

Economics of bio-digesters in the Solomon Islands

The value of bio-digesters to communities in Choiseul Province, Solomon Islands

Introduction

The Choiseul Integrated Climate Change Adaptation Programme (CHICCHAP) aims to reduce the vulnerability of the Luru people of Solomon Islands to natural hazards, food insecurity and climate change threats. To support this aim, the Solomon Islands Government is trialling a swine manure digester in Choiseul Province. The treated swine manure could be used to fertilise crops, while also providing biogas as an alternative to kerosene and firewood and reducing harmful run-off of pig waste. Drawing on an existing demonstration digester in Honiara, a study was conducted to examine the economic dimensions of adopting digesters in Choiseul.

Key messages

The study revealed that little monitoring and evaluation of digesters has occurred or been documented in the Pacific. The effect of digestate on agricultural yields is, therefore, unknown and cannot be quantified. Similarly, the potential health benefits of spreading safer fertiliser are unquantified due to lack of data. Drawing on what little data were available, the analysis suggests that losses might be expected every year a digester of a specific size is in operation. Just to break even, a digester would require more manure than is reasonably expected to be available. However, given the lack of quantified benefits, the analysis underestimates the value of digesters. If the benefit to agricultural yields and health were positive, the benefit-cost ratio would increase from the value presently calculated at 0.74.

Considering the need for better monitoring and evaluation when contemplating bio-digesters in the future, the analysis provides a template for quantifying the impacts of digesters in Choiseul. The 'data collection plan' details information that must be collected in order to monitor and evaluate the outcomes of the digester project effectively and provide a thorough economic assessment of the demonstration digester. If followed, the plan will assist the Government of Solomon Islands to make an informed decision on whether to pursue the project throughout the province.

Methodology

The well-being of the community without the digester was compared to the potential wellbeing of the community with the digester. The costs and benefits were totalled in each year, converted to their present-day value using a discount rate of 10% and aggregated in order to determine the final contribution of the digester to the community. Constrained by data limitations, the analysis provides only preliminary estimates of the effect of a demonstration digester.

The Taiwan Technical Mission (TTM) already runs a fifteen-swine digester at their Honiara site. The specifications for this facility were used as the basis for the economic analysis. At the Honiara facility, each adult pig produces 3 kg of manure/day for a 5 m³ digesting tank, which produces enough gas to power a single hob cooking burner for one hour each day. The slurry mixture



spends approximately two weeks in the digester before being removed as effluent, stored for a few months and then used to fertilise crops.

Given the limited supply of digesting tanks in Honiara and the few personnel able to assist in setting one up, the CHICCHAP digester will probably be identical to that used by TTM in Honiara. However, it is unlikely that sufficient manure will be collected from villages, most of which do not own 15 swine. Less manure means weaker gas pressure, increasing the length of time required before a burner can be powered effectively and reducing the digester's potential benefits.

Assumptions and uncertainties

It was assumed that the digester runs off manure from five swine producing 15 kg of manure every day and that the digester is running efficiently all year round. It was also assumed that collecting the manure and filling and maintaining the digester requires one hour of labour per day at a rate of SBD 7.69 per hour, and that cooking hobs efficiently burn all of the methane produced in the digester. Following previous studies, the benefit of carbon emission reduction was quantified using a monetary value of USD 5.90 per tonne. All quantified impacts are expected to remain constant over time and are discounted at a rate of 10%.

The cost of rearing the pigs from which the manure is collected was not included in the analysis; only the presently quantifiable benefits and costs of the digester demonstration project were included. The analysis yielded an underestimation of the overall impact of the digester.

Results

The quantified benefits are biogas use and the resultant emissions reductions. Combined, these benefits total SBD 2,212 in the first year and SBD 2,613 for all future years the digester is operational. The costs quantified are those of construction and the labour required to keep the digester running. These are higher than the quantified benefits both in year one when they total SBD 10,845 and in all future years when they total SBD 2,807.

Aggregated over a 50-year period, the calculated benefit-cost ratio equals 0.74; for each SBD invested, only 74 cents might be expected in return. Without sufficient values for the benefits associated with digestate, the project would not be expected to break even. In fact, given the costs and



Demonstration biogas digester at the Taiwan Technical Mission in Honiara constructed in partnership by the SPC/USAID Project, SPC/GIZ CCCPIR, Ministry of Agriculture & Livestock & Taiwan Technical Mission.

benefits quantified in the analysis, the digester would have to be supplied with 20 to 30 kg of manure per day to break even. This is well above what is feasible.

What if?

If swine manure were in abundance, the digester would generate multiple benefits. To increase the demonstration facility's chance of securing such benefits, exotic pigs or cross breeds – which, given their size and feed intake, tend to produce more waste than local breeds – need to be procured from Gizo or Honiara. Without access to the optimal volume of manure, the communities that choose to accept bio-digesters will not reap the full potential benefits of their use. The analysis suggests that a digester with requirements identical to the TTM facility in Honiara would require 30 kg of manure from 10 swine to break even over a five-year lifespan. Without having a sufficient value for fertiliser benefits, a digester using 15 kg of manure per day would not be expected to break even, and losses would be expected to increase with every year the digester is running.

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Conclusions and recommendations

The construction of a demonstration facility provides the Government of Solomon Islands with a good opportunity to assess the effects of introducing bio-digesters to communities throughout Choiseul Province. The preliminary economic analysis recommends a number of measures that would provide a solid foundation from which to confidently estimate the value of community digesters. Considering the lack of empirical data, governments and donors should appraise bio-digester projects in the Pacific while ensuring the methods and materials adopted are cost-effective. The lessons from this activity are likely to support improved policy in the region in general, not just in Choiseul Province.