International Journal of Engineering & Technology, 7 (2.29) (2018) 917-920

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Green Open Space Needs Analysis of Carbon Dioxide (Co_2) Gas Emissions Absorbtion in Serang City

Anis Masyruroh[1], Djoko M Hartono[2], Herman Haeruman[3], Emir Hadisuganda[4]

[1] Indonesia University, Environmental Science,
[2] Indonesia University, Environmental Science,
[3] Indonesi University, Environmental Engineering,
[4] Bogor Agriculter Institute, Forestry
**Corresponding Author E-Mail: Anismasyruroh@Gmail.Com*

Abstract

An increasing number of population in Serang has resulted in the diversion of vegetated land function to be built area, thus reducing total area of green open space (RTH) of the city. Impact of the land conversion increase will occur on the increasing area of land cover. Land cover thus reduced the vegetation ability to absorb CO2, so that the CO2 generated from activities in the city, such as from energy consumption, livestock and landfill waste cannot be absorbed optimally. The purpose of this study were: 1) to analyze the amount of CO2 emissions from energy use, livestock and garbage activities in 2016-2026; 2) to analyze the CO2 absorption by green space area; 3) to analyze RTH Needs of 2016-2026 to absorb CO2. gas emission. This study was conducted in May 2016 to September 2016. The method used in this research was IPCC calculation for the calculation of emissions from garbage, livestock, and electrical energy. Based on the results of the study showed that in 2016 the Serang city need of green space area was 9844.79 hectares to absorb CO2 gas emissions by 511,051.61 and in 2026 green space area needs of Serang city to absorb CO2 emissions by 18.168 tons was a total area of 1,058,468.16, 76 hectares.

Keywords: *green open space, absorption of CO2, emissions*

1. Introduction

Increasing population is growing along with the progress of science, technology, arts and culture (science and technology) of a region. It will be able to influence the development of construction in an urban area. The direct impact of the urban facilities construction is recognized from continuous conversion of green open spaces that occur , as a result of limited open spaces.

Serang city plays a role as a center of Banten province government, as well as alternative and hinterland area of the capital of State, because Jakarta is only about 70 km apart1. In addition, Serang city is a transit line connecting cities and counties due to its strategic location that will impact on increasing volume of vehicles from various regions and potential possibility of high CO2 pollution in the city of Serang. In 2010 the city of Serang has an area of 26.674 ha with a population of 576.961 people and in 2014 the population of the Serang city has increased to 631.101 inhabitants. Average population growth rate of Serang City is 6.51% 2, and the population density is about 2,320 inhabitants/km2 where most of the population live in urban areas as the economic center3. The growth of residents contribute to the development progress of Serang in terms of land use, transportation systems, residential areas that will continue to increase every year. Such a development certainly have an impact on the environmental degradation in the absence of good environmental management efforts.

One effort to be performed to minimize the impact of global warming is the provision of green open space. Green Open Space is a space in the city in which the green (vegetation) dominate the area content as a natural green space and trait of open space is more dominant4. Plant as the major component of Green open spce filler has ability to absorb CO2 emissions so as to reduce the concentration of CO2 emissions in nature. In addition, the plant on RTH is also able to produce oxygen (O2) which is vital to support the metabolic processes of living beings.

2 Research Method

2.1 Place and Time of Research

This research is conducted in the administrative area of Serang city, Banten Province. The research process begins with data collection, analysis and report preparation. Serang city is geographically located between 50990-60220 south latitude and 1 060 070-1060 250 East Longitude with an area of 266.74 km2. Serang city plays a role as a center of Banten province government, as well as alternative and hinterland area of the capital of State, because Jakarta is only about 70 km apart, the research is conducted for five (5) months, starting from May to september 2016

2.2. Calculation Method of Carbon Dioxide Emissions Produced From Trash

Trash is one of the sectors of human activities that contribute to global warming. Garbage piled up will decompose and produce gases that spread in the air. The most commonly produced gas from organic waste degradation process is methane (CH4) and carbon dioxide (CO2). The IPCC, in Chrismalia Hapsari 5 formula for calculating greenhouse gas emissions (CH4) and (CO2) is as follows:

CH_4 Emission (Gg/yr) = (MSWT x MSWF x MCF x DOC x DOCF x F x (16/12 -R)) x (1 - OX)

CO_2 Emission = Methane Emission (CH_4) x ((1- F/F) + OX) x 44/16

Description: MSWT : Heaps of waste that goes into processing or landfill (Gg/year)

MSWF: The percentage of waste that goes into processing or landfill compared to the amount of waste produced by the source.

MCF: Methane correction factor, Indonesian state does not currently have instruments of landfill gas processing, therefore 0.4 is selected in the calculation. (IPCC)

DOC: degradation of organic carbon (IPCC).

DOCF: fraction DOC, by 0,77 IPCC.

F: fraction based on methane gas volume in the waste

landfill. IPCC gives Standard value of 0,5.

R: CH_4 stored in gas processing instrument. Indonesia does not have a gas processing instrument. Thus, methane gas from waste generation cannot be measured, the R value is set to 0.

OX : oxidation factor, the IPCC provides default values 0,1

2.3 Analysis of Carbon Dioxide Emissions from Livestock

Analysis of CO_2 emissions from livestock include cattle, buffalo, horses, goats and sheep. CH_4 (methane) is one of emissions produced by livestock during the fermentation process in the body as well as at the time of manure management. Calculation of methane emissions from livestock manure fermentation and management is obtained by multiplying the number of animals with emission factor of methane (CH_4) The IPCC in R. Mohamad Mulyadin 6. Emission factors based on the fermentation process can be seen in Table 3.2. The calculation of emissions is as follows :

Mf =e x f

Description

Mf = CH_4 Emission from fermentation process (kg/year)

e = number of livestovk (ekor)

f = Emission factor of CH_4 based on livestock (kg/head/year)

Table 1. Emission factor of CH_4 from fermentation process based on types of livestock

No	Type of Livestock	Emission Factor CH_4 (Kg/head/year)
1	cattle	44
2	buffalo	55
3	horse	18
4	Goat	5
5	Sheep	8

Source : IPCC (1996)

CH_4 (methane) produced from manure management activities occur due to decomposition in anaerobic conditions. Factors emissions from manure management is determined by the temperature of the region, to Indonesia, including areas with warmer temperatures. This factor can be seen in Table 3.2. The calculation of emissions is as follows :

Mp= e x f

Description:

Mp = Emission CH_4 from fertilizer management (kg/year)

e = number of livestock (ekor)

f = Emission factor CH_4 based on livestock(kg/head/year).

Total Emission CH_4 yang dihasilkan ternak yaitu:

M=Mf +Mp.

CH_4 produced was oxidized to be CO_2 by chemical reaction :

CH_4 + 2 O_2 CO_2 + 2 H_2O

So that the mass of CH_4 emissions are converted into future CO_2 emissions by the following equation (Journal of Forestry Economic and Social Research Vol. 10 No. December 4th, 2013, p. 264 – 273):

T = (m/mr CH_4) x mr CO_2

Description:

T = Emission CO_2 dari ternak (kg/year)

m = Mass CH_4 (kg/year)

mr = relative mass of atom

mr = CH_4 by 16; CO_2 by 44

Table 2. CH_4 Emission Factor of Fertilizer Management Based on Temperature

No	Type of Livestock	Emission Factor CH_4 (Kg/head/year)
1	Cattle	2
2	Buffalo	3
3	Horse	2,27
4	Goat	0,23
5	Sheep	0,37

Source: IPCC (1996)

2.4. Analysis of Carbon Gas from Electrical Energy

Calculation of carbon gas analysis from electrical energy using Defran method and in accordance with Average grid emission factor based on Regulation of Minister of Energy and Mineral Resources number n Number 32 Year 2014 regarding Program Acceleration of Phase 2

Analysis of carbon dioxide absorption is useful to get information about the ability of green open space to absorb carbon dioxide in Serang city. The approach adopted for the calculation of carbon dioxide absorption is performed by determining the covered area from the vegetated land areas. Distribution and wide of green open spaces obtained is calculated based on the ability of vegetation to absorb carbon dioxide by7. Carbon dioxide absoption value for each type of vegetation are presented in the following table.

Table. 3. Carbon dioxide absoption value by Vegetation

No	Type of Coverage	CO	CO_2 (ton/ha/year)
1	Forest	15,9	58,26
2	Plantation	14,3	52,39
3	Bush	0,9	3,30
4	Grass	0,9	3,30

Source : Iverson et.al, (1993).

Carbon dioxide uptake value obtained on the basis of land cover classes for vegetated areas, including the distribution and extent. Carbon dioxide uptake value obtained based on the absorption of carbon dioxide through approach, not by calculation acquire field data. Carbon dioxide uptake value obtained just above the ground surface of the ground, especially for vegetated areas while the uptake of carbon dioxide in the soil and water are not counted.

3 Result of Analysis

3.1 Analysis of Livestock

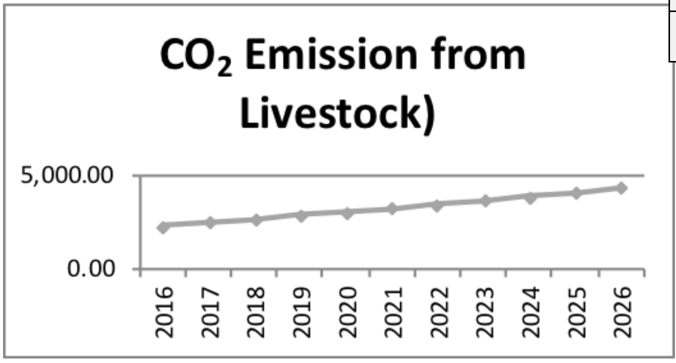
Table 4. Predicted Number of Livestock 2015 until the year 2016

Year	cow	buffalo	horse	goat	sheep
2015	1.133	5.269	10	38.002	29.195
2016	1.205	5.601	10	40.396	31.035

2017	1.280	5.954	11	42.941	32.990
2018	1.361	6.329	11	45.647	35.068
2019	1.447	6.728	12	48.522	37.277
2020	1.538	7.152	13	51.579	39.626
2021	1.635	7.602	14	54.829	42.122
2022	1.738	8.081	15	58.283	44.776
2023	1.847	8.590	16	61.955	47.597
2024	1.964	9.132	17	65.858	50.596
2025	2.087	9.707	18	70.007	53.783
2026	2.219	10.319	19	74.418	57.171

Source: Analysis result

From the analysis of potential CO2 emissions generated from cattle, buffalo, horse, cabin, and doba enicipated in 2026 CO2 emissions gas produced by 57,171 Ton



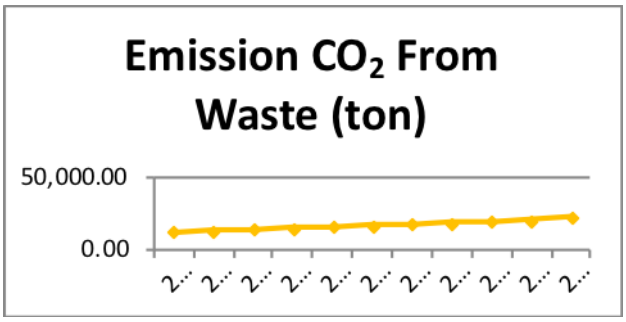
Graph 1. Emission From Livestock

3.2 Analysis result of Waste

Table 5. CO2 Emission produced from the waste untill 2016 to 2026

Year	amount of landfill waste (Ton)	Emission CH_4 Gg/year	Emission CO_2 Gg/year	Emission CO_2 Ton/year
2016	128,87	40,622	11,1710888	11.171,09
2017	137,26	43,267	11,8983755	11.898,38
2018	146,2	46,085	12,6733389	12.673,34
2019	155,71	49,083	13,4977127	13.497,71
2020	165,85	52,279	14,376698	14.376,70
2021	176,65	55,683	15,3128954	15.312,90
2022	188,15	59,308	16,3097723	16.309,77
2023	200,39	63,167	17,370796	17.370,80
2024	213,44	67,280	18,5020346	18.502,03

From the results of the above analysis, the potential of CO2 generated from the hoard in Serang City in 2026 amounted to 20,989.03 Ton



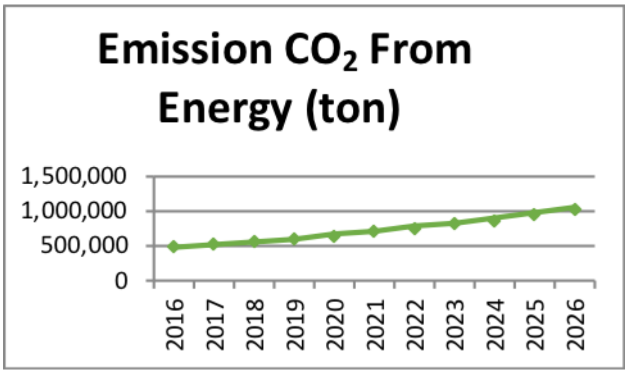
Graph 2. Emission From Waste

3.3 Electrical energy

Table 6. Carbon Dioxide Emissions from electricity use

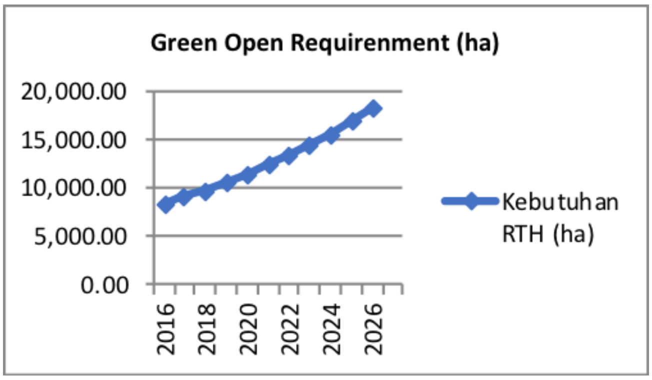
Year	Total KWH	Emission factor (kg/kwh)	CO_2 (Kg)	CO_2 (Ton)
2016	557.980.046	0,857	478.188.899	478.189
2017	602.618.449	0,857	516.444.011	516.444
2018	650.827.925	0,857	557.759.532	557.760
2019	702.894.159	0,857	602.380.294	602.380
2020	759.125.692	0,857	650.570.718	650.571
2021	819.855.747	0,857	702.616.375	702.616
2022	885.444.207	0,857	758.825.685	758.826
2023	956.279.744	0,857	819.531.741	819.532
2024	1.032.782.123	0,857	885.094.279	885.094
2025	1.115.404.693	0,857	955.901.822	955.902
2026	1.204.637.068	0,857	1.032.373.967	1.032.374

From the results of the above analysis, the potential of CO2 generated from the usage of electricity in Serang City in 2026 amounted to 955,902 Ton



Graph 3. Emission From Energy

3.4 Green Open Space Requirement in CO2 absorber



4. Conclusion

1 Total CO2 emissions in the city of Serang in 2016 is about 492,080.29 tons of CO2 and in 2026 increased to 1,058,468.16 tons of CO2. Total emission is viewed from three aspects, namely, electrical energy use, livestock and trash activities. This is due to the increase of electricity users, along with the increasing number of residents in the city of Serang.

2 Absorptive capacity of carbon dioxide emissions (CO2) from the land cover of green open space in Serang city is 251,680.99 from the total green area of 4320.14 hectares in 2016

3. The needs of green open space (RTH) which is ideal in 2016 to fulfill the function of absorbing carbon dioxide (CO2) emissions is 8446.63 hectares, whereas in 2026 the green open space (RTH) needs as an absorber of carbon dioxide gas emissions (CO2) in the city of Serang is 18168.76 hectares**.**

References

[1] The Central Bureau of Statistics of Serang City. City Attack In Figures. The Central Bureau of Statistics of Serang City **(2014)**

[2] [BAPPEDA] Regional Development Planning. Board. Serang City Profile **(2015)**

[3] The Central Bureau of Statistics of Serang City. City Attack In Figures. The Central Bureau of Statistics of Serang City **(2014)**

[4] Hakim, Rustam and Utomo, Budi. Landscape. Architecture Design Component. Jakarta: Earth Literacy **(2002)**

[5] Crismatalia Hapsari in *digilib.its.ac.id/public/ITS. -Undergraduate-16407-presentation.pdf* ***(2011)***

[6] *Mohammad Mulyadin* http://forda-*mof.org/files/Jurnal_Sosek_10.4****.(2013)***

[7] *Irwansyah, Rahmawati, and Yunus.* Green Open Space Capability Analysis on Reducing Concentration of CO2 from Motor Vehicles at Campus USU Medan **(2015)**