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The Effect of Population Behavior on New Renewable Energy in Primary Energy Mix for 2025 National Target: Sumedang Regency Review, West Java

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ABSTRACT

The results of the Study of the Agency for the Assessment and Application of Technology in 2018 estimated the primary energy mix target of renewable energy at 23 (twenty three) percent by 2025 will not be reached. It is estimated that only reach 12.9 (twelve point nine) percent. The use of renewable energy, especially biomass and biogas by the population independently has not been included in the calculation of meeting the energy mix target by the government. Even though the potential of primary energy of bio energy in Indonesia is 32,653.8 MW. This study examines the behavior of the population towards the use of renewable energy, especially biomass and biogas in meeting their needs for cooking and business. The face-to-face research was carried out on 85 (eighty-five) respondents and online as many as 16 (sixteen) respondents in 17 (seventeen) villages in 7 (seven) districts in Sumedang Regency. The study was also conducted on 574 (five hundred seventy four) respondents both online and face to face in 366 (three hundred sixty six) villages in 240 (two hundred forty) districts in 91 (ninety one) districts / cities in 22 (twenty two) provinces. From the results of research and analysis of characteristics, descriptive analysis, logistic analysis and calculations; shows that: (a) trends in 2025, Sumedang residents choose to use biogas fuel, (b) trends in 2025, Indonesians choose to use solid fuels, (c) minimum contribution or potential contribution of Indonesian population to achieving energy mix targets primary New and Renewable Energy of 3.80 (three point eight) percent in 2018 and increased to 8.16 (eight point sixteen) percent in 2025 or about 35 (thirty five) percent of the target of the New and Renewable Energy mix. Thus, this research needs to be followed up and encourage the government through the National Energy Council to conduct more comprehensive research in all regions in Indonesia.

KEY WORDS: Primary Energy Mix, Biogas, Biomass, Renewable Energy, Population Behavior.

NOMENCLATURE

KEN	Kebijakan Energi Nasional
RUEN	Rencana Umum Energi Nasional
RUED	Rencana Umum Energi Daerah

BPPT Badan Pengkajian dan Penerapan Teknologi

OEI Outlook Energi Indonesia
NRE New and Renewable Energy

RE Renewable Energy

LTSHE Lampu Tenaga Surya Hemat Energi

DME Desa Mandiri Energi

HTIE Hutan Tanaman Industri Energi
ESDM Energi dan Sumber Daya Mineral
PLN Perusahaan Listrik Negara

BPS Badan Pusat Statistik

1.0 INTRODUCTION

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below.

Primary Energy

Crude Oil

Natural Gas

Coal

Total

New and Renewable

To achieve the goals of the Republic of Indonesia's National

Energy Policy (KEN), the President established Presidential

Regulation No. 22 of 2017 concerning the National Energy

General Plan [1]. This regulation refers to Government

Regulation No. 79 of 2014 concerning the National Energy

Policy, where the KEN is prepared by the National Energy Board.

KEN is a guideline for giving direction on national energy

management in order to realize energy independence and national energy security to support sustainable national development. The

National Energy General Plan (RUEN) is the central government

policy at the macro level regarding national energy management

plans. RUEN is a translation and plan for implementing a cross-

sectoral KEN. To achieve the target of KEN, a modeling of

energy demand (supply-demand) was made until 2050. Policies

and strategies to be carried out were determined. RUEN becomes

a reference in preparing the Regional Energy General Plan

(RUED) on a micro-scale. Government Regulation No. 79 of

2014 Article 9 stipulates energy needs in Indonesia until 2025 and

2050 by using the primary energy mix as shown in Table 1.1

Table 1.1 Primary Energy Mix [2]

Note: (*) As long as the economy is met.

energy security, the role of renewable energy is enhanced even

greater. The government supports its fulfillment by using New

and Renewable Energy in the implementation of primary energy

mix in Indonesia [1,3]. The main concern in the development of

electricity infrastructure projects is the use of renewable energy.

In its journey, since the enactment of Government Regulation Number 79 Year 2014 with 2015, 2016 and 2017 RUEN, Agency

for the Assessment and Application of Technology (BPPT)'s

review in OEI 2018 states that the target of using renewable

energy planned by the government will be difficult to achieve

[1,4,5,6]. Table 1.2 shows the targets, achievements, projections

of NRE achievement and BPPT study results.

In line with the goal of creating energy independence and

Until 2025

23% (*)

25%

30%

22%

100%

Until 2050

31% (*)

20%

25%

24%

100%

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12,60 2023 11,55 13,20 2024 12,10 14.10 2025 12,65 23,10

Source: Processed from PerPres No. 22/2017, EBTKE Statistics 2016, 2 Presentations of ESDM, BPPT OEI 2018 [1,7,8,9,10,4] (*) Projections for 2017-2025 are calculated with an average growth of 0.55% (processed from [7,8].

By paying attention to the availability of RE-based primary energy in Indonesia [1], the potential is varied and quite large. The primary energy available consists of geothermal, hydropower, mini hydro & micro hydro, bioenergy, solar/ sunlight, wind and movement & temperature differences in the sea layers. Overall in Indonesia there is potential RE with power equivalent to 420,029.4 MW with total bioenergy equivalent to 32,654.4 MW.

The use of biomass and biogas by the population will contribute in achieving the target of using NRE in the primary energy mix. For this reason, it is necessary to conduct research on the significant impact of the influence of population behavior on the use of renewable energy (RE). The use of RE by the population in their daily lives is biomass and biogas. The achievement of the use of RE by the population independently does not require as much cost as is required in: (a) the use of B20 biodiesel and gradually increased the percentage of FAME (oil palm) to B100 [8,11], (b) access to lighting with energy-efficient solar lamps (LTSHE) [8]. The potential of RE in West Java is the most comprehensive and the largest in Indonesia, namely 28,235.1 MW including bioenergy at 2,554.1 MW [1]. Its area covers 27 regencies/cities [12].

Sumedang Regency was chosen for the following reasons:

- a. It is estimated that some of the population uses primary energy RE with the availability of fuel wood, rice husks, sawdust, charcoal, biomass briquettes, dairy farming centers, beef cattle, buffaloes, horses, goats, sheep and poultry and tofu industry centers [13, 14,15,16,17,18,19,20,21,22];
- b. The Sumedang Regional Government Strategy to increase energy independence and water sufficiency [23]; and
- c. Policy targets for developing energy creation and utilization [23].

According to the 2017 West Java Provincial Housing Statistics, the use of fuel wood, charcoal and other solid fuels in rural areas is 27.20% and in cities is 4.32% with an average city and rural area of 11.17% [13,14]. This percentage is categorized quite high [13]. Firewood users for cooking are still high in Indonesia. In 2017 in Indonesia, 31.3% of rural people still cook using firewood. This figure is very different from urban people, which is only 5.15% [14]. Compared to 2012 data, there was a decline in firewood users. Users in the village were 58.79% and in the city 12.79% [14].

1 teme vement						
Year	Target [1]	Achievement & Projection (*) [12, 13]	& Projection Achievem P		BPPT OEI 2018 [2]	
2010		4,42				
2011		4,32				
2012		4,52				
2013		5,18				
2014		6,35				
2015	5,06	6,70				
2016	5,69	7,70				
2017	6,36	8,25	12,15			
2018	7,23	8,80	12,71	12,50		
2019	8,21	9,35		12,40		
2020	9,60	9,90		12,10	11,00	
2021		10,45		12,40		

Table 1.2: Achievement Target and Projection of NRE Achievement

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1.1 Problem Formulation

In this research, it will be observed the behavior of the population towards the use of renewable energy, especially biomass and biogas. The choice of population for various primary energy for household needs (cooking, heating water, etc.) and tofu craftsmen are analyzed. The extent of Sumedang's love for the tradition of using traditional fuels and his understanding of a clean and sustainable environment.

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Based on achievement data from 2010 to 2016 and assuming an increase in the growth of the NRE mix for electric and non-electric power on average by 0.55% [13,14] or 6.1% / year according to the BPPT study [4], then in 2025 it is estimated that there will be a shortage of 10.35% or 10.1% according to a BPPT study (Table 1.2). The question is whether the utilization of RE as primary energy by the population independently can add a sufficient percentage in achieving the national target of non-fossil primary energy or NRE?

1.2 Research Objectives

The purpose of this study is to determine the type and amount of RE as primary energy use by the population by:

- examine whether the behavior of the population in Sumedang Regency is still willing to use RE as primary energy in their daily lives until 2025;
- calculate the percentage of the population of Sumedang Regency that uses biomass and biogas and compares it with statistical data for West Java; and
- c. to study whether the results of research in Sumedang Regency can be used as a reference on a national scale.

1.3 Research Benefits

It is hoped that the research results can provide confirmation that:

- a. The use of biomass and biogas primary energy by the population independently can contribute solutions to achieve the national target of primary energy NRE in the primary energy mix by 2025.
- b. As proof of community participation in reducing greenhouse gas emissions reductions.
- c. As a reference for more comprehensive and comprehensive research in Indonesia.

2.0 RESEARCH METHODOLOGY

2.1 Research Strategies

The object of research is the household. Sumedang Regency with 26 subdistricts, 283 villages, in 2017 had 370,375 families or households [25]. Not all household populations are respondents. The number of samples is not calculated based on the Slovin formula. To find out population behavior in the use of renewable energy, multistage sampling is used. 5 districts were selected according to their respective characteristics. For every 1,000 households in each sub-district, 1 household was randomly selected as a respondent (systematic random sampling). For the calculation of the use of renewable primary energy in Sumedang will be calculated based on secondary data obtained from various sources and results of research on population behavior. For national scale calculations, will be determined based on achievements in Sumedang.

2.2 Research Sites and Samples

The study sites were conducted in several villages as shown in Table 2.1 below.

Table 2.1: Research Sites and Samples

Selected Subdistrict Number of Family Number of	Selected Village	Number of Samples
---	------------------	----------------------

	Heads	Samples		
Tanjungsari	23.356	23	Tanjungsari	23
Pamulihan	20.036	20	Haurngombong	11
Pamuman	20.030	20	Pamulihan	9
Sumedang	30.003	30	Kebonjati	30
Utara	20.002		11000113411	20
Cibugel	7.438	7	Tamansari	7
Surian	4.479	4	Surian	4
Total		84		84

Tanjungsari Village, Tanjungsari Subdistrict is a village whose population mostly use LPG for household or business purposes [24]. Haurngombong Village, Pamulihan Subdistrict is the first Energy Independent Village (DME) and became a pilot DME in Sumedang [16]. However, according to data from the Sumedang Regional Government [24], the majority of the population uses LPG. Pamulihan Village, Pamulihan Subdistrict is a village where most of the population uses firewood for household and business purposes. Kebonjati Village, North Sumedang Subdistrict is a village whose population mostly use LPG [24]. But the results of observations on the first visit at the center of tofu craftsmen in Kebonjati on October 27, 2018, there were 9 tofu craftsmen who used rice husks. Tamansari Village, Cibugel Subdistrict is a village where most of the population uses kerosene [25]. Surian Village, Surian Subdistrict is one of nine villages where the majority of the population uses firewood.

2.3 Types and Data Sources

The type of data used in this study are primary and secondary data. Primary data obtained from survey results. Secondary data were obtained from several sources both through direct visits and from websites [1,14,15,16,18,25,26].

2.4 Survey Implementation

The survey was conducted by means of qualitative interviews through face-to-face or filling out survey forms online.

2.5 Primary Data Collection in Sumedang

The population survey was conducted face-to-face and online. Online system is prepared using free facilities from Google Forms: Free Online Surveys for Personal Use. Data collected through a face-to-face survey was entered into Google Forms, https://goo.gl/forms/BmZnHElcvuUVchpN2 uploaded since 6 December 2018. The face-to-face survey was conducted on 16 December 2018, 17 December 2018, 18 December 2018, 23 December 2018 and 30 December 2018. Realization of 85 face-to-face samples, 16 online, totaling 101 exceeding the initial target of 84 as shown in Table 2.2.

Table 2.2: Realization of Research Sites and Samples

	Surveyed	Number of Realized Samples			
Selected Subdistrics	Village	Face to	On-	Total	
	vinage	Face	line	Total	
Tanjungsari	Tanjungsari	18	-	18	
Tanjungsan	Marga Jaya	5		5	
	Haurngombong	11	-	11	
Pamulihan	Pamulihan	-	-	0	
Pamuman	Mekarbakti	2	-	2	
	Cilembu	8	-	8	

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	Kebonjati	28	8	36
	Situ	-	2	2
Sumedang Utara	Girimukti	-	1	1
	Rancamulya	-	1	1
	Kotakaler	-	1	1
Cibugel	Tamansari	8	ı	8
Cibugei	Cibugel	1	ı	1
Surian	Surian	4	ı	4
Sumedang Selatan	Kotakulon	-	1	1-
	Rancapurut	-	1	1
Tanjungkerta	Tanjungmekar	-	1	1
Total		85	16	101

2.4 Primary Data Collection in Indonesia

The population survey was conducted online and in person. Online system is prepared using free facilities from Google Forms: Free Online Surveys for Personal Use. Data collected through a face-to-face survey was entered into Google Forms, https://goo.gl/forms/XP2gnZDKHJ8 bjkpX2 uploaded since 6 December 2018 and closed on 20 January 2019. The face-to-face survey was conducted in Pontianak City, Pontianak West Kalimantan; Bogor Regency; Bandung district; Brebes Regency; Kebumen Regency; Pekalongan Regency; Cilacap Regency in the period from December 15, 2018 to January 15, 2019. Realized online samples were 420, and face to face including those in Sumedang were 154, bringing the total to 574 as shown in Table 2.3

Table 2.3: Realization of Research Sites and Samples

				Number of			
	No. of	No. of	No. of	Realized Samples			
Province	Regencies/ Cities	Subdistricts	- 101 01	On-	Face	T-4-1	
	Cities			line	to Face	Total	
Jawa Barat	16	62	78	98	115	213	
DKI Jakarta	5	28	47	60	1	61	
Banten	8	19	30	27	9	36	
Jawa Tengah	11	15	15	13	12	25	
DI Yogyakarta	2	5	5	5	-	5	
Jawa Timur	16	44	53	63	-	63	
Kalimantan Barat	1	4	8	7	17	24	
Kalimantan Selatan	5	16	26	45	-	45	
Kalimantan Timur	3	4	4	4	-	4	
Kepulauan Riau	1	7	17	33	-	33	
Riau	1	3	6	6	-	6	
Sumatera Barat	2	3	3	4	-	4	
Sumatera Selatan	1	2	2	2	-	2	
Lampung	2	5	6	6	-	6	
Sulawesi Selatan	2	3	4	8	-	8	
Sulawesi Tenggara	2	2	2	2	-	2	
Sulawesi Barat	1	1	1	1	-	1	
Nusa Tenggara Barat	5	10	15	16	-	16	
Papua Barat	2	2	2	2	-	2	
Maluku Utara	3	3	4	4	1	4	
Nusa Tenggara Timur	1	1	1	1	1	1	
Bali	1	1	1	1	-	1	
Empty	-	-	-	12	-	12	
22/34 (64,7%)	91/514	240/7.201	366/83.447				
44/3+ (U4,770)	(17,7%)	(3,33%)	(0,44%)				
Total				420	154	574	

2.5 Secondary Data Collection in Sumedang

2.5.1 Tofu Craftsman Data

According to data from the Sumedang Regency Industry Office in 2017, there were 282 tofu craftsmen [27]. Table 2.4 presents a simplification of the data which is adjusted to the needs of this study.

Table 2.4: Tofu Craftsmen in Sumedang in 2017

No. of Craftsmen	No. of Subdistricts	Production Capacity (kg/month)	Total Capacity (kg/month)
282	22	1.200 s/d 900.000	12.781.704

2.5.2 Cattle Breeder Data

Cattle population in 2017 in Sumedang Regency according to BPS Catalog: 1102001.3211 [25] as shown in Table 2.5.

Table 2.5: Cattle Population in Sumedang Regency

Tyoe of	No. of	No. of Cattles	Potential for Cattle's
Cattle	Subdistricts	(Tails)	Manure (kg/day) (a)
Dairy	12	4.163	114.182
Beef	25	29.592	813.780
	Total	33.755	928.262

Note: (a) A cattle can produce 25-30 kg of manure/day. In the calculation used 27.5 kg/day.

2.5.3 Population Growth Data

Population and family growth in Sumedang Regency is shown in Table 2.6. and Table 2.7.

Table 2.6: Sumedang Regency Population Growth Data 2018-

2017	2018	2019	2020	2021	2022	2023	2024	2025
1.146.435	1.150.791	1.155.164	1.159.554	1.163.960	1.168.383	1.172.823	1.177.280	1.181.754

Source: BPS Catalog:1102001.3211, Sumedang Regency in Figures 2018, Sumedang Regency Central Statistics Agency [25]

Table 2.7: Sumedang Regency Family Growth Data 2018-2025

2017	2018	2019	2020	2021	2022	2023	2024	2025
370.375	371.819	373.269	374.725	376.187	377.654	379.127	380.605	382.090

Source: BPS Catalog:1102001.3211, Sumedang Regency in Figures 2018, Sumedang Regency Central Statistics Agency [25]

2.6 Secondary Data Collection in Indonesia

2.6.1 Tofu Craftmen Data

According to the Ministry of Agriculture's 2017 Horticultural Food Outlook, soybean balance projections in Indonesia 2018-2021 [28], Indonesia imported more than 2 million tons of soybeans since 2018. BPS data in 2017 [29] shows higher soybean import figures than projected Ministry of Agriculture. Table 2.8 uses processed BPS data, where 70% of imported soybeans [30] are absorbed by tofu and tempeh craftsmen and it is assumed that 60% is utilized by tofu craftsmen.

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Table 2.8: Production Capacity of Tofu Craftsmen in Indonesia in 2017

Import	Production Capacity
(ton/year)	(ton/year)
2.671.914,1	1.122.203,9

2.6.2 Cattle Breeder Data

2018 cattle population in Indonesia according to BPS Catalog: 1101001 Statistics Indonesia 2019 [30] and http://www.bps.go.id/linkTableDinamis/view/id/1016 [31] as shown in Table 2.9.

Table 2.9: Cattles Population in Indonesia

Type of	No. of	No. of Cattles	Minimal Potential of Cattle's
Cattles	Province	(Tails)	Manure (kg/day) (a)
Dairy	18	550.100	15,13X10 ⁶
Beef	34	17.050.000	$468,9x10^6$
	Total	17.600.100	484,03x10 ⁶

Note: (a) A cattle can produce 25-30 kg of manure/day. In the calculation used 27.5 kg/day.

2.6.3 Population Growth Data

Population and family growth in Indonesia is shown in Table 2.10. and Table 2.11.

Table 2.10: Indonesian Population Growth Data 2018-2025

(III IIIIIIIIII)								
2017 2018 2019 2020 2021 2022 2023 2024 2025								
261,7	264,8	267,9	271,1	273,8	276,6	279,3	282,1	284.8

Source: Processed from BPS Catalog data: 2101018 Indonesian Population Projection 2010-2035, Agency National Development Planning, Central Statistics Agency, United Nations Population Fund, Jakarta 2013 [32]

Table 2.11: Indonesian Family Growth Data 2018-2025 (in million)

١	2017	2018	2019	2020	2021	2022	2023	2024	2025
	67.1	67.9	68.7	69.5	70.2	70.9	71.6	72.3	73.0

Source: Processed from BPS Catalog data: 2101018 Indonesian Population Projection 2010-2035, Agency National Development Planning, Central Statistics Agency, United Nations Population Fund, Jakarta 2013 [32]

Table 2.12: Data on Percentage of Households Using Wood Fuel and Charcoal/Briquettes

Year	20	15	20	16	2	2018
The Region	Firewood	Charcoal/	Firewood	Charcoal/	Firewood	Charcoal/
		Briquettes		Briquettes		Briquettes
Jawa Barat	15,71	0,01	13,80	0,04	10,98	0,00
Sumatera	40,34	0,03	34,53	0,03	24,48	0,00
Barat						
Kepulauan	3,72	0,09	2,77	0,02	2,63	0,05
Riau						
DI	27,49	0,29	26,16	0,26	19,77	0,29
Yogyakarta						
DKI	0,05	0,00	0,05	0,00	0,02	0,00
Jakarta						
Nusa Tenggara	78,17	0,00	77,58	0,06	74,81	0,00
Timur						
Bali	26,35	0,00	23,59	0,00	18,63	0,00
Kalimantan	30,40	0,04	25,19	0,02	15,69	0,00
Tengah						

Kalimantan	4,89	0,30	3,10	0,27	3,01	0,08
Timur						
Sulawesi	56,43	5,41	50,73	4,41	36,09	1,56
Tengah						
Sulawesi	18,98	0,84	15,56	0,51	11,61	0,43
Selatan						
Papua	67,74	0,10	67,04	0,14	64,37	0,04
Papua Barat	35,55	0,10	39,01	0,31	27,16	0,00
Indonesia	24,40	0,24	21,57	0,19	16,40	0,09

Source: Processed from BPS data, Percentage of Households by Province and Fuel Main for Cooking in 2001, 2007-2016 and 2018 [15,17].

3.0 DISCUSSION

 From the results of logistic regression analysis in Sumedang, there is a decrease in the use of solid fuels and LPG in 2025 as shown in Figure 3.1. However, the use of biogas, experienced a very significant increase in 2025.

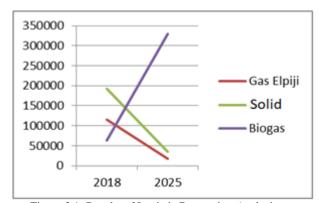


Figure 3.1: Results of Logistic Regression Analysis

2. The potential contribution of the Sumedang population to the achievement of the primary renewable energy mix can be seen in Table 3.1.

Table 3.1: Potential Population Contribution to Achievement of Primary Energy Mix Renewable Energy in Sumedang

Fuel	2018	2025
Solid	0,29%	0,23%
Cattle Dung Biogas	0,00089%	0,0037%
Total	0,291%	0,234%

3. From Table 3.1, for a national scale with a total of 514 regencies/cities, the potential contribution of the population can be calculated using the following assumption approach:

Table 3.2: Potential Contributions of Indonesia's Population to the Renewable Energy Mix

Region	No. of Regencies/Cities	2018	2025
Sumedang	1	0,291%	0,234%
2% No. of Regencies/Cities	10	2,91%	2,34%
5% No. Of Regencies/Cities	26	7,57%	6,08%
7% No. Of	36	10,48%	8,42%

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Regencies/Cities			
10% No. of Regencies/Cities	51	14,84%	11,93%

4. Different from Sumedang, the results of logistic regression analysis in Indonesia, there is an increase very significantly in the use of solid fuels and decrease in LPG in 2025 as shown in Figure 3.2. However, the increase in the use of biogas is not that significant in 2025.

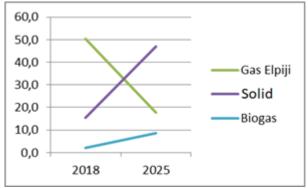


Figure 3.2: Results of Logistic Regression Analysis

The potential population contribution to the achievement of the primary renewable energy mix in Indonesia can be seen in Table 3.3.

Table 3.3: Potential Population Contribution to the Achievement of the Primary Renewable Energy Mix in Indonesia

Fuel	2018	2025
Solid	3,33%	6,81%
Cattle Dung Biogas	0,47%	1,35%
Total	3,80%	8,16%

4.0 CONCLUSIONS AND RECOMMENDATION

4.1 Conclusions

Based on the results of research and discussion in Section 3.0, the following conclusions can be drawn:

- 1. 7.9 (seven point nine) percent of respondents in Sumedang only use firewood on a daily basis for household needs. 25.7 (twenty five point seven) percent who use firewood and 3 kg LPG. 2 (two) percent use firewood, tofu biogas waste and 3 kg LPG. 4 (four) percent who use rice husk (bran), biogas waste tofu and 3 kg LPG. 2 (two) percent use rice husk (bran), biogas from tofu waste and 12 kg LPG. 14.9 (fourteen point nine) percent use tofu waste biogas and 3 kg LPG. 22.8 (twenty two point eight) percent use 3 kg LPG. 5 (five) percent use 12 kg LPG. Total RE use is more than 56.5 (fifty six point five) percent.
 - 50 (fifty) percent of respondents said they used firewood because it was easy to get, free / available around the house / garden / forest. 84.6 (eighty four point six) percent of respondents have used firewood for more than 16 (sixteen) years.

- Thus, hypothesis 2.5.a) "More than 40 (forty) percent of households in villages and 10 (ten) percent in cities cook using firewood or rice husks or sawdust or other solid fuels" can be said to be fulfilled.
- 92.6 (ninety-two point six) percent of respondents know tofu craftsmen using solid fuel and its combination with biogas / LPG. Hypothesis 2.5.b) "More than 80 (eighty) percent of tofu craftsmen use fuel wood fuel or rice husk or other solid fuels" can be said to be fulfilled.
- 3. 11.1 (eleven point one) percent of respondents of dairy farmers who utilize dairy cow dung to be used as biogas. Hypothesis 2.5.c) "More than 80 (eighty) percent of dairy farmers use their manure for biogas" not fulfilled.
- 4. There are no respondents who work as beef cattle breeders and other animals, hypothesis 2.5.d) "No more than 5 (five) percent of beef cattle breeders have used their manure to be used as biogas" and e) "No more than 5 (five) percent of other animal farmers and poultry that use their manure for biogas "are not met.
- 5. 49.9 (forty-nine point nine) percent of respondents know tofu utilizing their liquid waste to be used as biogas. Hypothesis 2.5.f) "No more than 20 (twenty) percent of tofu craftsmen who use their liquid waste to be used as biogas" can be said to be fulfilled.
- 6. The contribution and potential contribution of the Indonesian population to the achievement of the primary energy mix target for EBT, especially in the use of solid fuels and biogas for household and business needs, should be taken into account by the government.

The minimum contribution that can be achieved is 3.80 (three point eight) percent in 2018 and increased to 8.16 (eight point sixteen) percent in 2025 or around 35 (thirty five) percent of the target mix.

4.2 Recommendations

- The Government, through the National Energy Council, conducts more comprehensive research in all regions in Indonesia to be able to obtain real data. The real data to be obtained is data on the amount of use of solid fuels and biogas as well as the potential that can be generated from the utilization of livestock manure which has not been processed into biogas. This data can be used as material in calculating the achievement of the NRE target that must be achieved by the government, both in 2025 and 2050.
- 2. Accelerating the planting program of Industrial Energy Forest Plantations (HTIE) by dividing 3 plantation areas:
 - a. For the purposes of cooking $\slash\hspace{-0.6em}$ business of the population.
 - b. For regional power generation purposes remote / isolated.
 - For export purposes by making firewood in the form of wood pellets or wood chips.
- Monitor the use of energy efficient furnace equipment and reactor / biogas digesters that have been donated by the government / Dinas ESDM / PLN / other parties to residents or village cooperatives to be maintained and improved by users.
- Conducting socialization to the rural population on the benefits of using and utilizing solid fuels and biogas from animal waste and tofu waste.
- 5. Increasing knowledge of farmers and tofu craftsmen on the





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- making, installation, operation and maintenance of biogas reactors / digesters.
- 6. Conduct studies and design innovations and combustion systems waiting for solid fuels with little smoke or smokeless.
- Conducting studies and innovations in terms of material selection of biogas stoves so that they are not easily corroded.
- Conduct studies and innovations in making biogas reactors from tofu waste that can be operated simply at a cost that is affordable by tofu craftsmen.

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