



Household bio-digester installations in selected countries in Africa and Asia in 2021

Summary

This brief provides data and information on the status of household bio-digesters in selected countries in Africa and Asia based on self-reporting by expert stakeholders.

In 2021, over 27,000 digesters were installed in these countries, mainly fed with animal manure, providing biogas for clean cooking and bio-slurry as organic fertiliser for agricultural production. Compared to 2020, the installation rate in 2021 increased by 10%; compared to 2019 (pre-COVID) by 7%. Most stakeholders expect more digesters to be installed in 2022 due to reduced COVID effects, the emergence of new support programmes, and the increased price of LPG and chemical fertilisers. The most popular digester size in almost all countries is 4 or 6 m³, which is the total volume of the digester and gas storage. Investment costs of this size of bio-digester range from USD 500 to 700.

Most of the digesters are still constructed in-situ, using traditional construction materials like sand, gravel and cement, but prefabricated units are becoming more popular. An investment of USD 500 to 700 for a rural household is challenging, even though the technical lifetime of the digester surpasses 15 years. Still, most of the digesters are financed by households in cash. Financial institutions like local banks, MFIs and SACCOs perceive the market for household bio-digesters as financially unattractive and/or too risky. A few bio-digester enterprises have been successful in offering credit that has to be paid back in monthly instalments. Compared to 2018, the most popular-sized digesters installed in 2021 have increased in USD cost by up to 23%. Expert stakeholders observe the lack of access to finance and poor after-sales service as the most significant barriers. They see the availability of carbon finance and improved use of bio-slurry as the greatest opportunities to scale the market.

Methodology

This status brief has been limited to countries in which SNV ever provided implementation support and where market activities are still ongoing. In many of these countries, support by SNV has been terminated years ago while partners (private sector, government, donors) have continued to develop the sector. In this respect, the data presented below combine 'digesters installed with direct SNV support' and 'installed with the support of related follow-on projects'. In the selected countries, expert stakeholders (both SNV and non-SNV) were arbitrarily selected and approached in the second quarter of 2022 with a brief questionnaire. The questionnaire requested the following data: the number of digesters installed in 2021; cumulatively up to 2021; the type of digester (constructed in-situ or pre-fabricated); the gross investment costs for the most popular digester model and size; available investment subsidies for customers; and the share of digesters installed in cash, versus through credit. In addition, the stakeholders were invited to list up to three barriers and three opportunities to scale the digester market in their country. In some countries, a brief interview with the expert stakeholder was held to better

understand the market specifics. All data and information were self-reported, sometimes based on estimates, and should be taken as both indicative and informal. SNV would like to express its sincere gratitude to all partners for all data and information provided for this brief.

Installation rate in 2021

In 2021, over 27,000 household bio-digesters were installed in selected countries in Asia and Africa, see Table 1. Almost all these digesters are fed by animal manure. They provide two outputs: biogas, mainly used for clean cooking, and bio-slurry, a potent organic fertiliser to enhance agricultural production. Most digesters (about 20,000 units) were delivered in Asian countries, in particular Nepal, Bangladesh and Vietnam. About 7,000 digesters were delivered in African countries, with most units installed in Ethiopia, Kenya and Burkina Faso. Compared to 2020, selected countries in Asia witnessed an increase (21%), even though some countries (Pakistan and Vietnam) did not have a support programme in place. Countries in Africa witnessed a slight



Cooking on biogas in Cambodia. Copyright SNV

decrease (11%). Overall, the installation rate in selected countries increased by 10% compared to 2020; and by 7% compared to 2019 (pre-COVID). Most expert stakeholders expect an increase in the installation rate in 2022 due to reduced COVID effects, the emergence of new support programmes,

and the increased price of LPG and chemical fertilisers.

Up to 2021, almost 970,000 households¹ in the selected countries have invested in a bio-digester since the start of SNV's interventions in Nepal in the early nineties.

Table 1 Number of household bio-digesters installed in 2021, 2020 and cumulatively by the end of 2021 in selected countries in Africa and Asia.

Country	Digesters installed in 2021	Digesters installed in 2020	2021 versus 2020		Digesters installed up to 2021	Remarks
			(number)	(%)		
Africa						
Benin	42	0	42	N/A	249	
Burkina Faso	804	735	69	9%	15,019	
Ethiopia	3,241	4,686	-1,445	-31%	34,693	Security issues
Kenya	2,333	1,962	371	19%	26,768	
Rwanda	190	200	-10	-5%	11,625	
Uganda	420	300	120	40%	9,019	
Zambia	323	380	-57	-15%	5,671	
Total:	7,353	8,263	-910	-11%	103,044	

Country	Digesters installed in 2021	Digesters installed in 2020	2021 versus 2020		Digesters installed up to 2021	Remarks
			(number)	(%)		
Asia						
Bangladesh	4,539	3,930	609	15%	61,634	
Bhutan	902	896	6	1%	7,885	
Cambodia	1,120	1,106	14	1%	30,747	
Indonesia	1,661	385	1,276	331%	26,809	Provincial regulations
Nepal	6,806	4,285	2,521	59%	437,033	
Pakistan	109	73	36	49%	6,358	
Vietnam	5,000	5,961	-961	-16%	295,345	
Total:	20,137	16,636	3,501	21%	865,811	

Grand total:	27,490	24,899	2,591	10%	968,855	
---------------------	---------------	---------------	--------------	------------	----------------	--

Note: Nepal numbers as per their FY (2021/22 and 2020/21)

1. Including smaller numbers of digesters installed in 10 other countries as well, the cumulative number of digesters supported by SNV directly or indirectly amounts to over 982,000 by the end of 2021

Investment costs and financing

Among others, the investment costs of bio-digesters depend on the model and size of the unit, which in turn is determined by several factors including the amount of animal manure available for feeding.

Table 2 provides an overview of the most popular model and size of digesters in selected countries, the investment cost of this most popular unit in 2021 (in local currency and USD), and the investment subsidy provided by the government and/or programme/project if any.

The most popular size in almost all countries is 4 or 6 m³, being the total volume of the digester and gas storage. Kenya is an exception with 12 m³ as the most popular size of the prefab digester. Indonesia witnessed the emergence of a small (1 m³) prefab digester as a result of government regulations, requiring farmers keeping livestock to install a digester. The interviews with the expert stakeholders also informed that niche markets for medium (up to 100 m³) and large size digesters (mostly up to 1,000 m³) are emerging in several countries including, Kenya, Ethiopia, Bangladesh, Nepal and Vietnam, though numbers are still quite low. Most of the digesters are still constructed in-situ, using traditional construction materials like sand, gravel and cement, but prefabs are becoming more popular. See also Table 3.

Investment costs of the most popular sized bio-digester in Africa and Asia range from USD 500 to 700. Exceptions are Kenya and Indonesia. In Kenya, the higher investment cost is caused by the larger size (12 m³). The lower investment cost of Indonesia's most popular digester (prefab) is due to its smaller size (1 m³).

An investment of USD 500 to 700 for a rural household is challenging, even though the technical lifetime of the digester surpasses 15 years. In the case of in-situ construction, part of the financing may be covered by

the household through the collection of traditional construction materials like sand and gravel and/or through the provision of unskilled labour. Some governments and/or programmes/projects like in Burkina Faso, Ethiopia, Rwanda, Zambia, Bangladesh, Nepal and Indonesia provided investment subsidies, lowering the net investment for the farmers, see Table 2. The (gross or net) investments were financed by most households in cash. Exceptions are Kenya and Cambodia. In these countries, bio-digester enterprises such as respectively Sistema.bio and ATEC provide credit. Financial institutions like local banks, MFIs and SACCOs perceive the market for household bio-digesters as unattractive and/or too risky, making supplier credit the only available instrument to provide households with access to finance.

Table 3 compares the investment costs of household digesters in 2010, 2018 and 2021 for selected countries in Africa and Asia.

The investment costs of the most popular sizes of bio-digesters for the selected countries in 2021 compared to 2018 increased by up to 23%, as construction materials and labour became more expensive. The cost increase in Kenya is a result of the increased size of the digester. In Cambodia, it is due to prefabs becoming more popular than the in-situ installed unit. The cost reduction in Indonesia is a result of the substantial size reduction.



A Sistema.bio prefab biodigester installed in Kenya. Copyright Sistema.bio

Table 2 Investment costs and financing in 2021 for the most popular model and size of household digesters in selected countries in Africa and Asia

Region/country	Most popular size	Specification	Local currency	Exchange rate	Average investment cost for most popular size	Investment costs		Financing		Share of households financing through loan	Remarks	
						(m3)	(LCU)	(LCU:USD)	(LCU)			(USD)
Africa												
Benin	4	in-situ	CFA	555	400,000	721	300,000	541	180	100%	0%	
Burkina Faso	4	in-situ	CFA	555	320,000	577	160,000	289	289	100%	0%	
Ethiopia	6	in-situ	ETB	35	25,000	716	13,050	374	342	99%	1%	
Kenya	12	pre-fab	KES	110	100,000	912	0	0	912	20%	80%	Suppliers credit (24 months)
Rwanda	4	in-situ	RWF	989	650,000	657	100,000	101	556	100%	0%	
Uganda	6	in-situ	UGX	3,587	2,343,000	653	0	0	653	97%	3%	
Zambia	6	in-situ	ZMW	20	12,800	639	3,000	150	490	100%	0%	
Asia												
Bangladesh	6	in-situ	BDT	85	60,000	705	20,000	235	470	90%	10%	
Bhutan	6	in-situ	BTN	74	45,000	609	22,500	304	304	100%	0%	Cost-sharing mechanism
Cambodia	6	pre-fab	USD	1	700	700	0	0	700	10%	90%	Suppliers credit (27 months)
Indonesia	1	pre-fab	IDR	14,308	6,250,000	437	3,250,000	227	210	95%	5%	Provincial Regulations
Nepal	6	in-situ	NPR	118	101,000	855	30,000	254	601	98%	2%	
Vietnam	6	pre-fab	VND	23,160	12,000,000	518	0	0	518	95%	5%	

Note:1) Exchange rates 2021 by WB: <https://data.worldbank.org/indicator/PA.NUS.FCRF>

2) Digester sizing in Bangladesh (6 m3) is derived from gas production (2.4 m3/day)

Table 3 Investment costs in 2010, 2018 and 2021 for the most popular model and size of household digesters in selected countries in Africa and Asia

Region/country	2010			2018			2021			2021 versus 2018	
	Popular size (m ³)	Specification	Average costs (USD)	Popular size (m ³)	Specification	Average costs (USD)	Popular size (m ³)	Specification	Average costs (USD)	Costs difference (USD)	(%)
Africa											
Benin	6	in-situ	1,211	4	in-situ	553	4	in-situ	721	168	14%
Burkina Faso	6	in-situ	808	4	in-situ	560	4	in-situ	577	17	2%
Ethiopia	6	in-situ	800	6	in-situ	571	6	in-situ	716	145	18%
Kenya	6	in-situ	947	6	pre-fab	662	12	pre-fab	912	250	26%
Uganda	6	in-situ	741	6	in-situ	501	6	in-situ	653	152	21%
Asia											
Bangladesh	5	in-situ	488	6	in-situ	592	6	in-situ	705	113	23%
Bhutan				6	in-situ	774	6	in-situ	609	-165	-21%
Cambodia	4	in-situ	430	4	in-situ	550	6	pre-fab	700	150	35%
Indonesia	6	in-situ	660	4	in-situ	741	1	pre-fab	437	-304	-46%
Nepal	6	in-situ	663	6	in-situ	1,044	6	in-situ	855	-189	-29%
Vietnam	12	in-situ	621	7	pre-fab	610	6	pre-fab	518	-92	-15%

Note: Digester sizing in Bangladesh (5 m³ in 2010 and 6 m³ in 2018 and 2021) is derived from gas production (2.0 m³/day in 2010 and 2.4 m³/day in 2018 and 2021)

Main barriers and opportunities for market scaling

Expert stakeholders were also asked to stipulate the main barriers and opportunities for scaling the market in their country. These barriers and opportunities were grouped by demand, supply and enabling environment, see Annex 1 and 2, respectively. Most barriers were seen on the demand (16x) and supply side (17x); fewer were given for the enabling environment (10x). It is important to emphasise that some of the mentioned barriers are country specific. Table 4 provides the barriers mentioned more than once.

On the demand side, the lack of access to finance for customers (7x) and the lack of awareness among potential customers about the benefits of the (modern) technology (4x) are seen as the main barriers to scaling the market. Low functionality of installed digesters (7x) and limited private sector participation (3x) are mentioned on the supply side. In the enabling environment, the government's lack of willingness and ability to support the market is seen as the main barrier (4x).

When it comes to opportunities, most of these were interestingly seen in the enabling environment (17x), followed by demand (15x) and supply (6x), see Annex 2. Table 5 provides the main opportunities mentioned more than once.

On the demand side, stakeholders expressed high hopes that the improved use of bio-slurry would result in scaling the market, also because of the increased prices of chemical fertiliser (6x). The high technical potential of the markets is seen as an opportunity (3x). Medium and large size digesters are seen as an opportunity on the supply side (4x). In the enabling environment, the availability of carbon revenues or subsidies (7x) and enhanced government support (6x) are seen as the main opportunities. Also, waste management is mentioned (2x). It gives food for thought that larger-sized digesters and waste are mentioned as opportunities, as this may require moving away from manure-fed household digesters.

Table 4 Main barriers to scaling the household bio-digester market in selected countries, as mentioned more than once by expert stakeholders

Main barriers grouped by demand, supply and enabling environment
Demand
Lack of access to finance for households; lack of investment subsidy to reduce investment costs for households; limited willingness and ability to pay (7x)
Lack of awareness about the benefits of the business case; lack of awareness campaigns; lack of awareness about modern prefab technologies; perceived lack of business case (4x)
Supply
Lack of after-sales service; low functionality affecting the reputation of the technology; lack of quality assurance (7x)
Limited private sector participation, both in constructing; installation and financing (3x)
Enabling environment
Lack of development finance/public funding to develop the sector; lack of interest by the government to invest in the sector (4x)



Use of bio-slurry to grow vegetables in Burkina Faso. Copyright SNV

Table 5 Main opportunities for scaling the household bio-digester market in selected countries, as mentioned more than once by expert stakeholders

Main opportunities grouped by demand, supply and enabling environment	
Demand	
Improved application of bio-slurry through the promotion of positive experiences of households with bio-digesters; increased relevance to apply bio-slurry for climate resilience, effective use of bio-slurry for increased agricultural production; application of bio-slurry (“black gold”) to increase the benefits for the farmers; high cost of chemical fertiliser, benefiting organic farming, lack of access to and high price of LPG and chemical fertilisers; increasing the demand for organic fertilisers including bio-slurry (6x)	
High technical potential for bio-digesters (3x)	
Supply	
Emergence of (niche) markets for medium- and large-sized bio-digesters; national shift to commercial, larger farms (4x)	
Enabling environment	
Availability of carbon revenues; subsidies with increased market prices (7x)	
Political and government interest in the bio-digester sector; supportive government policies including the federal bio-digester strategy (ongoing), energy compact and NDC; clean cooking and other environment; climate change agenda taking centre stage in national policy, strategies and programmes; involvement of provincial and district authorities; new government policy to make pastoralism more sedentary through which more animal manure will become available as feedstock for bio-digesters (6x)	
Organic waste management in (peri)urban areas; zero waste provincial government programmes (2x)	

Multiple benefits

Bio-digesters in operation provide multiple benefits, as shown in Figure 1, by creating more income, increased well-being, reduced vulnerability, improved food security, and more sustainable use of the natural resource base for smallholder farmers. They potentially

contribute to nine of the 17 Sustainable Development Goals (SDGs). Based on current UNFCCC methodologies, a household digester reduces GHGs with 2.5 to 6 tonnes of CO₂-eq each year.

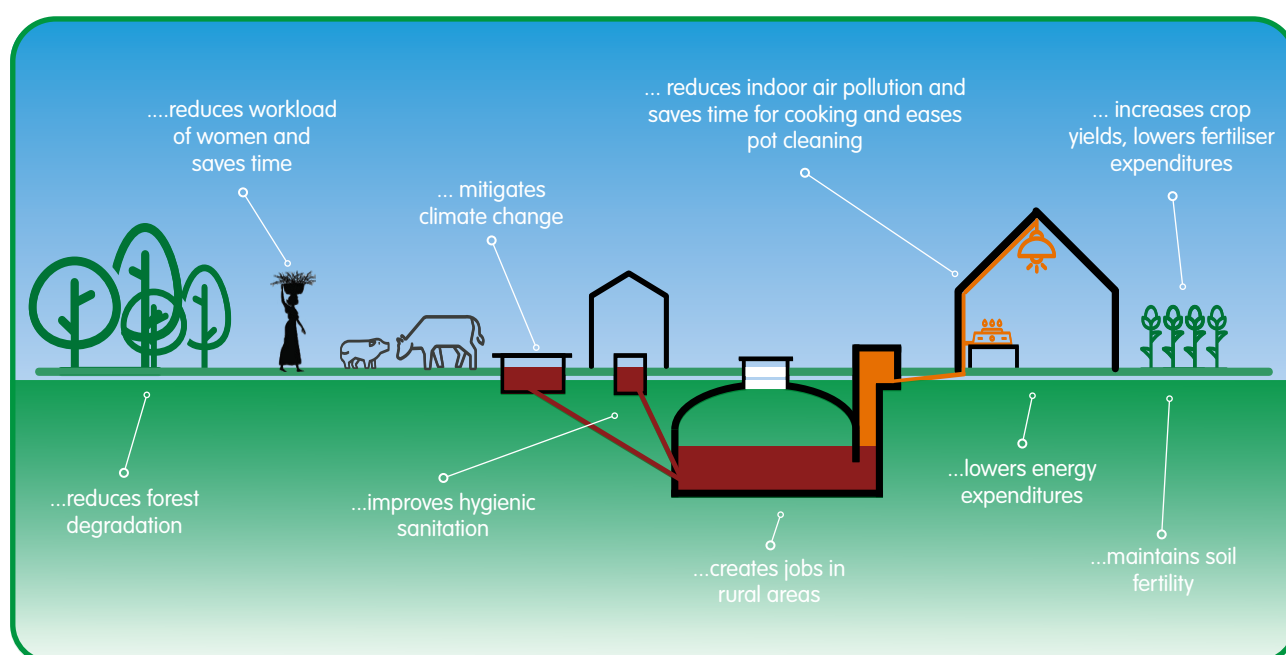


Figure 1 Multiple benefits of household bio-digesters, contributing to multiple SDGs

Final remark

Countries are hugely different, and even within countries, there are also high variations, in many aspects, which makes it hard to compare data and information on household digesters. However, further analyses and sharing of results, challenges

and opportunities are contributing to useful learning at the global level and are therefore strongly recommended.

Please contact SNV Netherlands Development Organisation at srai@snv.org for any questions, or comments.

Acknowledgement

SNV would like to thank the following people for their contribution to this brief: Edouard Fagnon (SNV Benin), Lin Da (SNV Burkina Faso), Carlos Bueso (SNV Ethiopia), Kevin Kinusu ([ABPL Kenya](#)), Esther Altorfer ([Sistema.bio Kenya](#)), Saroj Rai (SNV Rwanda), Michel Muvule Pinto ([BSUL Uganda](#)), Jonas Silwimba and Susanne Hounsell (SNV Zambia), Shibli Md. Faiz ([IDCOL Bangladesh](#)), Sonam Phuntsho ([Department of Livestock, Bhutan](#)), Ben Jeffreys ([ATEC, Bangladesh and Cambodia](#)), Bibah Romzini ([Rumah Energi Indonesia](#)), Nawa Raj Dhakal and Ishwar Chandra Khanal ([AEPC, Nepal](#)), Prakash Lamichhane ([BSP-N, Nepal](#)), Farid Khan ([RSPN, Pakistan](#)), Felix ter Heegde (SNV Vietnam) Harry Clemens ([FCF, Netherlands](#)) and Wim van Nes (SNV, Netherlands).

Front cover picture: Woman lighting biogas lamp in Burkina Faso. Copyright SNV

Annex 1

Main barriers to scaling the household bio-digester market in selected countries as mentioned by expert stakeholders.

Barriers grouped by demand, supply and enabling environment	Frequency
Demand	16x
Lack of access to finance for households; lack of investment subsidy to reduce investment costs for households; limited willingness and ability to pay	7x
Lack of awareness about the benefits of the business case; lack of awareness campaigns; lack of awareness about modern prefab technologies; perceived lack of business case	4x
Insufficient amount of animal manure to feed the digester	1x
Declining animal husbandry affecting the market potential	1x
Increasing investment costs for bio-digesters caused by higher costs for materials and (remote) labour	1x
Digesters are linked to the livestock sector which is (very) sensitive to price fluctuations and (regional) diseases	1x
Cheap electricity & abundant biomass resources	1x
Supply	17x
Lack of after-sales service; low functionality affecting the reputation of the technology; lack of quality assurance	7x
Limited private sector participation, both in constructing and financing	3x
Limited affordability for enterprises	1x
Weak development of value chains	1x
Perceived lack of business case	1x
Increased and unstable price of cement	1x
Lack of suppliers of proven prefab bio-digesters	1x
Lack of skilled masons at the local level	1x
Insufficiently compelling bio-slurry approach	1x
Enabling environment:	10x
Lack of development finance; public funding to develop the sector	4x
Lack of interest by the government to invest in the sector	1x
Security risks in sizable parts of the country	1x
Insufficient clarity of the institutional set-up for national ownership and steering	1x
Market distortion by programmes offering bio-digesters free of cost	1x
Limited enforcement of waste management policies by (local) governments	1x
Environmental policy occasionally results in 'perverse' investment decisions, when farmers install a digester to be allowed to raise livestock but do not use the technology, harming its reputation	1x

Annex 2

Main opportunities for scaling the household bio-digester market in selected countries as mentioned by expert stakeholders.

Opportunities grouped by demand, supply and enabling environment	Frequency
Demand	15x
Improved application of bio-slurry through the promotion of positive experiences of households with bio-digesters; increased relevance to apply bio-slurry for climate resilience; effective use of bio-slurry for increased agricultural production; application of bio-slurry ("black gold") to increase the benefits for the farmers; high cost of LPG and chemical fertiliser, benefiting organic farming; lack of access to and high price of chemical fertilisers, increasing the demand for organic fertilisers including bio-slurry	6x
High technical potential for bio-digesters	3x
High cost of the firewood due to increased scarcity	1x
Emergence of lease-to-own facility provided by some prefab suppliers	1x
Emergence of an aggressive awareness campaign by multiple stakeholders	1x
Increased cattle raising following import restrictions	1x
Financing by Corporate Social Responsibility (CSR) programmes	1x
Most of the farmers and school drop-outs have started dairy & pig farming businesses for their livelihood due to limited jobs in the market; more potential to upscale bio-digesters	1x
Supply	6x
Emergence of (niche) markets for medium- and large-sized bio-digesters; national shift to commercial, larger farms	4x
Emergence of new market players supplying innovative products and services (prefabs, finance)	1x
Emergence of local capacity to provide adequate services after the installation of the bio-digester	1x
Enabling environment:	17x
Availability of carbon revenues or subsidies with increased market prices	7x
Political and government interest in the bio-digester sector; supportive government policies including the federal bio-digester strategy (ongoing), energy compact and NDC; clean cooking and other environment or climate change agenda taking centre stage in national policy, strategies and programmes; involvement of provincial and district authorities; new government policy to make pastoralism more sedentary through which more animal manure will become available as feedstock for bio-digesters	6x
Organic waste management in (peri-)urban areas; zero waste provincial government programmes	2x
The country has become a member of the West and Central Africa Alliance for Bio-digesters and is currently chairing this Alliance	1x
Increased partnership between government, financial institutions, and civil society organisations	1x

Parkstraat 83
2514 JG The Hague
The Netherlands

Phone: + 31 70 3440 244
Email: info@snv.org
www.snv.org

twitter.com/SNVworld
facebook.com/SNVworld
linkedin.com/company/snv



SMART
DEVELOPMENT
WORKS