



# STUDY OF SLURRY MANAGEMENT IN WASTE-TO-ENERGY LARGE SCALE BIOGAS PLANTS

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## SUMMARY

The management of bio-slurry is a major problem that emerged due to lack of proper management and application procedures, guidelines and regulations. Along with this, storage and transportation of the slurry is also unsatisfactory. As a result, a big volume of slurry is discharged to the environment that causes air and water pollution. The study also aims to recommend best technologies and practices for slurry management in the local context.

A total of 11,036 MT of organic fertilizer is estimated to be produced from the existing industrial scale biogas plants under existing technology each year. Further, 24,000 MT/year of additional organic fertilizer will be produced once the under-construction commercial and municipal projects are completed. Adoption of complete conditioning technologies helps to retain the dry matter lost in liquid fraction, increasing the production of fertilizer by 10%.

ADS (2015-2035) identifies the importance of organic fertilizers and targets to increase the organic content in Nepalese soil from 1% (2010) to 4% (2030). However, due to fragmented and uncoordinated efforts from various stakeholders, the achievement so far is insignificant.

The study on management of slurry produced from waste-to-energy large scale biogas plants conducted by Agricultural Technology Center (ATC) aims to prepare a slurry management plan for large scale biogas plant developers.

## HISTORY OF BIO-GAS IN NEPAL

The history of biogas development began with a prototype unit being installed at Godawari in 1955. The Government of Nepal launched the first official biogas program in 1974, in which the potential customers were provided with a construction loan, made available by ADB/N. Subsequently, several organizations including the Department of Agriculture (DoA), the Development and Consulting Services (DCS) of Nepal, 18 the United Mission to Nepal (UMN) and the Khadi and Village Industries Commission of India (KVICI) along with the Government of Nepal worked for the development of biogas technology as a joint venture. In 1997, Bio-gas and agricultural equipment Pvt. Ltd popularly known as Gobar Gas Company (GGC) was established for the development and wide-scale promotion of bio-gas technology in Nepal.

Alternative Energy Promotion Centre (AEPC), a government institution currently under the Ministry of Energy, Water Resource and Irrigation has played a central role in promoting biogas technology in Nepal since its establishment in November 3, 1996.

## METHODOLOGY

Quantitative data were collected based on desk review, field observation of selected sites, consultation with experts and interviews with biogas plant operators and other stakeholders and whereas for qualitative data, the samples were passed through laboratory analysis.

## REFERENCE

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## RESULTS

### Qualitative analysis

Lagoon water exceeds NPK and OM contents of other two forms i.e., fresh digest and decanted slurry which implies it can be used as liquid fertilizer. Lower nutrient content in marketable OF compared to fresh and decanted bio-slurry indicates that there is a substantial loss of nutrient during the OF processing.



**Fig 1 : Qualitative analysis of slurry, lagoon water and slurry-based fertilizer of cow-based farms**

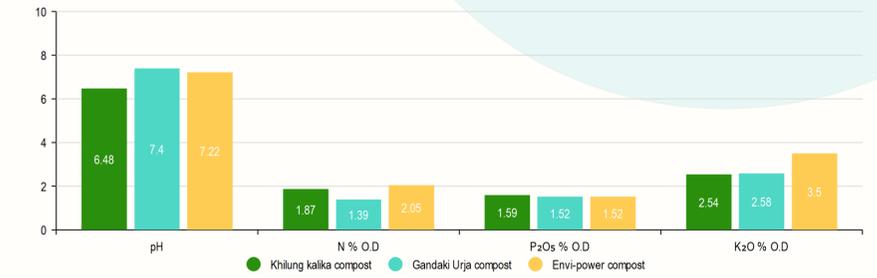
### Situational analysis

A broader quantification based on the projected production as per the targets of 15th plan shows that around 35102 MT of can be produced from biogas sector as a whole by the end of 2024. Based on the results of N, P, K contents of industrial-based obtained through lab analysis, this amount is equivalent to 13,50.66 MT of Urea, 1126.19 MT of SSP and 1679.04 MT of MOP from industrial-scale bio-gas. Domestic biogas plants are capable of producing 946393 MT of organic fertilizer annually. The potential OF production from biogas sector by the year 2024 is estimated to be 13,89,226.48 MT.

**Table 1 Potential OF production from biogas sector by year 2024 and their chemical fertilizer equivalent**

Plant type	No. of existing plants	Additional plants as per 15th Plan	Current potential (TPY)	Potential from additional projects (TPY)	Potential by 2024 (TPY)	N (MT)	P (MT)	K (MT)	Urea equivalent (MT)	TSP equivalent (MT)	MOP equivalent (MT)
Industrial scale	5	12	11036	24066	35102	621.31	540.57	1007.43	1350.66	1126.19	1679.04
Large scale	307	500	6338	10322.48	16660.48	294.89	256.57	478.16	641.06	534.52	796.92
Domestic biogas plants	434000	200000	946393	391071	1337464	23673.11	20596.95	38385.22	51463.28	42910.3	63975.36
<b>Total</b>			963767	425459.48	1389226.48	24589.31	21394.09	39870.8	53455.01	44571.01	66451.33
									<b>Total Equivalent (MT)</b>		<b>164477.36</b>

**Fig 2 : Laboratory analysis for compost samples from large-scale industrial bio-gas plants**



## CONCLUSION

Under proper management and storage condition, the fertilizer production can be increased by 10%. The share of total traded organic fertilizer from biogas sector is expected to increase by 25% on completion of large scale commercial and MSW biogas plants. The study provides recommendations and interventions to overcome constraint that exists in the production, storage, transportation, marketing and policy fronts. Lack of knowledge and policy gap seems to be the root cause of mismanagement of bio-slurry. Co-ordination of the concerned authority, policy-makers and biogas operators is a must in order to overcome this problem.

## RECOMMENDATION

The study recommends various measures for cow-based biogas plants, industrial scale biogas and policy makers separately to overcome the constraints that exists in the production, storage, transportation, marketing and policy fronts.

### For cow-farm based biogas plants

- Reinforcements of slurry pits to avoid leaching and nutrient loss
- Slurry composting for adding value
- Use of waster decomposer for accelerating decomposition process
- Use of submersible pumps

### For industrial scale biogas plants

- Better safety and sanitation specially at feeding lot
- Construction of lagoon pit of appropriate size
- Lining and fencing of lagoon pit
- Complete conditioning using membrane separation technology

### For policy makers

#### Short term interventions

- Farm demonstrations and long-term trails for yield assurance.
- Training bio-gas operators regarding new alternatives and technologies to retain/enhance nutrient content of organic fertilizer.

### Long term interventions

- Development of comprehensive guidelines for improving nutrient content.
- Bio-gas operators should be supported with training, subsidy/ financial aid or other incentives to install state of art technologies to produce fertilizer from bio-slurry.