

NEW NORMAL PANDEMIC IMPACT ON GREENHOUSE GAS EMISSIONS (CASE STUDY OF SALEMBA RAYA ROAD)

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Abstract: New Normal is a policy of the government that is applied to all Indonesian people. The New Normal Policy is a condition where Indonesian people carry out normal activities, but still with the Health protocol. In this study, researchers wanted to find out where the impact of New Normal on Greenhouse Gas Emissions carried out of the Salemba Raya road. Data collection was done through direct observation by doing Traffic Counting. The data obtained was based on data that had been measured.

Keywords: Outbreak, New Normal, Gas, Emissions, Energy Consumption

I. Introduction

In the early 2020s, the world was shocked by an outbreak with an unknown cause, according to the Yogyakarta Institute of Health and Calibration Health. An outbreak is the emergence of a disease in the community. In contrast to massive transmission, an outbreaks is characterized by the far more number of people infected. Diseases that attack also occur during certain seasons which originated from a report from China to the World Health Organization (WHO) of 44 patients with severe pneumonia in an area of Wuhan City, Hubei Province, China, precisely on the last day of 2019 China. The initial suspicion was related to the wet market selling fish, sea animals and various other animals. On January 10, 2020 the cause was identified, and the genetic code was obtained, which was the new corona virus¹

The impact of the Covid-19 outbreak was seen in almost all sectors of people's lives. Covid-19 itself is a disease caused by severe acute respiratory coronavirus 2 (SARS-CoV-2) virus. COVID-19 can cause respiratory system disorders, ranging from mild symptoms such as flu, to lung infections, such as pneumonia.² In this pandemic period, social activity was banned and temporarily postponed. In addition, economy was slowing down, transportation services were reduced and tightly regulated, tourism was closed, and shopping centers had much less, or no, visitors and were closed. It also affected the informal sector such as; Online motorbike taxi (ojek), public transportation driver, street vendors, traveling merchants, Rough coolies decreased income. Trade

centers, such as malls, Tanah Abang market, which was usually crowded by buyers, was suddenly deserted and temporarily closed.³

Various countries carried out lockdown policies (in the Great Dictionary of the Indonesian Language, translated as regional quarantine) to limit the total spread of this virus. However, changing people's social behavior was not an easy job. Indonesia itself modified it by the name of the Large-Scale Social Restrictions (PSBB) which were imposed by regional. Restrictions on activities in public places and quarantine yourself in the house. PSBB rules were recorded in the Minister of Health Regulation No. both provincial or district / city based on the severity of the outbreak whose assessment was determined by the central government through the Ministry of Health. PSBB was an implementation of r9 of 2020. After 3 months through the emergency response period and PSBB, the Indonesian government began to explore the application of a new normal life (new normal) and loosened PSBB. According to a government spokesman for handling Covid-19, new normal was that we changed the habits of the past which we considered normal. Because at that time, the threat of Covid-19 did not yet exist, with that the community could implement a disciplined health protocol so that the community remained safe. The government tried to schedule a New Normal policy so that the economic impact of the pandemic did not result in a prolonged crisis. This policy was related to development planning where the Government had set programs, targets and major projects in the National Medium-Term Development Plan (RPJMN) 2020-2024.⁴

With the application of the New Normal during the pandemic, people started using motor vehicles again. According to the World Meteorological Organization (WMO) during the pandemic, greenhouse gas (GHG) emissions have decreased by 6 percent.⁵ Greenhouse Gases (GHGs) are gases in the atmosphere that are responsible for causing global warming and climate change. The main greenhouse gases are carbon dioxide (CO₂), methane (CH₄) and nitrogen oxides (N₂O). The least common, but very strong, greenhouse gases are hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆) (Anonymous, 2010) This could be felt and seen in the blue sky some time ago.

The intensity of greenhouse gas emissions in the atmosphere was higher, resulting in rapid climate change. Based on the Nature Exchange and Global Project, since the country adopted a Lockdown policy to improve the economy, the level of Co2 emissions from fuel had increased again, though it experienced a rapid decline in March and April 2020. If greenhouse gas emissions in New Normal are not reduced, it will increase air pollution. Motorized vehicles have specific emission factors seen from the technology and quality of the engine with the type of fuel used. Emission factor data is currently obtained from vehicle measurements using fossil fuels (diesel, gasoline), for biodiesel it is still limited (Martin Djamin and Soni S. Wirawan, September 2010). In calculating a Greenhouse Gas (GHG), the calculation that can be calculated is the amount of energy consumption and gas emissions of a vehicle.

II. Research methods

In this study, the authors wanted to find out how much influence new normal era had on greenhouse gas emissions by using quantitatively measured data methods. The data collection technique that I used was field observation by using traffic counting.

The location of the traffic counting that the author did was in Senen - Salemba and Salemba - Senen, this calculation was carried out for 3 consecutive days which later the calculation would be used to determine the CO2 emissions emitted by the vehicle where it affected the greenhouse gases produced by the vehicle passing on the route where the writer did traffic counting.

This data used two levels of calculation of greenhouse gas (GHG) emissions, which were tier 1 and tier 2. the limitation of this tier 2 calculation method was used in CO2 gas. From the results of the calculation of greenhouse gas (GHG) emissions by using comparable emission factors in order to know the difference and its impact, each type of energy consumption had CO2 gas emission factors as the table below.⁶

Type of Fuel	Tier 1 (kg CO2 / TJ)	Tier 2 (kg CO2 / TJ)
Gasoline RON 92	69,300	72,600

Gasoline RON 88	69,300	72,967
Avtur	71,500	73,333
Kerosene	71,900	73,700
Automotive Diesel Oil (ADO)	74,100	74,433
Industrial Diesel Oil (IDO)	74,100	74,067
Residual Fuel Oil (RFO)	77,400	75,167
Coal	96,100	99,718
Natural gas	56,100	57,600

Source: - 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2
- Puslitbang Lemigas, 2017 - Puslitbang Tekmira, 2016

The calculation of CO₂ emissions used is as follows (IPCC, 2006)

Formula:

$$E = n \times EF \times K \dots\dots\dots (1)$$

Where:

E = Number of emissions (g / hour.km)

n = Number of Vehicles (vehicles / hour)

EF = emission factor (g / liter)

K = Fuel Consumption (liters / km)⁷

III. Discussion and Result

Factors that determine the intensity of exhaust emissions were due to the fuel consumption of motor vehicles. Fuel consumption of motor vehicles can emit pollutants

such as CO₂ which causes air pollution in the environment.⁸ Emission calculations using Tier 2 methods were based on vehicle mileage and emission factors. The calculation of CO₂ emissions depends on fuel energy consumption per type of vehicle. Of the remaining combustion of energy consumption used by motor vehicles the main source of CO₂ emissions in the Salemba Raya road section where the movement of vehicles was quite high.⁹

According to the source of the calculation of emissions using Tier 2 factors using calculations that were previously replaced in the emission factors written in table 1, the figure below is the result of the calculation of greenhouse gas emissions (GHG) using tier 2 emission factors then compared with the results of calculations using emission factors tier 1.⁶

Then it could be discussed in the research conducted by the researcher producing the following data:

Day 1 Vehicle Volume				Day 1 Vehicle Volume			
Time period	Senen - Salemba Road Section			Time period	Salemba - Senen Road Section		
	Motorcycle	Car	Bus / Truck		Motorcycle	Car	Bus / Truck
6.00 a.m - 7.00 a.m	3788	2588	26	6.00 a.m - 7.00 a.m	3907	3420	20
7.00 a.m - 8.00 a.m	3800	2680	64	7.00 a.m - 8.00 a.m	4023	3223	70
8.00 a.m - 9.00 a.m	3820	2790	52	8.00 a.m - 9.00 a.m	3949	3009	64
9.00 a.m - 10.00 a.m	3772	2640	45	9.00 a.m - 10.00 a.m	3839	2988	62
10.00 a.m. - 11.00 a.m	3760	1592	43	10.00 a.m. - 11.00 a.m	3910	2875	48
11.00 a.m-12.00 p.m	2458	1520	52	11.00 a.m-12.00 p.m	3109	2510	46
12.00 p.m - 13.00 p.m	2400	1498	56	12.00 p.m - 13.00 p.m	2761	2447	38
1.00 p.m - 2.00 p.m	2894	1847	52	1.00 p.m. - 2.00 p.m.	2427	2311	63
2.00 p.m - 3.00 p.m	2364	1921	75	2.00 p.m - 3.00 p.m	2981	2201	73
3.00 p.m - 4.00 p.m	3023	2053	82	3.00 p.m - 4.00 p.m	3517	1891	90
4.00 p.m - 5.00 p.m	4875	3610	48	4.00 p.m - 5.00 p.m	3501	2428	60
17.00 p.m - 18.00 p.m	4758	2176	40	17.00 p.m - 18.00 p.m	3747	2890	57
6.00 p.m - 7.00 p.m	4517	2064	44	6.00 p.m - 7.00 p.m	3653	2232	48
19.00 p.m - 20.00 p.m	3245	1893	71	19.00 p.m - 20.00 p.m	4090	1512	53
8.00 p.m - 9.00 p.m	3343	1258	53	8.00 p.m - 9.00 p.m	3968	1607	58
total	52817	32130	803	total	53382	37544	850

Day 2 Vehicle Volume				Day 2 Vehicle Volume			
Time period	Senen - Salemba Road Section			Time period	Salemba - Senen Road Section		
	Motorcycle	Car	Bus / Truck		Motorcycle	Car	Bus / Truck
6.00 a.m - 7.00 a.m	3658	2733	32	6.00 a.m - 7.00 a.m	3876	2997	42
7.00 a.m - 8.00 a.m	3868	2820	47	7.00 a.m - 8.00 a.m	4210	3036	44
8.00 a.m - 9.00 a.m	3877	2897	55	8.00 a.m - 9.00 a.m	4035	3156	47
9.00 a.m - 10.00 a.m	3321	2613	48	9.00 a.m - 10.00 a.m	3878	2874	53
10.00 a.m. - 11.00 a.m	3204	2410	50	10.00 a.m. - 11.00 a.m	3412	2543	51
11.00 a.m-12.00 p.m	2842	2011	38	11.00 a.m-12.00 p.m	3206	2409	56
12.00 p.m - 13.00 p.m	2423	1722	43	12.00 p.m - 13.00 p.m	3354	1940	50
1.00 p.m. - 2.00 p.m.	2279	1423	46	1.00 p.m. - 2.00 p.m.	2975	2032	41
2.00 p.m - 3.00 p.m	2470	1976	40	2.00 p.m - 3.00 p.m	2521	1879	45

Day 3 Vehicle Volume				Day 3 Vehicle Volume			
Time period	Senen - Salemba Road Section			Time period	Salemba - Senen Road Section		
	Motorcycle	Car	Bus / Truck		Motorcycle	Car	Bus / Truck
6.00 a.m - 7.00 a.m	3532	2986	29	6.00 a.m - 7.00 a.m	4103	3543	27
7.00 a.m - 8.00 a.m	3742	2645	53	7.00 a.m - 8.00 a.m	4424	3712	64
8.00 a.m - 9.00 a.m	3223	2765	47	8.00 a.m - 9.00 a.m	4361	3800	61
9.00 a.m - 10.00 a.m	3165	2343	44	9.00 a.m - 10.00 a.m	3942	3102	54
10.00 a.m - 11.00 a.m	3219	2213	50	10.00 a.m - 11.00 a.m	3513	2678	50
11.00 a.m-12.00 p.m	2976	1765	56	11.00 a.m-12.00 p.m	3005	2321	49
12.00 p.m - 13.00 p.m	3015	1967	50	12.00 p.m - 13.00 p.m	2989	1943	36
1.00 p.m. - 2.00 p.m.	2775	2046	62	1.00 p.m. - 2.00 p.m.	2344	1472	58
2.00 p.m - 3.00 p.m	2986	2223	70	2.00 p.m - 3.00 p.m	2543	1646	53
3.00 p.m - 4.00 p.m	3323	2765	69	3.00 p.m - 4.00 p.m	2767	1850	39
4.00 p.m - 5.00 p.m	3986	2906	51	4.00 p.m - 5.00 p.m	3501	2012	59
17.00 p.m - 18.00 p.m	4017	3124	39	17.00 p.m - 18.00 p.m	2134	1757	51
6.00 p.m - 7.00 p.m	4344	3442	40	6.00 p.m - 7.00 p.m	2324	1953	44
19.00 p.m - 20.00 p.m	3987	2546	42	19.00 p.m - 20.00 p.m	2042	1423	41
8.00 p.m - 9.00 p.m	3645	2228	37	8.00 p.m - 9.00 p.m	2115	1442	35
total	51935	37964	739	total	46107	34654	721

From the table above it can be said that the volume of vehicles on the first, second and third days of the highest volume on the Senen - Salemba and Salemba - Senen roads was packed with motorcycles with the highest volume of the first day at 16.00-17.00 4875, 19.00 - 20.00 4090 motor vehicles and on the second day at 18.00 - 19.00 4231, 07.00 - 08.00 4210. From the vehicle volume data obtained, the researchers calculated energy consumption. Vehicle energy consumption data were calculated as follows:

Senen-Salemba Road Section		Day 1		
Transportation type	AMOUNT OF ENERGY CONSUMPTION			TOTAL
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00	
Motorcycle	719,72	467,02	775,504	1962,244
Car	2303,32	3031,34	2538,458	7873,118
Bus	72,28	81,64	83,72	237,64
Truck	55,2	63,2	64,4	182,8
Salemba-Senen Road Section		Day 1		377
Transportation type	AMOUNT OF ENERGY CONSUMPTION			TOTAL
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00	
Motorcycle	702,506	562,21	508,706	1773,422

Senen-Salemba Road Section		Day 2		
Transportation type	AMOUNT OF ENERGY CONSUMPTION			TOTAL
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00	
Motorcycle	719,72	489,934	887,604	2097,258
Car	2385,2	1563,374	2480,964	6429,538
Bus	24,564	70,2	67,6	162,364
Truck	55,6	54	51,6	161,2
Salemba-Senen Road Section		Day 2		
Transportation type	AMOUNT OF ENERGY CONSUMPTION			TOTAL
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00	
Motorcycle	771,666	559,284	484,424	1815,374
Car	2334,826	1845,86	1600,754	5781,44
Bus	78	72,8	90,48	241,28
Truck	60	56	69,6	185,6
Senen-Salemba Road Section		Day 3		
Transportation type	AMOUNT OF ENERGY CONSUMPTION			TOTAL
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00	
Motorcycle	1220,75	648,166	767,98	2636,896
Car	4094,89	1871,314	2485,77	8451,974
Bus	121,16	82,68	67,08	270,92
Truck	92,8	63,2	51,2	207,2
Salemba Road Section - Senen		Day 3		
Transportation type	AMOUNT OF ENERGY CONSUMPTION			TOTAL
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00	
Motorcycle	1523,42	710,714	425,98	2660,114
Car	5285,71	2806,526	1166,79	9259,026
Bus	140,4	104,52	70,2	315,12
Truck	108	80,4	54	242,4

From the data above it can be seen that the amount of energy consumption every day was different. As shown in the data above, the energy consumption of 1815,374 motorcycles and cars in 9259,026 with the highest value was compared to the energy consumption of bus with 315,12 and trucks with 242,4. From the energy consumption data obtained, the researchers calculated the emission factors. Emission factor data were calculated as follows:

Senen-Salemba Road Section		Day 1			
Transportation type	AMOUNT OF EMISSION FACTORS			TOTAL	AVERAGE
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00		
Motorcycle	2,010666916	1,304704139	0,029841729	3,345212784	1,115070928
Car	6,434737565	8,46859202	7,091637745	21,99496733	7,331655776
Bus	0,207025388	0,233834431	0,239791996	0,680651815	0,226883938
Truck	0,158104613	0,181018325	0,184455382	0,523578319	0,174526106

Senen-Salemba Road Section		Day 2			
Transportation type	AMOUNT OF EMISSION FACTORS			TOTAL	AVERAGE
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00		
Motorcycle	2,061432101	1,368718508	2,479680983	5,909831592	1,969943864
Car	6,663484032	4,36756569	6,931017943	17,96206767	5,987355888
Bus	0,070356553	0,201067823	0,193620866	0,465045242	0,155015081
Truck	0,159250298	0,154667556	0,147793442	0,461711297	0,153903766
Salemba-Senen Road Section		Day 2			
Transportation type	AMOUNT OF EMISSION FACTORS			TOTAL	AVERAGE
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00		
Motorcycle	2,155787384	1,562460172	1,353325335	5,071572891	1,690524297
Car	6,522755227	5,156741001	4,471993425	16,15148965	5,383829884
Bus	0,223408692	0,208514779	0,259154083	0,691077554	0,230359185
Truck	0,17185284	0,160395984	0,199349294	0,531598119	0,177199373

Senen-Salemba Road Section		Day 3			
Transportation type	AMOUNT OF EMISSION FACTORS			TOTAL	AVERAGE
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00		
Motorcycle	3,41038409	1,856486132	2,145489882	7,4123601	2,4707867
Car	11,72864127	5,227851315	6,944444366	23,900937	7,96697898
Bus	0,347028168	0,236813214	0,192131475	0,77597286	0,25865762
Truck	0,265799059	0,181018325	0,146647757	0,59346514	0,19782171
Salemba-Senen Road Section		Day 3			
Transportation type	AMOUNT OF EMISSION FACTORS			TOTAL	AVERAGE
	Morning 06.00 - 11.00	Afternoon 11.00 - 16.00	Evening 4:00 - 9:00		
Motorcycle	4,255947025	1,985507039	1,190051538	7,4315056	2,47716853
Car	14,76657898	2806,526	3,259637151	2824,55222	941,517405
Bus	0,402135545	0,2987547	0,291067933	0,99195821	0,33065274
Truck	0,309335112	0,230282806	0,154667556	0,69428547	0,23142849

The calculation of CO₂ emissions in the Salemba - Senen - Senen - Salemba road was carried out using the manual CO₂ emission on 10/10/2023 the 0.115070928. From the data table above it can be said that the average emissions released by motorcycles on the first day were 1.115070928 and 357.62191922, cars were 7.331655776 and 742.4192468, buses were 0.226883938 and 0.222912228 and trucks were 0, 174526106 and 0.17108905 while on the second day the average emission of motorcycles were

1.969943864 and 1.690524297, cars were 5.987355888 and 5.383829884, buses were 0.155015081 and 0.230359185 and trucks were 0.153903766 and 0.177199373. On day 3, the average emissions were 2.470786702 and 2.477168534 on motorcycles. Cars were 7.966978984 and 941.5174054, buses were 0.258657619 and 0.300857039, and trucks were 0.197821714 and 0.231428491.¹⁰

IV . Conclusions and recommendations

From the research made by researchers, it can be said that the energy consumption generated by each vehicle that passed through the Salemba Raya road was quite high and the expenditure of gas emissions was also quite high, which made the greenhouse effect worse. Gas emissions produced on the Salemba Raya road were produced by gasoline and diesel.

Suggestion

The results show that greenhouse effect worsened. To cope with this, there are some recommendations to consider, such as: there needs to be a limitation on the number of vehicles, the enactment of using public transport, management on the Salemba Raya road traffic, and the need for tree belts along these roads.

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