PoA Case Study 3 – Sampling

Guidance to carry out the case study

- Read the relevant information on the PoA and the reference regulatory documents provided for the case study.
- After reading the documents, discuss the questions asked within your group and then try to answer them individually.
- A plenary discussion will follow where selected members of your group can present your results.
- The facilitators will comment on your results and compare them with the ones suggested by the UNFCCC secretariat.

Case Study 3a

- **Brief description of the PoA**

The objective of the PoA is to replace, approximately 30 million household incandescent lamps, with equal number of energy efficient, self ballasted, compact fluorescent lamps (CFLs), of same or higher lumen output with a minimum expected rated life time of around 8,000 hours. Each CPA within the PoA will install 420,000 CFLs.

As per the applied methodology AMS II.J version 4, the post-installation survey will be undertaken to determine the number of CFLs that are still in operation within one year of CFL installation and the subsequent random sample surveys will likely be undertaken in the fourth and seventh years after installation of CFLs.

Considering the large number of installations of 420,000 CFLs under a single SSC-CPA, statistical sampling is a necessary tool to determine the parameter (failure rate of the CFLs).

Below, the number of project CFLs that are still in operation in the fourth year will be calculated with the following assumptions:

Assumptions:
- 1 household = 1 CFL
- The population is homogenous with respect to the continued use of the CFLs.
- It is thought that the proportion of project CFLs that are still in operation in the fourth year is 0.5 (50%).

The equation to give us the required sample size is:

$$n \geq \frac{1.645^2 NV}{(N-1)\times \partial^2 + 1.645^2 V} \quad \textbf{(1)}$$

Where:

$$V = \frac{p(1-p)}{p^2}$$

n	Sample size
N	Total number of households
p	Our expected proportion
∂	Represents the relative precision (%)

Therefore the required sample size is at least 271 households. This assumes that 50% of the CFLs would be operating. If we changed our prior belief of the underlying true percentage of working CFLs *p*, this sample size would need recalculating.

- **Reference regulatory documents**

1. *"Standard for sampling and surveys for CDM project activities and programme of activities (Version 04.0)" (CDM - EB74- A06)* - paragraphs 10,12, 20
2. *AMS-II.J Demand-side activities for efficient lighting technologies - Version 4.0* – paragraphs 17 and 20
3. *"Guidelines-Sampling and surveys for CDM project activities and programmes of activities (Version 3.)" (CDM-EB67-A06-GUID)- table 1 page 7, paragraphs 12 to 18*

- **Questions:**

1. In your opinion, which sampling method would be appropriate to be used in the proposed PoA? What will be the target population?
2. What will be values for the variables *N*, *p*, ∂ in the context of this example? What will be confidence/precision required in case a single sampling plan covering a group of CPAs is undertaken?
3. Assuming equation 1 gives a result of 271, what will be sample size if we expect a response rate of 80% from the sampled households?

Case Study 3b

- **Brief description of the PoA**

The proposed small scale programme of activity (PoA) involves the distribution of domestic fuel-efficient stoves, with 29.5% thermal efficiency in 120 villages in Country A with a population of 1,884,741. The efficient stoves will replace traditional wood-fired, three rock fires in households. Emission reductions will be claimed for the reduced consumption of woody biomass by the efficient stoves in comparison with the three rock fires. Each CPA will involve the installation of a number of stoves in recipient households such that the aggregate thermal output capacity of the stoves will not exceed 180 GWh of stove thermal output . This translates to a maximum number of 15,939 stoves per CPA.

A.4.4.2. Monitoring plan:

In the PoA-DD, CME chooses to use clustering sampling approach in conducting the baseline survey for both stove efficiency and baseline wood fuel consumption. The minimum sample size of the stoves to be taken was calculated by using an on-line calculator:

Raosoft®

Sample size calculator

What margin of error can you accept? 5% is a common choice	10 %	The margin of error is the amount of error that you can tolerate. If 90% of respondents answer *yes*, while 10% answer *no*, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.
What confidence level do you need? Typical choices are 90%, 95%, or 99%	90 %	The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer *yes* would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.
What is the population size? If you don't know, use 20000	1884741	How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.
What is the response distribution? Leave this as 50%	50 %	For each question, what do you expect the results will be? If the sample is skewed highly one way or the other,the population probably is, too. If you don't know, use 50%, which gives the largest sample size. See below under **More information** if this is confusing.
Your recommended sample size is	68	This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

CME concluded that the minimum sample size of the stoves to be taken for a simple random sample was 68, in accordance with the methodology requirements for precision and accuracy. With a view to get a higher accuracy, oversampling was employed and the sample size was enhanced to 120 for greater precision.

- **Reference regulatory documents**

1. *"STANDARD FOR SAMPLING AND SURVEYS FOR CDM PROJECT ACTIVITIES AND PROGRAMME OF ACTIVITIES (Version 04.0) (CDM - EB74- A06) - paragraphs 5 and 10*

- **Question:**

1. Considering the guidance in the latest version of the sampling standard and guidelines, do you think the proposed sampling approach is clear?
2. What key issues may arise during the validation of the above sampling information?

Case Study 3c

- **Brief description of the PoA**

This case study focuses on alternative post-adjustment method to follow when the required reliability is not met by sample data. A single sampling plan where the reliability criteria is 95:10 (i.e. 95% confidence and 10% relative precision), and where the parameter of interest is a proportion one as applied to a PoA is considered.

Scenario : Cook stoves project – Numeric parameter
The parameter of interest here is the percentage of improved cook stoves that are still in use (hereinafter called as "retention rate of improved cook stove") for a whole population of cook stoves that were distributed in a particular region of a country. The population is the 80,000 households to which cook stoves were distributed, one per household. A simple random sample was to be taken.

The sample size calculation used a value of 0.85 (85%) for the expected proportion. This gave a required sample size of 68 cook stoves. Considering that the expected response rate from the sampled cook stoves would be 70%, it was decided to scale up this number and to sample 68/0.70 = 98 cook stoves. A simple random sample of 98 households was taken, and the number of improved cook stove that is still in use was recorded. The summaries of the data and of the reliability calculations are presented below.

Summary statistics	**Sample data**
Population size	80,000
Sample size (n)	98
Number of distributed improved cook stoves that is still operational	74
retention rate of improved cook stove	0.7551
Relative precision	11.28%

Here the required reliability is not met by the sample data and so it is concluded that the retention rate of improved cook stove is not sufficiently reliable.

- ## Reference regulatory documents

1. *AMS-II.G "Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass" Version 05.0*
2. *"Standard for sampling and surveys for CDM project activities and programme of activities (Version 04.0) (CDM - EB74- A06) - paragraph 16*
3. *Guidelines-Sampling and surveys for CDM project activities and programmes of activities ver 3.0-paragraph 92*

- ## Questions:

Instead of taking additional samples, can alternative post-adjustment methods be used to deal with missed reliability targets? If yes, how?