The Main Parameter Analysis in Developing Low Pressure Biogas Standards

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Abstract. The Indonesian is one of the countries consuming fossil energy as a petroleum fuels which are quite high with the average needs increasing by 7% per year. The Indonesian Government has a commitment to address the issue of based energy crisis through one of the ways to find alternative energy sources that have the potential to generate energy that significantly to support the government program. The use of biogas is a part of renewable energy which is one of the references for government programs in order to increase energy access for the community through the utilization of New and Renewable Energy especially bioenergy. Biogas is a gas produced by anaerobic activities from organic materials including waste from human, animals, domestic and biodegradable waste or any organic waste that is biodegradable under anaerobic conditions. Biogas is a very interesting gas fuel to be developed because it can be updated and can be made by yourself with uncomplicated simple technology. The purpose of this study was to analyze the main parameters in the low pressure biogas quality requirements. This study uses descriptive qualitative analysis using the software Framework for Analysis, Comparison, and Testing of Standards. The stages of this study include determining the basic principles, formulation and proof of standard concepts, stakeholder analysis, technical analysis and comparison of standards. The research locus includes producers, consumers, technical committees and conformity assessment agencies of biogas. Primary data collection and surveys include 10 provincial cities in Indonesia. This research recommends several parameters that can be used as a basis in developing national and international standards include low pressure factors; gas content including methane; hydrogen sulfide; carbon dioxide and oxygen.

Keyword: Parameters, Standards; Biogas, Energy, FACTS

1. Introduction
The Indonesian government is committed to addressing the issue of the energy-based energy crisis through one way of finding alternative energy sources that have potential to generate energy that significantly support intended government program. The biogas policy is included in one of the bio-energies developed through Presidential Regulation No. 61/2011 and Perpres No. 5/2006, where in Presidential Regulation No. 5/2006 biogas is included in the category of biofuel renewable fuels, the percentage of which is only 5% of total energy used. Biogas is a gas produced by bacteria if organic material undergoes a fermentation process in a digester (biodigester) under anaerobic conditions (without air). Digester used to produce biogas is generally called a digester or biodigester, because this
is where bacteria grow by digesting organic materials. To produce biogas in certain quantities and qualities, the digester needs to be regulated by temperature, humidity and acidity so that bacteria can develop properly. Biogas itself is a combination of methane gas (CH4), CO2 and other gases (Suyitno; Agus Sujono, 2010). Biogas is very potential as a renewable energy source because of its high methane (CH4) content and high calorific value. CH4 itself has a heating value of 50 MJ / kg. Methane (CH4), which has one carbon in each chain, can produce fires that are more environmentally friendly than long carbon chain fuels. This is because there is less amount of carbon dioxide produced during combustion of short carbon chain fuels.

The first benefit of biogas is that it can reduce the use of liquefied petroleum gasnational, this can be done because the methane gas contained in biogas can be used as a combustion as it does in liquefied petroleum gas. The second is that the environment becomes cleaner and more beautiful, this happens because it utilizes waste and dirt to be used as material for making biogas. Third, it can save operational costs for households, by replacing oil and gas fuels that are relatively more expensive with the use of biogas. Furthermore, we can use the digester waste from biogas as an organic fertilizer, either in the form of liquid or solid for agriculture. The sixth benefit of biogas is that biogas can contribute to reducing greenhouse gas emissions, reducing these emissions due to a lack of use of fuel oil and wood. The benefits of the seven biogas can be alternative fuels that can produce electricity to replace diesel fuel use. This biogas fuel can produce around 6000 watts per hour using around 1 cubic meter of biogas. Final Biogas is also useful for reducing smoke and carbon dioxide levels in the air. The use of biogas is estimated to have a green house gases emission reduction during 2010-2020 of 0.13 million tons of carbon dioxide. From these problems and regulations, it is necessary to conduct research on the development of low-pressure National Standard of Indonesia Biogas. Some of the problems found in this research include: 1) The energy crisis based on fuel oil in Indonesia; 2) Unknown parameters in the specifications of low pressure Biogas Standards; and 3) Not yet known the low pressure Biogas quality requirements. The objectives of the study are: 1) Analyzing parameters in the specifications of the Low Pressure Biogas Standard; 2) Analyzing quality requirements that will be used as a reference in order to develop the national standards. The reason is the purpose of the formulation of the Indonesian National Standard for low-pressure biogas; the first is to protect consumers and low-pressure biogas producers from three important aspects, namely safety; safety and health. Secondly, the low-pressure biogas national standard will facilitate the trade in low-pressure biogas, namely the Indonesian national standard of low-pressure biogas as a tool in trade transactions.

2. Method Research

2.1 Standardization of Low Pressure Biogas

Indonesia needs standardization to meet the conditions in the Technical Barier to Trade (TBT). One of the provisions stipulated in the agreement is standard. Standards are used as tools in inter-country trade transactions known as the global market. Indonesia as a member of the Technical Barrier to Trade (TBT) incorporated in the World Trade Organization, known as the World Trade Organization (WTO). Indonesia has ratified the World Trade Organization (WTO) Technical Barrier to Trade (TBT) agreement, namely by agreeing and was signed by the Indonesian government in 1994 WTO TBT Ratification Act Number 7 of 1994 concerning the Ratification of the Agreement Establishing The World Trade Organization. In Law Number 7 of 1994 stipulated by the government of the Republic of Indonesia with the aim that national development aims to create a just and prosperous society that is materially and spiritually equitable based on the Pancasila and the 1945 Constitution in the unified, united Republic of Indonesia, sovereign and sovereignty in the atmosphere of a nation's life that is safe, peaceful, orderly and dynamic in an environment of an independent, fair, friendly, orderly and peaceful world. In carrying out this development, it is necessary that efforts in national development, especially in the economic sector, continue to improve, expand, strengthen and secure markets for all products, both goods and services, including aspects of investment and intellectual property rights. Relating to trade, as well as increasing Indonesia’s ability to competitiveness, especially in international trade. To
implement Law Number 7 Year 1994, the Government of Indonesia stipulates the existence of Law Number 20 of 2014 concerning Standards and Conformity Assessment. In Law Number 20 of 2014 the definition of standardization is the process of planning, formulating, stipulating, implementing, enforcing, maintaining, and supervising standards that are carried out in an orderly manner and cooperating with all Stakeholders (Law Number 20 on 2014 concerning Standardization and Conformity Assessment chapter I General provisions, Article 1 paragraph 1). The government establishes Standardization with the intention of protecting the interests of the state, safety, security, and health of citizens and the protection of flora, fauna and preservation of environmental functions required standardization and conformity assessment. On the other hand, standardization and conformity assessment is one of the tools to improve quality, production efficiency, facilitate trade transactions, realize fair and transparent business competition (Law Number 20 of 2014 concerning Standardization and Conformity Assessment). Furthermore, the definition of standardization is obtained by a standard that is interpreted as follows: Standard is a technical requirement or something standardized, including procedures and methods compiled based on the consensus of all parties / Government / international decisions related to safety, security, health, environmental, development science and technology, experience, as well as current and future developments to obtain maximum benefit (Law Number 20 of 2014 concerning Standardization and Conformity Assessment chapter I General provisions, Article 1 paragraph 3). Further clarified the meaning of the Indonesian National Standard (we call SNI) is that the Standard stipulated by the National Standardization Agency (we call BSN) applies in the territory of the Unitary State of the Republic of Indonesia.

From the above description, it is necessary to standardize low-pressure biogas with the aim of protecting quality improvement, production efficiency, expediting trade transactions, realizing fair and transparent business competition. The low pressure biogas standardization intended in this study includes:

1. Parameters that become technical requirements
2. Low pressure biogas composition
3. Properties or characteristics of low pressure biogas
4. Requirements for low-pressure biogas quality

2.2 Low Pressure Biogas

In Indonesia, Biogas has now been produced which can be categorized as low-pressure biogas. For the Biogas industry that has produced Biogas with the category of high-pressure biogas, it is expected and encouraged to comply with the quality requirements set out in the Indonesian National Standard (SNI). Currently the Indonesian National Standardization Agency has set the Indonesian National Standard (SNI), namely SNI 8019-2014 High-pressure biogas quality requirements. The high pressure Biogas definition refers to SNI 8019-2014 High Pressure Biogas Quality Requirement is Biogas which has been purified and compressed into a tube at a pressure of about 20000 kPa or equal to 200 bar [15]. The quality requirements of high pressure Biogas require the parameters and composition to be met by high-pressure biogas produced, as shown in Table 1, Parameters and Composition of High-Pressure Biogas;

| No | Test Parameter | Unit (min / max) | Requirements |
|----|----------------|-----------------|-------------|
| 1. | Water dew point on 20000 kPa (200 bars) | °C, maks | 5 |
| 2. | Index Wobbe | MJ/Nm³ | 39 – 41 |
| 3. | Methane Number(CH₄) | %vol., min | 80 – 118 |
| 4. | Methane(CH₄) | mg/Nm³, maks | 23 |
| 5. | Hydrogen sulphide(H₂S) | | |
From Table 1 above, the requirements for quality and parameters related to the main parts of biogas produced must meet international and foreign standards. That the production of Biogas in the quality testing of low-pressure biogas products refers to international standards including the International Organization for Standardization (ISO) and also the Foreign Standards, namely American Standards for Testing and Material (ASTM) and Gas Processors Association (GPA) a Gas Association Agency in Oklahoma USA, which can be shown in Table 2, below:

**Table 2** Quality and parameter requirements when biogas is produced must meet international and international standards

| No  | Test Parameter                  | Unit (min / max) | Requirements | International Standards / Standards of Foreign Countries |
|-----|--------------------------------|------------------|--------------|--------------------------------------------------------|
| 1.  | Water dew point on 20000 kPa (200 bars) | °C, maks         | 5            | ASTM D1142                                             |
| 2.  | Index Wobbe                    | MJ/Nm3           | 39 – 41      | ASTM D3588/ ISO 6976/GPA 2172                          |
| 3.  | Methane Number(CH₄)            | %vol., min       | 80 – 118     | ISO/TR 22302                                           |
| 4.  | Methane(CH₄)                   | %vol., min       | 80           | ASTM D1945/GPA 2261                                    |
| 5.  | Hydrogen sulphide(H₂S)         | %vol., min       | 23           | ASTM D4084/ISO 19793                                   |
| 6.  | Hydrogen                       | %vol., maks      | 0,1          | ISO 6974-5/ ASTM D1945/GPA 2261                         |
| 7.  | Carbon dioxide(C₂O)            | %vol., maks      | 18           | ISO 6974-5/ ASTM D1945/GPA 2261                         |
| 8.  | Oksigen (O₂)                   | %vol., maks      | 1            | ISO 6974-5/ ASTM D1945/GPA 2261                         |
| 9.  | Sulphur Total                  | mg/Nm3, maks     | 50           | ASTM D4468/ ASTM D 6667                                |
| 10. | Relative density               |                  | 0,55 – 0,75  | ISO 6976/ GPA 2172/ ASTM D3588                          |

[15] The National Standardization Agency of Indonesia (BSN); Indonesian National Standard (SNI) 8019-2014 Quality Requirements for High Pressure Biogas); Jakarta; 2014

The selection of the appropriate biogas storage system contributes significantly to the efficiency and safety of biogas plants. The biogas storage system compensates for fluctuations in production and consumption of biogas and changes in volume related to temperature. There are two broad categories of biogas storage systems: Internal Biogas Storage Tanks are integrated into the anaerobic digester while...
External Biogas Holders are separated from the digester which forms autonomous components of the biogas plant.

2.3 Types of Biogas Storage Systems

The simplest and cheapest storage system for on-site and biogas storage is a low pressure system. The floating gas holders in the digester tank form an option for low pressure storage for the biogas system. This system usually operates at pressures below 2 psi.

Floating gas holders can be made of steel, fiberglass or flexible fabrics. Separate tanks can be used with floating gas reservoirs for digestate storage and also raw biogas storage. The main advantage of a digester with a gas storage component that is inseparable is the reduced system capital costs.

The cheapest and most problem-free gas holder is the top of a flexible rubber cloth, because it does not react with H2S in biogas and is an integral part of the digester. This type of cover is often used with plug- flow and complete digester. Flexible membrane materials commonly used for these gas holders include high-density polyethylene (HDPE), low-density polyethylene (LDPE), linear low density polyethylene (LLDPE), and polyo-chloronulfonated polyethylene closed polyester. The thickness for cover material usually varies from 0.5 to 2.5 millimeters.

Frequently used low pressure tanks have an excess pressure range of 0.05 to 0.5 mbar and are made of special membranes, which must meet a number of safety requirements. The membrane tank is installed as an external gas reservoir or as a dome / gas cover, above the digester. An external low pressure reservoir can be designed in the form of a membrane pillow / gas balloon. Membrane pillows are placed in buildings for weather protection or equipped with a second membrane [11] and [23].

It is said that Biogas has a high pressure if the produced biogas has been refined and compressed at a pressure of 20,000kascal or equal to 200bar related to pressure on biogas described [24]; as follows:

- Pressure (p) Air 1 atmosphere (atm) = 760mmHg = 14.7 psi = 1,013 mbar = 10.13 bar = 1,033.23cmH2O

- Formula: Biogas pressure (p) = p (biogas) + p (air)

- Biogas pressure that can ignite a stove of at least 2.0 cmH2O and smells very sharp H2S; if so, then: p biogas = 2.0 x 0.98 mbar = 1.96 mbar = 0.00196 bar

- From the experimental results by Prof. Dr. Muhammad Junus in the digester vessel in the Malang city location in East Java, found that the highest biogas pressure reached 40cmH2O and the highest was 120cmH2O; if converted, as follows:

  a. When the biogas pressure reaches 40cmH2O = 40 x 0.98 mbar = 32.9 mbar = 0.0329 bar
  b. At the highest biogas pressure 120cmH2O = 120 x 0.98 mbar = 117.6 mbar = 0.1176bar

  From the results of the experiments above, it can be concluded that all the results of biogas produced from organic materials through anaerobic processes (without oxygen) produced without purification and compression have a low pressure with ranges: 0.0329bar to 0.1176bar.

- When compared with Pressure (p) Air 1 atmosphere (atm) 10.13 bar = 1,033.23cmH2O then the pressure(p) of biogas produced directly from the digester is very low.

High pressure biogas is biogas which has been purified and compressed into a tube at a pressure of around 20000 kPa (200 bar) [15].

From the results of the Technical Committee Workshop Forum 27.04 Bioenergy under the authority of the Directorate of Renewable Energy (EBT) of the Ministry of Energy and Mineral Resources (ESDM) on May 2019 and the June 2019 Focus Group Discussion (FGD) Forum between the Research Team of the National Standardization Body and Biogas Experts come from Brawijaya University Malang; PT Swen Inovasi Trasfer and CV Seyogomoro Malang then from the results of the experts'
research and discussion it was determined that apart from the pressure factors that form the basis of the low pressure biogas parameters, a formula which describes low pressure biogas as follows: Low Pressure Biogas is a gas produced by anaerobic microorganisms from organic materials, without going through a process of purification and compression; with Composition, which is shown in Table 3 Low Pressure Biogas Composition, as follows:

| Table 3 Parameters and Composition of Low Pressure Biogas |
|-------------------------------------------------------------|
| No | Test Parameter | Unit (min / max) | Requirements |
|----|----------------|------------------|--------------|
| 1. | Water dew point | °C, maks | ≤ 1,0 |
|    | on 0.1-0.9 bar |                  |              |
| 2. | Methane(CH₄)   | %vol., min | 78-85 |
| 3. | Hydrogen sulphida(H₂S) | mg/Nm³, maks | 0-10 |
| 4. | Carbondioxide(C₂O) | %vol., maks | 15-20 |
| 5. | Oksigen (O₂)   | %vol., maks | 0.5-1.0 |

From Table 8 above it is shown that the characteristics of low-pressure Biogas are very low pressures of 0.1 to 09.9 bar (≤ 1.0); by producing very high methane (CH₄) gas which is 78 to 85% of the volume at a very maximum level; carbon dioxide (CO₂) in the range 0 to 10% volume at the maximum level and produce hydrogen sulfide (H₂S) gas with a high concentration, namely with a range (range) 0 to 10 mg / Nm³ at the maximum level.

2.4. Standard Development
The development of Low Pressure Biogas standards in Indonesia is very much needed by considering several aspects that:
1. Indonesia is an archipelago consisting of around 17,000 large and small islands
2. Indonesia has a population of around 250,000,000
3. For sufficient electricity needs for 250,000,000 people need a large amount of electrical energy to meet the lighting / lighting needs and the need for electricity.
4. It needs new renewable energy as a new source of electrical energy known as renewable energy (EBT) to meet the electricity needs of 250,000,000 people.
5. To meet the electricity needs sourced from renewable energy, the Republic of Indonesia has developed Electricity Energy sourced from Biogas, as part of Bioenergy.

To meet the needs of renewable electrical energy sourced from Biogas, in Indonesia from 2009 to April 2019 there were 43,836 digesting tanks (biodigester) [25]. Indonesia has many of the home industry scale in ten provinces in Indonesia [1]; include:
1. West Java Province
2. Central Java Province
3. Yogyakarta Special Province
4. East Java Province
5. Banten Province
6. Bandar Lampung Province
7. Bali Province
8. East Nusa Tenggara Province
9. West Nusa Tenggara Province
10. South Sulawesi Province

Of the 24,000 digesting tanks (biodigesters) that exist in Indonesia today consist of digestive tanks (biodigesters) with volume capacity, including:

- a. Tank with a volume of 2m³
- b. Tank with a volume of 4m³
- c. Tank with a volume of 6m³
- d. Tank with a volume of 8m³
- e. Tank with a volume of 10m³
- f. Tank with a volume of 12m³
- g. Tank with a volume of 20m³
- h. Tank with a volume of 30m³
- i. Tank with a volume of 50m³

The development of international standards developed by The International Organization for Standardization (ISO) related to Biogas is handled by ISO Techniocal Committe 255 Biogas. ISO / TC 255 Biogas has 19 member countries with status participants (P-members) and 22 countries member with status observer (O-members). ISO / TC 255 Biogas has scope: Standardization in the field of biogas produced by anaerobic digestion, gasification from biomass and power to gas from biomass sources.

The ISO Technical Committee 255 Biogas has formulated 4 (four) standards related to Biogas products as shown in Table 4: List of TC / ISO 255 Biogas and Standard Products.

| No. | ISO Standards               | Description                                                                 | Status                     |
|-----|-----------------------------|-----------------------------------------------------------------------------|----------------------------|
| 1   | ISO 20675-2018              | Biogas -- Biogas production, conditioning, upgrading and utilization -- Term, definitions and classification scheme | Publish                    |
| 2   | ISO/DIS 22580-2018          | Flares for combustion of biogas                                             | Under development          |
|     | ISO/AWI TR 23585-2018       | Safety and Environment Guidelines for Biogas                               | Under development          |
| 4   | ISO/CD 23590-2018           | Household Biogas System Requirements                                       | Under development          |

[7] International Organization for Standardization (ISO); Technical Committee (ISO/TC 255) Biogas; June 30, 2019

Standar ISO 20675-2018 Biogas production, conditioning, upgrading and utilization - Terms, definitions and classification scheme dengan lingkup This document defines terms and describes classifications related to biogas production by anaerobic digestion, gasification from biomass and power to gas from biomass sources, biogas conditioning, biogas upgrading and biogas utilization from a safety, environmental, performance and functionality perspective, during the design, manufacturing, installation, construction, testing, commissioning, acceptance, operation, regular inspection and maintenance phases.

Biogas installations are, among others, applied at industrial plants like food and beverage industries, waste water treatment plants, waste plants, landfill sites, small scale plants next to agricultural companies and small scale household installations.

The following topics are excluded from this document:
- boilers, burners, furnaces and lighting, in case these are not specifically applied for locally produced biogas;
- gas-fuelled engines for vehicles and ships;
- the public gas grid;
- specifications to determine biomethane quality;
- transportation of compressed or liquefied biogas;
- transportation of biomass or digestate;
- assessment and determination whether biomass is sourced sustainably or not.

This document describes the following for information purposes as well:
- the parameters to determine the size (e.g. small, medium-sized, or large scale);
- the parameters to determine the type of installation (e.g. domestic, industrial);
- the parameters to describe the type of technique;
- terms and processes in order to develop health, safety and environmental protection guidelines for biogas installations.

Standar ISO/DIS 22580-2018 Flares for combustion of biogas dengan lingkup is applies to the design, manufacture, installation and operation of flares for the combustion of biogas. Test methods and performance requirements are also included. Biogas systems are amongst others applied at industrial plants like food and beverage industries, waste water treatment plants, waste plants, landfill sites, small scale plants next to agricultural companies and small scale household systems. From table 9 above shows that until 2018 only one ISO standard has been published related to ISO 20675-2018 Biogas production, conditioning, upgrading and utilization Terms, definitions and classification scheme.

Furthermore, there are three other ISO standards in development, namely:ISO/DIS 22580-2018 Flares for combustion of biogas, including :
1. ISO/DIS 22580-2018 Flares for combustion of biogas
2. ISO/awi TR 23585-2018 Safety and Environment Guidelines for Biogas
3. ISO/CD 23590-2018 Household Biogas System Requirements

On the other hand, in order to develop the Biogas industry in Indonesia and to meet the needs of the Biogas Industry in Indonesia, up to 2018 in Indonesia has five Biogas Indonesian National Standards (SNI), as shown in Table 5 of the Indonesian National Standard ( SNI) Biogas, as follows:

| No | National Standards of Indonesia (SNI) | Description | Current Status |
|----|--------------------------------------|-------------|---------------|
| 1  | SNI 7639-2011                        | Fixed dome type biogas reactor (biodigester) glass fiber - Quality requirements and test method | Publish |
| 2  | SNI 7826-2012                        | Biogas producing unit with fixed dome type digester tank | Publish |
| 3  | SNI 7927-2013                        | Network equipment for biogas units | Publish |
| 4  | SNI 8019-2014                        | High-pressure biogas quality standards | Publish |
| 5  | RSNI1 XXXX-2019                      | Performance of installation of communal biogas | Publish |

[17] The National Standardization Agency of Indonesia (BSN); The National standards of Indonesia (SNI) Cotaloug; 2018

From Table 5 it is shown that the National Standardization Agency of Indonesia (BSN) has set five SNIs that have been published and have been applied in the biogas production industry and also SNI user stakeholders in the biogas trade. On the other hand, the National Standardization Agency of
Indonesia (BSN) until June 2019 has prepared a draft SNI with the SNI Design Code (RSNI) XXX - 2019 with the title Performance of installation of communal biogas, in the development stage, on progress to be set to National Standard of Indonesian (SNI).

From Table 10 and Table 11 it can be concluded that both internationally and nationally Indonesia in June 2019 has not developed a low pressure biogas standard. In conditions up to June 2019 that gas produced from biogas produced from digestive tanks (biodigesters) is categorized in the Biogas group with low pressure with biogas pressure (p biogas) between ranges from 0.9 to 1.0 bar with compositions as shown in Table 8. From Table 8, Table 9 and Table 10 it is expected that the results of this study can recommend the development of Low Pressure Biogas Indonesian National Standard (SNI). Judging from the trend of the development of biogas produced both in Indonesia and internationally and which has been traded until June 2019 which is categorized as low pressure Biogas, it is hoped that Indonesia will be the first country to develop a low-pressure Biogas Quality Standard. This is one step in Indonesia's progress both at the national and international level in the context of developing the intended low-pressure biogas standard.

The results of data analysis based on questionnaires show that most industries develop Biogas in Indonesia, shown in Figure 1 Number of Biogas Developers in Indonesia; as follows:

![Figure 1. Number of Biogas Developers in Indonesia](image)

Figure 1 shows that 60% of the Home Industry develops the Biogas business for the sake of the electrical energy needs in its home environment. This also strengthens the Indonesian government to develop a low pressure Biogas Indonesian National Standard (SNI).

2.5. Benefits of Standard Development

From the description above in section 4.3 of the Development of Standards it is known that in Indonesia from 2009 to 2018 there have been 43,836 home industry scale biodigesters in ten provinces in Indonesia producing a volume of Biogas 74,568 m3 of gas per day [25]. Cumulatively in one year biogas production with a volume of 25,760,000 m3 of gas per year [25].

In Indonesia biogas produced annually with a volume of 25,760,000 m3 of gas per year is used by users to:

1. Eco friendly

   Biogas produced in Indonesia until April 2019 is categorized in the renewable energy group (EBT); raw materials are easy to find; easy to produce; clean produced energy; does not cause pollution and reduce greenhouse gas emissions. In relation to Biogas as Eco friendly, the Indonesian government
advises the Indonesian population in rural areas (far from the city center) to utilize Biogas Energy as new renewable energy to generate electricity that is useful for lighting and for meet the electrical energy needs in the rural environment in question.

2. Reducing pollution in soil and water
   Improving water quality with a pattern or method of not removing animal waste (cows, chickens, pigs, and humans) directly on the flow of nearby rivers has the effect of reducing pathogenic bacteria on the soil, so that the environment becomes hygienic.

3. Produce organic fertilizer
   Dregs of biogas production called slurry are organic fertilizers which are useful as organic fertilizers for plants and slurry is used for animal feed.

4. Simple and economical technology
   It is a simple technology because in building digestive vessels (biodigesters) requires raw materials with affordable economic value and can be found in all locations in rural areas (including sand; cement; gravel; red bricks; fibers and others). Have economic value because all the raw materials can be purchased at low prices. On the other hand, the biogas production can be directly utilized by the community in the village to light the stove; activate / run an electric generator as a source of electrical energy for lighting at home; move the fan; heating water with water heater and others. This has led to long-term investment in biogas users, namely utilizing renewable energy for their daily needs. The benefits of using renewable energy (EBT) that people in rural areas can live frugally and save money.

5. Appropriate technology to produce new renewable energy (EBT) in rural areas in Indonesia.
   Biogas is an alternative energy that is replacing fuel oil (BBM) with biogas used to light the stove; drive electric generator set; replace the function of biomass (wood) as fuel for cooking.

6. Every 1 (one) Unite The digesting tank (Biodigester) that will be built at each location will reduce the amount of 2.6 tons of carbon dioxide (CO2) gas per year.
   From the description of the 6 (six) aspects of the utilization of biogas mentioned above, in its development in the years to come there is a great need for the development of the Indonesian National Standard (SNI), in order to trade beneficial low-pressure biogas. In this case the biogas produced is in accordance with the parameters and characteristics shown in Table 7 in section 4.3 of the Types of Biogas Storage, required low pressure Biogas Indonesian National Standard (SNI). Benefits of developing Low Pressure Biogas, including:
   1. Protect consumers of low-pressure biogas users
   2. Protect the industry in terms of producing low-pressure biogas
   3. Increase the added value of the low-pressure biogas trade by making the Biogas Indonesian National Standard low-pressure as a tool in trade transactions at the national and international levels
   4. Provide positive value to the government in the formulation of national policies related to low-pressure biogas production

From the results of the questionnaire analysis from the results of surveys and interviews in the field up to May 2019, it shows that most of the Biogas businesses developed by Biogas entrepreneurs are low pressure, as shown in Figure 3 of the Biogas Business Type.
Figure 2 Biogas Business Type

The results of Figure 2 show that the number of Biogas businesses developed is 67% developing a low pressure Biogas Business / Industry. On the contrary, only 16% carried out high-pressure biogas business and 17% carried out high-pressure Biogas business as well as low pressure (Both).

3 RESEARCH RELATED TO BIOGAS

The results of the literature review from the published standards of Biogas research in Indonesia can be seen in the Table 6;

Table 6. Research Results About Biogas Based on Standard
| Author | Research Topics | Publication | Results |
|--------|----------------|-------------|---------|
| Guyup Mahardhian, Dwi Putra, Sirajuddin Haji Abdullah, Asih Priyatih, Diah Ajeng Setiawati, Surya Abdul Muttalib | Designing Portable Biogas Digester Type from Cattle Manure; | Jurnal Ilmiah Rekayasa Pertanian dan Biosistem, Vol. 5, No. 1, Maret 2017 | (1) Design of small and portable biogas digester. (2) Analyze the quality of the biogas flame test by taking into account temperature, pH and pressure. |
| Mu’anah, Cahyawan Catur Edi Margana, Asih Priyati, | Study of Characteristics of Cattle Digester Based on Water Composition Based on Kinetics of Methane Gas for Bio Gas Production; | Jurnal Ilmiah Rekayasa Pertanian dan Biosistem, Vol. 5, No. 1, Maret 2017 | To study the design and construction of digester equipment and to know scientifically the process of producing methane gas with cow dung raw materials. |
| Suyitno Agus Sujiro Dharmaanto | Biogas Technology Making, Operational, and Utilizing; | Teknologi Biogas, Edisi Pertama; 2010 | Biogas is a very interesting gas fuel to be developed because it can be renewed and can be made on its own with less complicated technology. In addition to obtaining biogas fuel, the by-product of biodigester can also be used as fertilizer. |
| Trisno Saputra, Suharjono Triatmojo, Ambar Pertiwiningrum | Biogas production from a mixture of cow faeces and sugarcane pulp (Bagasse) with different C / N ratios; | Buletin Peternakan Vol. 34(2): 114-122, Juni 2010 | Knowing the quality of biogas produced from a mixture of cow faeces and bagasse with different C / N ratios, so that the most optimal mixture is known. Three treatment groups based on differences in the C / N ratio, namely C / N 22, C / N 30, and C / N 35 with three replications. |
Biogas is produced from the fermentation process of organic materials by anaerobic bacteria. The calorific value contained in biogas depends on CH4 concentration. One of the things that affects CH4 production in biogas is the terminology of the C-N ratio in dry materials ranging from 25: 1 - 30: 1. Cow manure has a C-N ratio of 18: 1, so other ingredients such as rice husk must be added which has a C-N ratio of 65: 1.

The research capability of biogas digester production made of 120-liter Fiberglass was carried out with the aim of knowing several stages of the process to be able to process cow manure into biogas and find out the process of making biogas produced from cow dung equipment used: pipe saws, electric welding machines, grinding, hammers, gauges, scissors, while the material used: fiberglass 120 liter, ½ inch pipe, 4 inch pipe, L and T pipe shape, 4 inch L pipe shape, glue pipe, stop the value of ½ inch, stop the value ¼ inch, hose rubber, iron pipe ¼
The results of the literature review obtained in Table 3 above conclude that if the gas produced from the results of the low pressure biogas digestion vessel has; specific properties and characteristics, depending on the biogas raw material which is mixed into the digesting tank (biodigester); and has different qualities. Based on the raw material in the digesting tank (biodigester) to produce biogas with a carbon ratio inversely proportional to Nitrogen (C / N) to produce methane gas, can be seen in Table 4, as shown below; Table 7 Sources of raw materials in the Biodigester with a ratio of carbon and nitrogen (C / N ratio).

| Raw material | C/N ratio | Gas methane (CH₄) production (m³) |
|--------------|-----------|----------------------------------|
| Duck droppings | 8         | 0,065-0,116                      |
| Chicken droppings | 8        | 0,065-0,116                      |
| Goat dung     | 12        | 0,16                             |
| Pig dung      | 18        | 0,04 – 0,059                     |
| Sheep dung    | 19        | 0,016                            |
| Cow dung      | 24        | 0,023-0,04                      |

Table 7 above shows that raw material (raw material) that can be processed on a digestive tank (biodigester) to produce good quality methane (CH₄) gas, namely: Goat dung; duck droppings; chicken droppings; pig dung; Cow dung and Sheep dung. For this reason, in producing quality methane (CH₄) gas, it must pay attention to the priority of the raw material.

4. Conclusions and Recommendations
4.1. Conclusions
This research produces 5 (five) parameters which become specifications of low pressure Biogas Standards, including: 1) Water dew point at 0.1 - 0.9 bass; 2) produce methane (CH₄); 3) produce Hydrogen Sulfida (H₂S) with the dominant odor; 4) produce carbon dioxide (CO₂); 5) produces Oxygen (O₂).
4.1.2. This research produces quality requirements that are a reference in the development of standards, as shown in the Table 8 below:

| No. | Test Parameter                  | Unit (min / max) | Requirements |
|-----|---------------------------------|------------------|--------------|
| 1.  | Water dew point on 0,1-0,9 bar   | °C, maks         | ≤ 1,0        |
| 2.  | Methane(CH$_4$)                 | %vol., min       | 78 - 85      |
| 3.  | Hydrogen sulphida(H$_2$S)       | mg/Nm$^3$, maks  | 0 - 10       |
| 4.  | Carbon dioxide(C$_2$O)          | %vol., maks      | 15 - 20      |
| 5.  | Oksigen (O$_2$)                 | %vol., maks      | 0,5 – 1,0    |

The analysis of this study concluded that 67% of businesses / industries developed low-pressure biogas. This is a positive input to the Indonesian government and related parties to develop the low-pressure Biogas Indonesian National Standard (SNI).

4.2. Recommendations

Based on the above conclusions, this study recommends the Indonesian government and related parties to carry out the development of a low pressure Biogas Indonesian National Standard (SNI), taking into account the 5 (five) parameters as quality requirements, adjusted to the Table 12 above.

5. Acknowledgements

The research activities of the Development of Low Pressure Biogas Indonesian National Standard (SNI) are research / research activities of INSINAS for the Fiscal Year 2019 which are funded by the Ministry of Research and Technology; Directorate General of Higher Education in Jakarta. Implementation Team of INSINAS Research in Fiscal Year 2019 Development of Low Pressure Biogas Indonesian National Standard (SNI) is carried out by the National Standardization Agency of Indonesia (BSN) Human Resources Research and Development Center, with the Main Researcher concurrently Team Leader Mr. Bendjamin Benny Louhenapessy, with Researcher position Intermediate Level in the Field of Standardization. On this occasion, let us represent the 2019 INSINAS Research Team to thank the Ministry of Research and Technology; The Directorate General of Higher Education in Jakarta has provided funding until the implementation of this research and has succeeded in producing scientific papers (KTI) published in the nationally accredited Scientific Journal and Publications in the International Indexed Scientific Journal. We express our gratitude to the Management of the National Standardization Agency of Indonesia (BSN); especially to the Head of the Center for Research and Development of Human Resources who has provided the opportunity for our Team to carry out the 2019 Insinas Research in question.

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