition unit (EI_k) tCO$_2$e/kcal$*10^{-6}$	Density for transportation (if volumes are required) tonnes/m$^3*10^{-3}$
Winter wheat	0.6 (1)	3.59 (4)	13 (2)	0.17	673-769 (5)
Corn	0.48 (1)	4.15 (4)	13 (2)	0.12	760 (5)
Rice		3.81 (4)	13 (2)		577-753 (5)
Soya (1)	0.38 (1)	4.59 (4)	6-8 (3)	0.08	753 (5)

References cited in table:

Ref 1. http://www.sciencedirect.com/science/article/pii/S097308261000013X
2. http://books.google.co.za/books?id=qx-BaufhXKoC&pg=PA23&lpg=PA23&dq=moisture+content+of+corn,+rice,+wheat&source=bl&ots=X3T3ENl3Qf&sig=B1ClbbBd0Xc2Yd9uvbWyCToYstk&hl=en&sa=X&ei=uTdoUKCsKcmShgfVmIDwAw&ved=0CF8Q6AEwCQ#v=onepage&q=moisture%20content%20of%20corn%2C%20rice%2C%20wheat&f=false
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