Green Open Space Provision Evaluation in Gresik Urban Areas Through Carbon Footprint Approach

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August 5, 2018

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Abstract

Gresik urban area moves into an area that is growing rapidly as the main line of economic activity and services. These developments have consequences more awakened space requirements that can potentially lead to conflicts over land use, environmental damage thereby could reduce the carrying capacity of the environment. One indication of the declining carrying capacity is global warming phenomenon in which the production of CO^2 *emissions increases beyond the ability of green open space to absorb.*

In the period of 2011-2012 in Gresik urban areas has decreased extensive green areas such as paddy fields, ponds and dry land of 1106.73 ha. Based on previous studies, Gresik urban areas have experienced ecological deficit on aspects of carbon sequestration between 0.25 to 0.36 gha. On the other hand activities which occupied green open spaces in urban areas Gresik dominated by vacant land and shrubs which at any times can be converted into smaller plots.

Green Open Space in the region are occupied 18.3% of total land use which supposed to be 30% of total land use. The lack of green space availability conditions will impact on the people quality of life in the city due to the declining of environment carrying capacity which is resulting potential respiratory health problems due to high air pollutants, as well as the potential for flooding due to reduced absorption area/rainwater catchment area. Therefore, it is crucial to give an evaluation regarding how the provision of green open spaces in Gresik urban areas as an effort to create a balanced utilization of space between land use for economic and environmental activities.

Thus, in these research some research phases are needed. The first phase will be carried out analysis of CO^2 *emissions (carbon footprint) production in Gresik urban areas from several activities such as housing, transportation and industry which is as dominant activity in this urban area. The second stage is* CO^2 *emissions absorption analysis by green open spaces in Gresik urban areas based on existing condition.*

The result of this paper could be a good input for continued research to calculate adequate green open space for Gresik Urban area and at once give the recommendation where the green opens space should be plotted. Thus, the provision of green open spaces in urban areas Gresik could create balanced space utilization between land use for economic and environmental activities.

Keywords: CO2 Emissions, Carbon Footprint, and green open space.

2.0 Introduction

A healthy city is said to grow if the city applies the dynamics of balance of various phenomena, including dynamic balance in the proportion of use of land for various purposes (Soeriaatmadja, 1981). In this case, both the use of land that is profit, and land use that are non-profit (public interest and general welfare purpose) such as Green open space, TPA, tombs, drainage, and others. However, the phenomenon of urban development which exist today only economically, but declined ecology. As a result the city suffered environmental degradation, and decreased quality of life in society.

Urban areas the District Gresik Gresik, District Manyar, District and Sub-District Kebomas Duduksampeyan have a change of land use non awakened into residential and industrial land drastic. In the period 2011-2012 in urban areas has decreased Gresik spacious green areas such as rice paddies, ponds and dry land of 1106.73 ha (BPS, 2012). The growth of the undeveloped land makes air pollution and CO2 gas emission levels in urban areas Gresik larger than other districts (Ghozali, et al, 2013).

The findings Ghozali, et al (2013) also showed that urban areas Gresik has experienced an ecological deficit of CO2 emissions at the level of housing and transport deficit minor (minor deficit). Each of these districts in urban areas Gresik has a land deficit in 2012 CO2 absorber for 0:26 gha (Subdistrict Gresik), 0:36 gha (Subdistrict Manyar), 0:25 gha (Kebomas sub-district) and 0:31 gha (Subdistrict Duduksampeyan). Thus the production of land use CO2 gas emissions in urban areas is greater than the land Gresik absorbing CO2 gas emissions.

This condition as a result of an imbalance of land use and settlement industry continued to grow in addition to land reduced green area (Arsyad, et al, 2008). Industrial activities and transport are the largest emitters of CO2 gas (Astra, 2010). Industrial growth in urban areas grew significantly Gresik. In the period 2007-2012 the growth of the number of medium and large scale industries which recorded increase from 242 units to 260 units (BPS, 2008-2012). The amount represents 49% of the total industry in Gresik (BPS, 2012).

On the other hand the use of the land for Green open space in two main districts Gresik urban areas dominated by vacant land, land urug and shrubs that at any time can be converted into smaller plots. Green open space in the two districts are 651.56 hectares or by 18.3% of the area.The percentage is far from the minimum allocation of open space in urban areas are mandated by Act No. 26 of 2007 on Spatial Planning of 30% of the total area. Green open space is intended as an instrument to maintain a sustainable urban environment ecologically with increased land values.

The lack of availability of green space conditions will impact on the quality of life of the city and the community is in it due to declining environmental carrying capacity as the potential respiratory health problems due to high air pollutants, as well as the potential for flooding due to reduced absorption area / rainwater catchment. Green open space needs need to be known in advance as part of the environmental balance of the waste CO2 gas emissions generated by the activities of the population. Thus necessary to study that evaluated the provision of Green open spaces in urban areas gresik in an effort to maintain, balance and increase the carrying capacity of the environment through the provision of adequate Green open space.

3.0 Method

3.1 Calculation Production CO2 Emissions Method

Production calculation of CO2 emissions in urban areas can gresik divided by type of activity, among others:

a. Calculation of CO2 emissions from Household activities

1. The calculation of the amount of CO2 emissions from energy use cooking

The calculation of the amount of CO2 emissions from energy use is calculated based on the use of cooking gas LPG and kerosene used by the household. The emissions calculated by the following formula:

$$\text{Emissions } CO_2 = RT \times FC \times EF \times NCV \text{……….(IPCC, 2006)}$$

Specification:

RT = Total household users of LPG or kerosene (KK)

FC = average use of LPG or kerosene per household (kg / household / year)

EF = CO2 emission factor of the use of certain energy (MJ / Kg)

NCV = Net Calorific Valome per unit mass of fuel

Some EF and NCV value of some types of fuel, among others, as shown in Table 1.

Tabel 1. EF values and NCV Some Types of Fuel

Energy type	NCV	Unit	EF	Unit
LPG[1]	47.3	MJ/Kg	0.0631	ton CO2/MJ
Kerosene[1]	43.8	MJ/Liter	0.0719	ton CO2/MJ
Electricity[2]	-	-	0.725	ton CO2/ kWh
Petrol[1]	33*10-3	MJ/Liter	69.3	ton CO2/MJ
Solar[1]	36*10-3	MJ/Liter	74.1	ton CO2/MJ
Waste incineration[3]	-	-	12.01	ton CO2/Kg

Source : 1) IPCC (2006), 2)Badan Kebijakan Pengendalian Iklim dan Mutu Industri (2012), 3)Agustina (2008)

2. The calculation of CO2 emissions from energy use

The calculation of the amount of CO2 emissions from the use of electrical energy is calculated from the total household electricity use in the study area multiplied by the value of the electrical energy EF as shown in Table 1.

3. The calculation of CO2 emissions from waste incineration

Burning garbage can directly generate CO2 gas emissions. Calculation of CO2 emissions from waste incineration activity was calculated using the following formula:

$$\text{Emission } CO_2 = TP \times \%DB \times EF \text{……………(Ghozali, 2014)}$$

Specification:

TP = Total waste generation (kg / year)

% DB = Percentage of garbage is burned (%)

EF = Emission factor of burning waste (Kg CO2 / Kg of garbage are burned)

b. Calculation of CO2 emissions from Industrial activities

Calculation of CO2 emissions in the industrial sector of this experiment is the calculation of CO2 emissions from industrial production processes. Calculation of CO2 emissions from industrial production processes is calculated directly based emission factors of each industry. The emission factor is the CO2 emissions resulting from the production process of a good overall energy use of fuel, electricity and the processing of raw materials to produce one unit of product. The use of emission factors in the industry's carbon footprint calculation is done due to lack of data or difficulty of access to inventory data for the use of fuel, electricity and the amount of raw material every industry. The emission factors obtained from the calculation of total CO2 emissions per production capacity of some types of the same industry in other regions. Characteristics of industries in urban areas Gresik is not much different from other developing countries that follow the explanation of the value of the emission factors IPCC (2007) which is the total value of each type of industry in the state thailand, brazil and china. Also in this calculation as well just take the types of industries that are dominant in urban areas Gresik like metal processing, chemical, fertilizer, and wood processing. This is because the types of other industrial uses only electrical energy source in the production process. on the emission calculation as follows:

$$\text{Emission } CO2 = \sum KPi \times EFi \text{..........(IPCC, 2006)}$$

Specification:
KPI = total production capacity throughout the industry type I (tonnes)
EFI = Emissions Factor industry i (tonnes CO2 / tonne product)

Some EF and NCV value of some types of fuel, among others, as shown in Table 2.

Table 2. Value EF Some type Industry

Energy type	EF	Unit
Metal Processing 1	3,8	Ton CO2/Ton Produk
Chemistry 1	2,97	Ton CO2/Ton Produk
Fertilizer 1	1,88	Ton CO2/Ton Produk
Wood 2	1.09	Ton CO2/Ton Produk

Source : 1) IPCC (2007) dan 2) Ghozali (2014)

c. Calculation of CO2 emissions from transport activities
calculation of CO2 emissions from transportation activities derived from the number of motor vehicles and fuel use of the vehicle. This calculation uses the following formula:

$$CO2 \text{ emissions} = \Sigma \text{ vehicles} \times FC \times EF \times NCV$$

where:
Vehicle Σ i = Number of vehicle types (unit)
FC = Average fuel usage per vehicle (kg / unit / year)
EF = Factor CO2 emissions from the use of fuel (MJ / kg)
NCV = Net calorific volume per unit mass of fuel type i

3.2 Method of the equation upon Green open space ability in Reducing Gas Emissions C02

At this stage of the calculation of the total uptake of CO2 emissions conducted to measure the natural ability to absorb the study area of CO2 emissions annually. Uptake is divided into two kinds are differentiated by the type of vegetation that shrubs and trees. Calculation of total natural uptake in the study conducted by the formula:

$$TSA = (Ls \times Ds) + (Lp \times Dp) \text{ .... adopted from Rini (2014)}$$

Specification:
TSA = Total natural absorption (tonnes CO2 / year)
Ls = area of land cover types of shrubs years i (ha)
Lp = area of land cover types of trees in i (ha)
Ds = Average power CO2 gas sinks shrub cover (tonnes CO2 / ha / year)
Dp = Average power CO2 gas sinks tree cover (tonnes CO2 / ha / year)

The following represents the average CO2 absorption capacity of natural gas of the type of land cover and land cover tree bush in Table 3.

Table 3. CO2 Absorption in each type of Vegetation Cover

Vegetation Cover type	CO2 Absorption	
	(kg / ha / h)	(kg / ha / month)
tree	129,92	46771,2
bush	12,56	4521,6
prairie	2,74	986,4

Source: Prasetyo et al (2002) in Rini (2010)

Data calculation natural uptake of CO2 gas in Gresik obtained by calculating the area of land cover of shrubs and trees in urban areas Gresik use land cover analysis of Landsat imagery 8 2013. Land cover 8 results Landsat images are classified based on the type of tree cover, shrubs, constructed land and agencies water. Tree cover can be a plantation, afforestation and building roads, parks and urban forests. Shrub cover may be fields, fields, meadows and shrubs. Land cover awakened a residential area and industry. Water bodies are of pond, river and pond.

4.0 Result

4.1 CO^2 Emissions (Carbon Footprint) Production in Gresik

Global warming is the increase in the average temperature of the air at the earth surface and oceans were identified since the mid-twentieth century and is projected to continue (UNFCCC, 2011). With increasing concentration of greenhouse gases, especially CO2 in the atmosphere, the more heat reflected waves of the eaGreen open space's surface is absorbed in the atmosphere that resulted in the earth's surface temperature increases (Dwiyatmo, 2007).

Greenhouse gases, especially CO2 causes global warming, and global warming causing climate change, which then leads to global changes (Bala and Hosain, 2012). Global warming refers to the increase in temperature of the earth's surface. Climate change refers to changes in the earth's climate as this temperature increases. These changes include, among others, changes in rainfall patterns, the availability of fresh water, glaciers and sea ice quantity, ecosystem health, and biodiversity (Wilson and Pipier, 2009). Global change is a term that most covers and refers to the global changes of all kinds, some of which are due to climate change (eg, sea level, ocean pH, biodiversity) and others for effects such as population, globalization, economics, and pollution (Franchetti and Apul, 2013).

The emission of carbon dioxide is emissions or release of CO2 into the air as a result of people's activities. Sources of CO2 emissions vary widely, but can be classified into 4 types (Aqualdo, 2012) as follows:

1. Mobile transportation (moving source), among others: motor vehicles, airplanes, trains, motor boats and peneganan / evaporation of gasoline.
2. Stationary combustion (stationary sources) include housing, local commerce, energy and industry marketing, including steam power is used as energy by the industry.
3. Industrial processes (process industries), among others: chemical processes, metallurgy, paper and oil extraction.
4. Solid waste disposal (landfill) include: household waste and trade, mining and agricultural discharges.

Wilson and Pipier (2010) explains that the significant growth of CO2 from 280 ppm before the pre-industrial to 350 ppm in 2005 by human activities such as:

1. Burning fossil fuels
2. Activities processing industry
3. Changes in land use

Changes in land use of green land into building land also contributed to the growth of CO2 emissions due to the function of the building and transport activities (Siahaan, 2012). Specially in the industrial sector, all industry sectors contributing GHG emissions, but the biggest contributor is the cement industry, steel industry, pulp & paper industry, textile industry, petrochemical industry, ceramic industry, fertilizer industry, food and beverage industry (IPCC, 2007). These industries are industries that produce emissions from the processing of raw materials directly.

This condition as a result of an imbalance of land use and settlement industry continued to grow in addition to land reduced green area (Arsyad, et al, 2008). Industrial activities and transport are the largest emitters of CO2 gas (Astra, 2010). Industrial growth in urban areas grew significantly Gresik. In the period 2007-2012 the growth of the number of medium and large scale industries which recorded increase from 242 units to 260 units (BPS, 2008-2012). The amount represents 49% of the total industry in Gresik (BPS, 2012).

4.1.1 Production of CO2 emissions from residential activities

CO2 emissions of households consisted of the use of electricity, kerosene, LPG, and waste incineration. CO2 emissions of households affected by the number of households and energy use. In 2012 the number of households in urban areas reached 94 562 households Gresik. If you look at the data per gresik districts in urban areas, the districts with the highest number of households is Manyar districts the number of 28 414 households. A large number of households can memberikat contribution of CO2 gas emissions due to greater use of fuel in each household. Based on the results of the sampling survey of households in urban areas Gresik obtained data on the use of fuel and household garbage burning intensity as in **Table 4** below.

Table 4. Hasil household survey average fuel consumption and burning of garbage in Gresik urban areas

Consumption Type	Amount	Unit
Firewood	Not Found	
Kerosene	630	Liters / Year /KK
LPG	180.41	Kg / year / HH

The table shows that household fuels used in urban areas Gresik consists of the type of kerosene and LPG. The average fuel use of LPG for 180.41 kg / year and kerosene amounted to 630 liters / year. Although urban areas Gresik an urban area and Minak land conversion program by the government is already running but households in the region are still found using kerosene. The use of kerosene was found in districts manyar and sat sampeyan. Both districts have a transition from urban districts and rural areas. Percentage of kerosene users in urban areas Gresik is 22%.

In addition to the use of cooking fuel, the contribution of CO2 emissions from housing activity also derived from household waste incineration activities. Waste incineration activities can still be found in urban areas Gresik. This is because the waste transportation system is yet to reach any settlements in urban areas Gresik and coupled with the culture of the rural population are still attached. The survey results showed that each household produces an average of 1091.35 tonnes of waste per year. Of the 120 samples of 19.1% of households burn household trash periodically. Of these 7.73 tons of waste burned. Thus the percentage of household waste pdembakaran is 0.006% per year. In addition to the use of cooking fuel, the contribution of CO2 emissions from housing activity also derived from household waste incineration activities. Waste incineration activities can still be found in urban areas Gresik. This is because the waste transportation system is yet to reach any settlements in urban areas Gresik and coupled with the culture of the rural population ares still attached. The survey results showed that each household produces an average of 1091.35 tonnes of waste per year. Of the 120 samples of 19.1% of households burn household trash periodically. Of these 7.73 tons of waste burned. Thus the percentage of household waste pdembakaran is 0.006% per year.

CO_2 emissions household activities also derived from indirect emissions is the use of electric energy. The electrical energy consumed by each household generated from power plants in the region. The Indonesian power plant is still dominated by the use of fossil fuels to produce CO_2 emissions. Thus the household electricity users also contribute to the emission of CO_2. Based on the data network services unit PLN Gresik, Number of total electricity consumption of households in urban areas Gresik in 2012 amounted to 13,049 MWh. This consumption is far below the total electricity consumption of industrial activity, which reached 98,898 MWh. Calculation of CO_2 emissions from housing activity in urban areas Gresik can be presented in **Figure 1**.

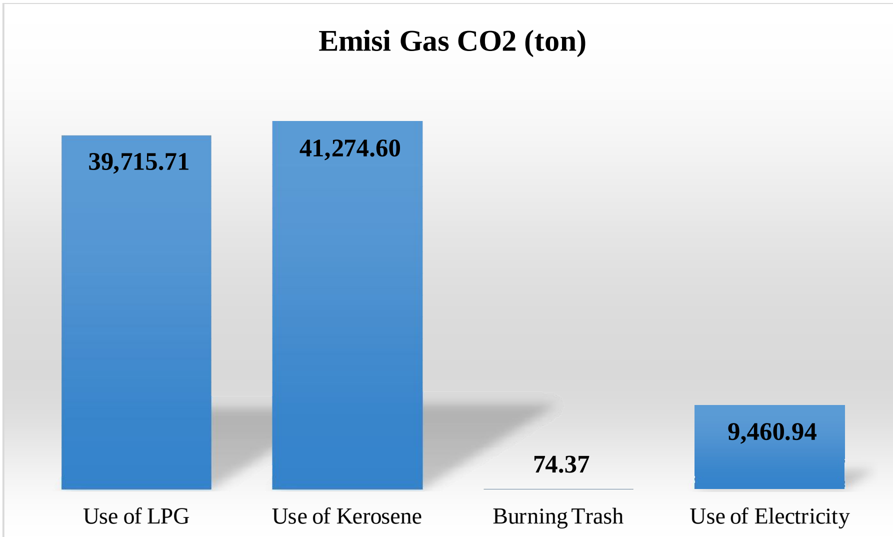


Figure 1. Calculation of CO_2 Emissions From Housing Activity In Gresik Urban Areas

Figure 1. showed that the use of kerosene has the largest contribution in the production of CO_2 emissions from residential activities. Although the number of household kerosene users in urban areas Gresik only by 22%, but the value of kerosene emission factor greater than LPG gas. Waste incineration have the lowest contribution in the production of CO_2 gas emissions housing activities in the amount of 74.37 tons per year. Thus the largest contribution to the production of CO_2 emissions from housing activity is the use of fuel terutaama kerosene.

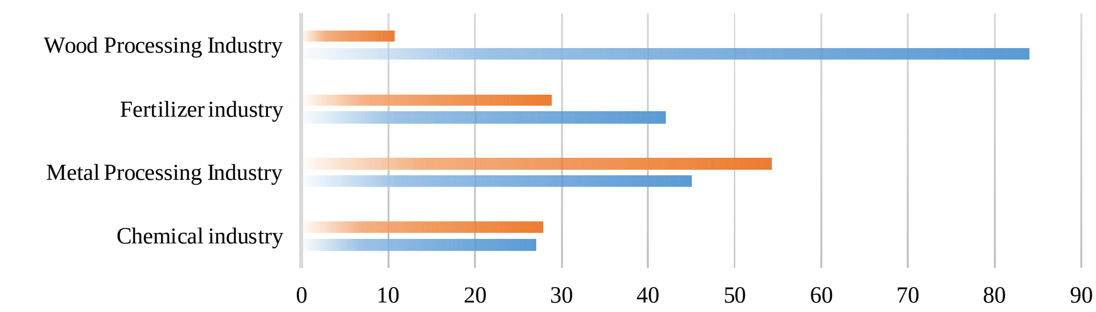
4.1.2 Production of CO_2 emissions from industrial activities

Industry Gresik in urban areas grew rapidly. It can not be separated from an urbanized area Gresik which is a buffer area of Surabaya that have an abundance of activities, especially activities in the industrial sector. This activity is growing and developing in urban areas Gresik supported by the port. Urban industrial Gresik various kinds such as the cement industry, fertilizer industry, the steel processing industry, wood industry, chemical industry and other basic.

All types of industry can produce, contributing CO_2 emissions but most come from industry-chemical industry, fertilizers, metals and wood processing. The types of industry produces CO_2 gas emissions from the use of fuel and decomposition of raw materials (IPCC, 2007). CO_2 emissions resulting from the combustion of fuels and electric energy usage.

The dominant type of industry in Gresik berdasarkann data from the Department of Industry and Trade Gresik and Investment Board Gresik are Wood Industry, Fertilizer, Chemicals and Metals. The growth of this type of industry is quite significant. Chemical industry in urban areas Gresik is the production of basic chemicals industry, other chemicals and petrochemicals. Metal industry metal processing industry includes both iron, copper and steel. Fertilizer industry include natural fertilizer industry and also the synthesis of non-primary macro nutrients. Timber industry includes producers of wood processing industry in which there is the process of molding, flooring, drykiln. Based o data from the

Department of Industry and Trade Gresik and Investment Board Gresik, the number of industries can be presented in **Figure 2**.



	Chemical industry	Metal Processing Industry	Fertilizer industry	Wood Processing Industry
Prodcution Capacity (*10^5)	27.87	54.29	28.83	10.68
Unit	27	45	42	84

Prodcution Capacity (*10^5) Unit

Figure 2. Calculation of CO2 Emissions From Housing Activity In Gresik Urban Areas

The timber industry is an industry with the largest number though small production capacity. One unit of the wood processing industry memilikirata average production capacity of 12,715 m3 / year. Chemical Industry has an average production capacity per unit of the biggest industry is 120,633 tons / year. Chemical industry is the industry with the smallest number but has an average capacity per unit of industrial production amounted to 103,214 tonnes / year. The greater capacity of production of a type of industry, the greater the emissions produced as a result of the processing of raw materials and fuel use are higher.

Calculation of CO2 emissions from the production of industrial activities is calculated from four types of this dominant industry. Other industry types have a small number of industry and not have contributed CO2 emissions from the processing of raw materials can be assumed will result in CO2 emissions are insignificant. **Figure 3** shows CO2 emissions production from industry operations.

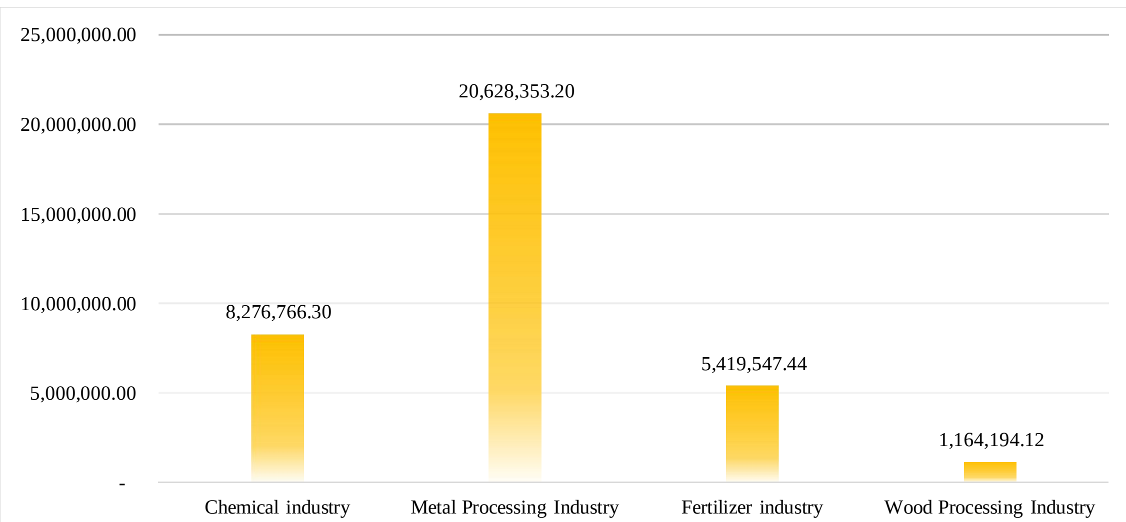


Figure 3. CO2 emissions production from industry operations

Production of CO2 emissions of metals and chemical industry activities have the largest contribution in the total production of the industrial sector CO2 emissions. In 2013 the production of CO2 emissions from this activity reached $38.49*10^6$ tonnes. Industrial metals have the highest contribution to the production of CO2 emissions reached $20.62*10^6$ tons or 58.13% of the entire production CO2 emissions industry activities. Wood processing industry has the lowest production by $1.16*10^6$ ton or 3.28%. production of CO2 emissions by the metal industry as a result of numerous and large production capacity in each industrial unit.

4.1.2 Production of CO2 emissions from transport activities

Modes of transport in urban areas Gresik consists of public transportation and private transportation modes. Public transportation in urban areas Gresik is a public transport vehicles (lyn) comprising rural transport, urban transport, public transport and taxi transportation border. The village is a type of freight transport routes serving rural and connect every district in Gresik. City transport is transport routes serving around urban Gresik, District and Sub-district Kebomas Manyar. Border transport is a type of transport that serve the routes across districts / cities such as Gresik, Surabaya, Gresik-Sidoarjo and Gresik, Mojokerto.

In addition to public transportation, in urban areas there are also modes Gresik private vehicles and transportation of goods. Private vehicles consist of four wheels and a motorcycle. Type of four-wheeled vehicles, among others, sean, jeeps, minibuses. Whereas the transport of freight transport is associated with industrial activities and warehousing in urban areas Gresik and a more than 4-wheel vehicle. Freight vehicles very diverse kinds of small size such as boxes and pick-up trucks and heavy equipment and mobile system types. The number of vehicles in urban areas can be inventoried Gresik as in **Table 5.**

Table 5. The Number of Vehicles In Gresik Urban Areas

Vehicle type	Vehicle Petrol Fuel	Vehicle Fuel Solar	Total	Average fuel use per unit
Motorcycle	183,375		183,375	501.14 liters / year
4 Wheel Vehicles	8,014	12,022	20,036	2662.52 liters / year
4 Wheel more Vehicles		9,736	9,736	3819.10 liters / year

Source: Department of Provincial Revenue Services Unit East Jaws Gresik, 8hasil sample survey vehicle

Production of CO2 emissions from transportation activities derived from the use of fuel both types of gasoline and diesel fuel. The greater the number of vehicles in urban areas Gresik increase the use of fuel. Based on the results of a survey of some types of vehicles shows that the use of fuel each unit type motorcycle of 501.14 liters / year, 4-wheel vehicles amounted to 2662.52 liters / year and 4-wheel vehicles in excess of 3819 liters per year. Thus the vehicle size affects the amount of fuel use.

From table 5 can be calculated production of CO2 emissions from transportation activities as shown in **Figure 4.** Production of CO2 emissions from transportation activities comes from private vehicles either the motorcycle or vehicle wheel 4. Production of CO2 emissions each type of vehicle that is 210,158 tonnes and 134,182 tonnes. Vehicles more than 4 which is dominated by the vehicle industry have contributed to the production of CO 2 emissions by 98,188 tonnes.

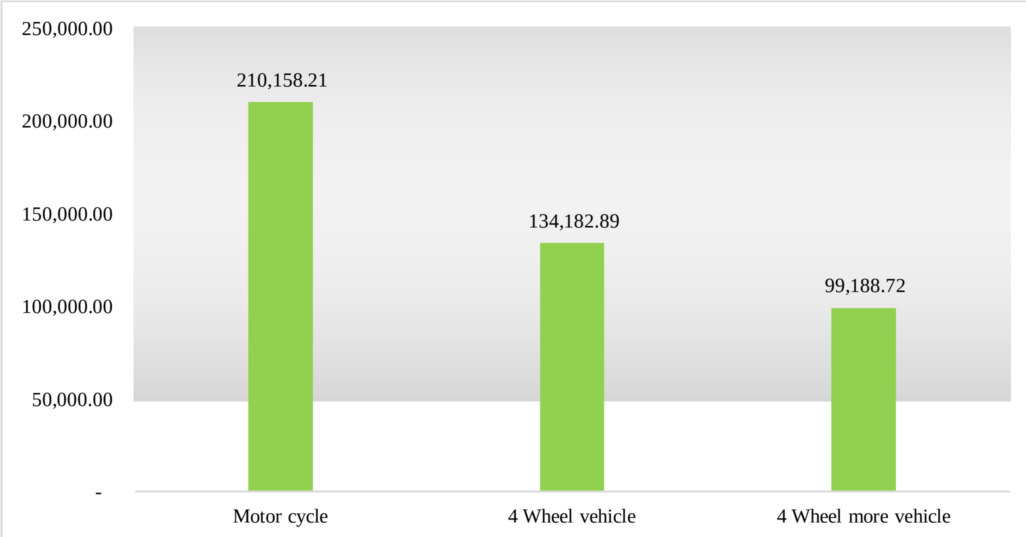


Figure 4. Production of CO2 emissions from transportation activities

4.2 CO^2 Emissions Absorption Analysis By Green Open Spaces in Gresik

The release of CO2 emissions into the air causing greenhouse effect that if left unchecked will bring harm to human life, because it is necessary to take measures to eliminate CO2 emissions is often called the environmental balance (of damage). CO2 gas concentration increased diatmosfer can cause most of the emitted infrared earth stuck in the earth's surface (Aqualdo et al, 2012).

One of the best ways is to plant a tree, it is known that plants can absorb CO2 and release O2 through photosynthesis process, because it can absorb carbon emissions other than CO2 plants also have other functions as supplier O2 necessary for humans, but it can be provide shade and beautify the landscape aesthetics (Gratimah, 2009).

In line with these opinions Suwari and Rozari (2012) argues that one of the efforts to maintain and control the concentration of CO2 is to increase the area of green open space (RTH) urban forest. RTH urban forest is part of the city green space. RTH city consists of green space in the form of urban forest tree vegetated areas gazetted as a town forest and non-forest green open spaces of the city in the form of forests, gardens, fields, shrubs and grass (Dahlan, 2004).

Landsat 8 image analysis results indicate the land cover in urban areas can Gresik presented in Figure 5. Green land cover such as shrubs and trees each count reached extensive 2450.79 and 5062.59 ha. Extensive green areas in urban areas Gresik is still influenced by the agricultural land rice / fields and plantations. Regular plantations planted with fruit trees such as manga. While many bush land cover derived from wetland / fields. The largest land cover is a body of water or pond degan an area of 11097.81 hectares.

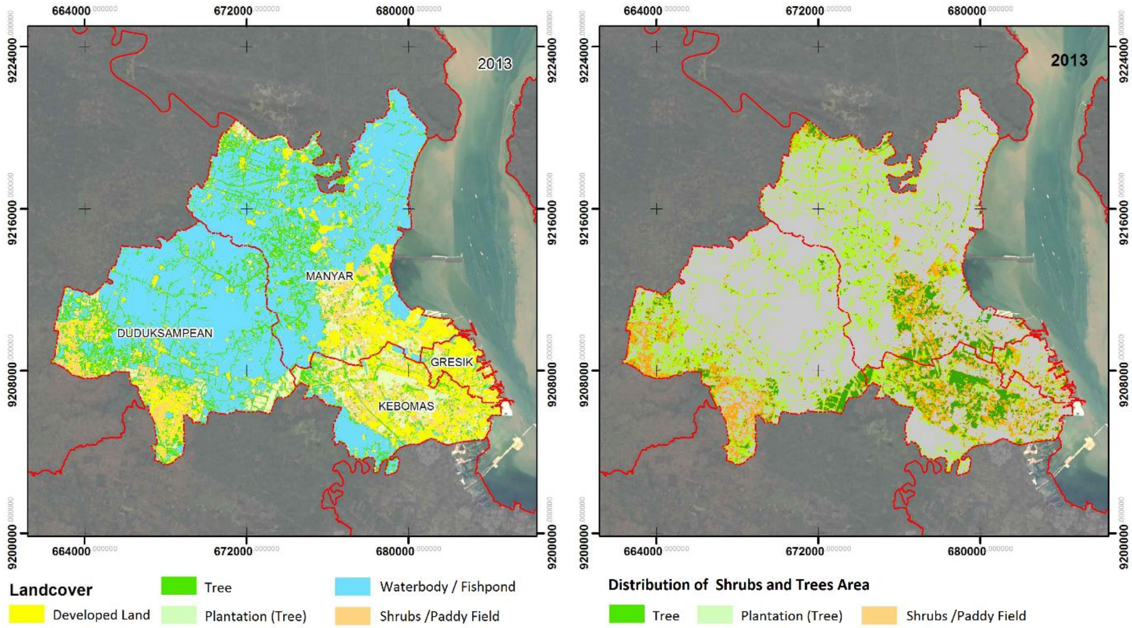


Figure 5. Land Cover in Gresik Urban Area using Landsat 8 Image

From table 6 can be calculated absorption capability of CO2 emissions in urban areas Gresik. In 2013 the absorption of CO2 emissions as a basis Gresik biokapasitas urban areas reached 2.97×10^6 tons of CO2 / year. Absorption of CO2 gas emissions by tree cover greater than the bush. Contributions plantations in absorbing CO2 emissions in urban areas Gresik of 830,678.06 tons of CO2 / year. While other tree cover in the form of greening roads, parks, and other mangrove absorb CO 2 emissions by 2.01×10^6 tons of CO2 / year.

Table 6. Lanc Cover Absorption Capability of CO2 Emissions in Urban Areas Gresik

Land Cover Type	**Size (Ha)**	**Absorption of CO2 Emissions (tonnes CO2 / year)**
bush	2,450.79	132,955.36
tree	3,582.54	2,010,700.58
Plantations (tree)	1,480.05	830,678.06
Water bodies / ponds	11,097.81	-
land Awakened	3,214.89	-
Total	21,826.08	2,974,334.00

The total absorption when compared to the production of CO2 emissions in urban areas Gresik still deficit. As in **Table 7**, in 2013, total production of CO2 emissions in urban areas Gresik at 36.02×10^6 tonnes of CO2, while the absorption of CO2 emissions amounted to only 8.26% of the production of CO2 gas emissions in urban areas Gresik. Production of the largest CO2 emissions come from industry activities with a percentage of 98.52%. Activities of households had the lowest contribution with a percentage of 0.25%.

Table 7. CO2 Emissions Production based on Activities in Urban Areas Gresik

Activity	CO2 Emissions Production (Tons)	Percentage
housing	90,525.62	0.25
industry	35,488,861.06	98.52
transportation	443,529.83	1.23
Total	36,022,916.51	100.00

Thus the industrial activity is an activity that is dominant in urban areas Gresik and produce gas emissions CO2, which is great. Gresik industries in urban areas need to be directed into environmentally friendly industries and efficient in fuel use. In addition a large pond land in urban areas Gresik needs to be directed into green land and not allowed to be constructed land, especially land industry.

5.0 Conclusion

Three main activities that dominate the production of CO2 emissions in urban areas Gresik namely from industrial activities, transportation, and housing. Industrial activity dominates 98% of the total production of CO2 emissions in urban areas Gresik, the next row is the transportation and housing of 1.23% and 0.25%. While the absorption of CO2 emissions in urban areas Gresik based on calculations only reached $2.97*10^6$ tons of CO2 / year, which means the absorption of CO2 emissions amounted to only 8.26% of the production of CO2 emissions occur in urban areas Gresik. Thus from this comparison we can conclude that the imbalance between production and absorber of CO2 emissions shows that the ecological deficit is occurred in urban areas Gresik.

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