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A Brief History of Biogas in Nepal: Lessons for the Future from the Past

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ABSTRACT

Biogas, a gaseous mixture resulted from anaerobic digestion of organic matter, is an alternative source of energy that contributes to circularity. This paper introduces biogas and briefs its history in the context of Nepal. Despite being used as early as the 10th century BC, biogas only caught proper attention since the dawn of the industrial revolution. Meanwhile, biogas technology started its development only in the late-mid 19th century whilst taking a hundred more years for Nepal to follow suit. Since the construction of the first biogas plant in 1960, Nepal has introduced several plans and policies with the help of private and international agencies to construct about half a million biogas plants as of 2021. The major turning point in the history of biogas in Nepal came in 1992 with the initiation of Biogas Support Program which coincided with the then His Majesty Government of Nepal's ambitious eight 5-year plan. The future policymakers are suggested to keep the growing urban population in mind whilst making new deals and policies to promote and facilitate biogas technology.

Keywords : Biogas, History of Biogas, Anaerobic Digestion, Circular Economy, Alternative Energy, Renewable Energy, Organic Waste Management

INTRODUCTION

Biogas

Biogas is a mixture of gases produced when organic matter is broken down by bacteria in the absence of oxygen. The composition of these gases varies, but it primarily consists of Methane (CH_4) and Carbon dioxide (CO_2) gases alongside other gases like Hydrogen sulfide (H_2S) in trace amounts(Guo et al., 2015). Among these gases, only

methane is inflammable contributing to produce energy for work. The rest of the gases are non-combustible- i.e. they do not burn and do not produce heat to produce energy. The organic matter, called feedstock, that is broken down by bacteria to produce biogas, is generally considered to be agricultural, food, and municipal waste, dung, plant material, and sewage. The production of biogas is focused on the valorization of waste. The overall process of the bacteria breaking down organic waste in the absence of oxygen to produce biogas is called anaerobic digestion (AD) (Karki, n.d.).

HISTORY OF BIOGAS IN NEPAL

Early Developments

The earliest mention of Biogas in Nepal is only found in 1960, when Reverend B.R. Saubolle designed and constructed a biogas plant at St. Xavier's School. He designed a 200-liter oil drum plant, with a metallic gas holder, primarily to demonstrate to people how fuel could be obtained from waste (Saubolle & Bachmann, 1983). In 1968, in an exhibition held in Kathmandu, the Indian Aid Mission demonstrated a 250 cubic feet capacity Gobar Gas plant. Reports suggest that only 4-9 families had installed biogas plants throughout Nepal by 1973; that too only in elite households (Consolidated Management Services Nepal, 1996; Singh & Maharjan, 2003). However, the 1973 Energy crisis led the then His Majesty's Government of Nepal (HMG) to rethink its approach towards fuel and energy- ultimately leading to the launch of the first official biogas program in 1974 with the primary goals being to control deforestation and utilize manure. Agricultural Development Bank of Nepal (ADB/N) provided interest-free loans to people for the installation and the construction of 199, out of the 250 planned, biogas plants that took place in the fiscal year 1974/75 under the supervision of the Department of Agriculture (DOA). (Karki et al., 2015)

The fiscal year 1975/76 was the biggest turning point for the development of Biogas in Nepal. By the end of 1976, Biogas Development Committee (BDC) was formed as a part of the Energy Research and Development Group (ERDG) under the Tribhuwan University. Rev. Saubolle was called upon for his expertise on this topic (Shakya, 2002). The fiscal year of 1975/76 was also celebrated as "Agriculture Year" by the Ministry of Agriculture of Nepal, where Biogas was a special program (World Bank, 2010). There were further 250 biogas plants constructed in the floating drum type design based on KVIC with the capacity of 6, 8, and 10 cubic meters. Furthermore, a project sponsored by USAID and executed jointly by the DOA and US Peace Corps/Nepal saw the establishment of a few pilot digesters around the country. In 1977, Biogas and Agriculture Equipment Development Ltd., a.k.a. Gobar Gas Company (GCC), was established to promote biogas technology through workshops, seminars and trainings in Nepal and remained the only major organization responsible for the promotion of biogas in Nepal for 15 years. By 1978, there were 708 biogas plants constructed all over the country (Singh & Maharjan, 2003). In 1980, GCC introduced a modified Chinese fixed dome design and recognized the fixed dome system to be the most appropriate for Nepalese households. The government planned to complete the construction of 4,000 plants all across the country, with a provision of 25%

subsidy on investment costs and 50% subsidy on bank loans, but only managed to install 3,856 plants (Karki et al., 2015; World Bank, 2010).

Initiation of Biogas Support Program

Instead of being let down by these numbers, the government planned to install 30,000 plants over the next five-year program that lasted from 1992 to 1997. The intermediate years between 1990 and 1992 saw 3,090 plants constructed throughout the country which showed good signs for the thirty thousand estimates (National Planning Commission, 1992). The rates of subsidy were also fixed- Rs. 7,000 for Terai and Rs. 10,000 for the Hills(AEPC, 2014). 1992 also saw the introduction of Phase I of the Biogas Support Program (BSP I), which lasted till 1994, which aimed to independently construct 7000 plants throughout the country. BSP I was funded by HMG and the Directorate-General for International Cooperation of the Netherlands (DGIS) through the Netherlands Development Organization-Nepal (SNV/N). BSP I managed to complete 6,824 plants throughout the country by 1994(Kumar Jha, 2010). Impressed by the potential economic advantages, 23 private biogas plant companies were established between 1992-1996, which worked in collaboration with established entities like ADB/N, GCC, and BSP to construct biogas plants (Consolidated Management Services Nepal, 1996). These private companies came together in 1995 to form an umbrella organization-cum-NGO named Nepal Biogas Promotion Association (NBPA) (Karki et al., 2015).1996 saw the introduction of Alternative Energy Promotion Centre (AEPC), a government institution under the then Ministry of Science and Technology, with the goals of promoting renewablesources of energy (Pokharel, 2007). On the other side, after the end of BSP Phase I, Phase II, which started in 1994, aimed to construct 13,000 plants by the end of 1997- a number which was over exceeded as 13,375 plants were installed by the end of February. All in all, the relevant agencies and private companies managed to install 30,494 biogas plants, in contrast to the planned 30,000, in the eighth 5-year plan that lasted from 1992 to 1997 (National Planning Commission, 1997).

The goal of BSP III(March 1997-June 2003) was to construct 100,000 biogas plants. In addition to the Dutch sponsors, the German Development Bank (KfW) started funding the project BSP III An additional small-system subsidy of Rs. 1,000 was also allowed during this phase. The HMG, in response to the overachievement in the field of biogas installation in the eight 5-year plan, set a target of 90,000 biogas plants by the end of the 9th 5-year plan that lasted from 1998-2002 (National Planning Commission, 1997). By 2002, only 59,678 out of 90,000, were completed in time (National Planning Commission, 2002). Nepal, embroiled in the peak of the Civil War, could not utilize its resources as much as it would like to. BSP III fell just short of their goals by 2003- installing 91,196 biogas plants in the span of 6 years. The 4th phase of the Biogas Support Program lasted from July of 2003 to June of 2009(Rai, 2009). During the final month of 2003, BSP transformed into Biogas Sector Partnership- Nepal (BSP-N) and became responsible to carry on BSP's 4th phase as an NGO. AEPC assumed the role of the Executing Agency while BSP-N and NBPA took the responsibility of Principal Implementing Agency and Implementing Agency,

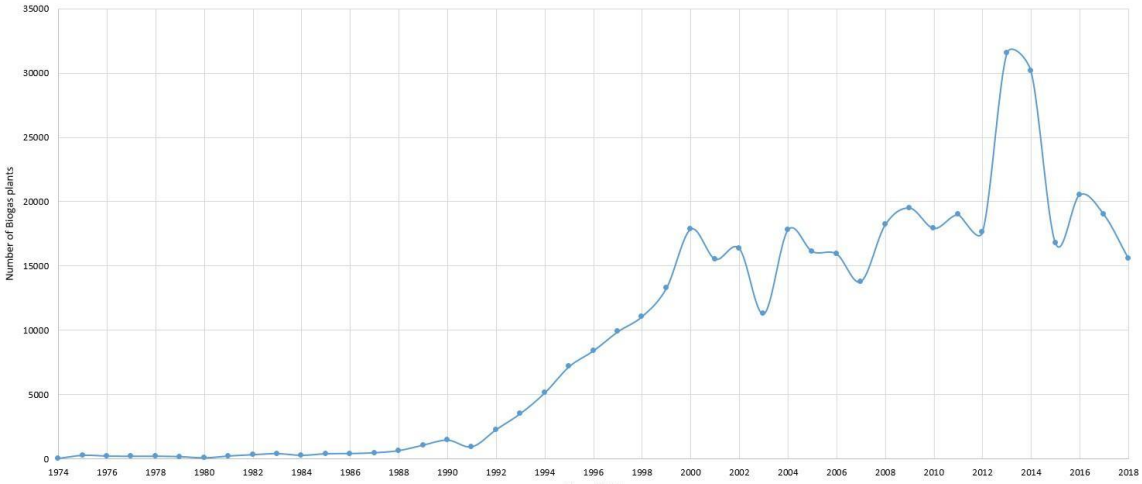
respectively. The initial target was 200,000 plants, coinciding with the plans of the tenth 5-year plan of the HMG that lasted from 2002 to 2007. AEPC and BSP-N also started working with World Wide Fund for Nepal (WWF-Nepal) to develop a new biogas project called the Gold Standard Biogas VER Project (GSP) in 2007(WWF, 2012). GSP worked in the construction of biogas plants in conservation buffer zone areas. However, only 93,095 biogas plants were installed by 2009. The revised target became 117,500, which had to be achieved by the July of 2010. However, only 114,253 plants were installed by the end. Similarly, the eleventh interim 3-year plan for 2007-10 reported that nearly 170,000 biogas plants had been installed between 2002-2007; it also planned for 100,000 biogas plants to be installed across 70 districts in the country. However, only 55,521 plants were installed between 2007-10.(Karki et al., 2015)

New Age in Biogas Technology in Nepal

The new decade saw major developments in the field of medium to large-scale plants. 2010 also saw the start of the new government's 12th plan. The government planned on installing 100,000 plants across the country. There were 222,933 biogas plants before the initiation of the 12th plan (National Planning Commission, 2011). In 2012, the Government of Nepal (GoN) alongside External Development Partners of Nepal's rural and renewable energy sector, like DANIDA, a Norwegian Ministry of Foreign Affairs, KfW, SNV, ADB, World Bank, among others, initiated the National Rural and Renewable Energy Programme (NRREP). NRREP was set to run for five years- i.e. 2012-2017 and planned to install 130,000 household biogas plants and 1200 Community, and Institutional, Commercial, and Municipal Waste Based Biogas Plants (AEPC, 2014). In The 12th plan of completing 100,000 biogas plants could not be completed and only about 61 thousand big and small biogas plants were completed. The 13th plan arranged to last from 2013 to 2016, planned biogas plants- 800,000 household plants, 900 community-cum-institutional plants, 50 commercial plants, and 10 municipal waste plants(National Planning Commission, 2014). In 2014, The World Bank initiated the Scaling Up Renewable Energy Program (SREP/WB) which aimed at "promoting large off-grid biogas energy generation in Nepal" in collaboration with AEPC. At the end of the 13th plan, Nepal recorded about 364 thousand biogas plants all over the country- out of which 78,296 were new ones. The 14th plan (2016-19) planned for 200,000 new biogas plant installations and was again under AEPC(National Planning Commission, 2014).

2017 was the year that Nepal saw its first large-scale biogas plant- Envipower Nepal Energy & Fertilizer company. Biratnagar Pipeline Pilot Project, located in Morang, was inaugurated in 2018 and served 32 households via pipelines Khilung Kalika Poultry, a fully automated poultry farm in Syangja, started its biogas plant to produce electricity farm. Similarly, Gandaki Urja Pvt. Ltd. started its biogas production after 2019 The plant required 45 tonnes of raw materials per day to produce 200 cylinders of biogas and 15 tonnes of bio-fertilizer. By the end of 2019, there were 1,993 Community and institutional plants, urban plants, and commercial plants, and 426 thousand household biogas plants (National Planning Commission, 2020) .

In mid-2020, The World Bank extended the SREP biogas project till the August of 2021 (Amatya, 2020). Furthermore, the 15th plan (2019-2023) planned to install 200,000 households and 500 large-scale biogas plants. Figure 1 displays the number of new biogas plants that have been installed in Nepal from 1974 to 2018. Similarly, Table 1 lists the most important events in the history of Biogas in Nepal in a chronological fashion.



SUGGESTIONS

Only 30% of the population of Nepal has access to clean energy for cooking despite having about 431,629 domestic biogas digesters, more than 321 institutional, and 1812 community biogas plants in almost all parts of the country; the contribution of these plants to clean cooking is only 3.1%. Furthermore, there is a huge potential for biogas production from the rapidly increasing urban population's MSW. However, the current amount of production of biogas is 20 times lesser than the actual potential (Lohani et al., 2021).

There is a myriad of reasons for this under performance, which are tricky to tackle without consulting history. The first real boom in biogas installations came in 1992 because of the BSP which was a successful policy that focused on ordinary citizens in the rural parts of Nepal, providing awareness, skills for construction, utilization, and maintenance, and generous subsidies. A similar policy should be introduced, for the modern age, to facilitate not just rural households but also urban ones. Like GCC promoted biogas through radio and pamphlets, contemporary stakeholders must do the same for to both rural and urban settlers using new forms of communication like social media. As of 2018, the GoN has received more than 380 applications for the construction of large-scale biogas plants(AEPC, 2018). Proper coordination from private, public, and international sectors must be promoted to carry these projects on as sustainably and efficiently as possible. AEPC also has a huge task, like it always has since its promulgation in 1996, of signing better deals with entities, like

with the World Bank during the surge in 2013, and plan flexible policies to take biogas production to a new level.

CONCLUSION

Biogas is an important alternative source for the present and future as fossil fuels and other non-renewable sources are on the brink of extinction. The significance of biogastechnology took a lot of time for mainstream consideration, possibly because of the socio-economic, technological, and political condition of the world throughout human history. After making initial development in the 1850s, it took almost a century for the technology to make a show in Nepal. The introduction of technology, that could bring great benefits to the farmer-class, was probably not in the best interests of the Nepalese autocratic regime of the time. Despite a slow start, Nepal currently has one of the most recognizable biogas scenes in the world. Several international agencies, in collaboration with the then contemporary governmental agencies, launched valuable programs like the BSP that contributed to the development of biogas in Nepal. Nepal now must learn from its history and adapt to the changing times to promote biogas. Unlike previous years, however, the upcoming plans and policies should also focus on the rapidly increasing urban societies and facilitate large-scale plants.

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