# SMALL- AND MEDIUM-SCALE BIOGAS PLANTS IN SRI LANKA: CASE STUDY ON FLUE GAS ANALYSIS

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## Introduction

Global warming, caused by increasing emissions of CO2 and other greenhouse gases (GHG) as a result of human activities, is one of the major threats, which are now confronting the environment. CO2 accounts for the largest share of GHG. For agricultural activities is estimated to account for about 13.5 % of the total GHG emissions and if emissions are allowed to increase without limits, the greenhouse effect can possibly destroy the environment for humans and other living creatures; even threatening the existence of humankind.

Biogas production by anaerobic fermentation is a promising method of producing energy, while achieving multiple environmental benefits. However, there are still some unscrutinised factors waiting for an examination. One of such is a flue gas analysis of biogas cookers.

## Methods

The study was carried out in August 2014 in the different areas of Sri Lanka at the level of biogas plants (n=51) and local consultants (n=4). Methods of data collection included semi-structured personal interviews, questionnaire survey and flue gas analysis. Flue gas analysis was done through portable device TESTO 330-2, which is capable of capturing the gas concentration of CO, NO, consequently by recalculating CO2 and NO2.

**Picture 1: Fulfilling of medium-scale BGP**

## Results

With relatively stable thermal efficiency, biogas is of a high heat value and is also convenient to use, making it appropriate for technological economy. Although, structure of rural energy consumption has changed in Sri Lanka, cooking still plays the leading role in energy consumption in rural household and examined BGPs.

If considered almost 20 m3 as average size of BGP, 600-700 m3 of biogas generation per year can be expected.

In our case reflecting average time when BGP is on use: 6.03 hours per day (+/- 3.98), with minimum 1 hour per day up to 12 hours per day.

Quite high COppm was detected (COppm=10089.24), which might be caused by insufficient burning, inappropriate biogas cookers and inappropriate maintenance.

NOppm is under the value of 0.046, which is showing acceptable value.

Flue gas temperature seem appropriate (TS=449.16°C) as well as efficiency (53.96 %) and excess air (3.99 %).

Recalculated values are corresponding with values for such biogas systems.


**Picture 2: Sri Lankan small-scale biogas plant and its owner**

## Discussion

There were no significant differences among size categories of biogas plants; as also mentioned in the study by Obada et al. (2014). Showing that the size is not a crucial factor influencing the amount of flue gas within the biogas cookers. As a significant factor we identified time spent on maintenance of biogas technology.

Also further consideration should be given to exploration of gas itself and its microbiological content. For example Vinneras et al. (2006) were trying to identify microbiological community in biogas systems. There were evaluated low risks of spreading disease via biogas system; however, wide variety of fungi, spore-forming and non-spore-forming bacteria were recognized in biogas. As well, as characterization of emissions from biogas cookers should be done, as similarly was done in study of Fan and Zhang (2001), with taking into account particle size distribution, emission rates and potential exposures.

**Picture 3: Vegetable input for biogas plant**

## Conclusion

Easy energy access is a trigger for development, especially in form of human, social and economic development and biogas plants represents a boon for farmers and rural people to meet their energy needs. However, further factors must be also examined and evaluated.

## Acknowledgement

This research was conducted the People in Need project: "Promoting Renewable Energy as a Driver for Sustainable Development and Mitigation of Climate Change in Sri Lanka" (funded by European Commission), also thanks belong to all PIN Sri Lanka team. Further support was within the Internal Grant Agency project [20145024] and [2015511] at the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague.

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