Mapping of Greenhouse Gas (CO2) Due To Domestic Energy and Household Electricity Consumption in Padang City

by Vera Surtia Bachtiar

Submission date: 06-Mar-2018 11:33AM (UTC+0800)
Submission ID: 925849674
File name: B11-Prosiding_-_607-618_Mapping_of_Greenhouse_Gas_CO2.pdf (2.07M)
Word count: 4434
Character count: 22867

Mapping of Greenhouse Gas (CO_2) Due To Domestic Energy and Household Electricity Consumption in Padang City

Vera Surtia Bachtiar [a], Wahyu Eka Putri Djasli[a]

Air Quality Laboratory, Environmental Engineering, Andalas University
vera_sb@ft.unand.ac.id

Abstract

Residential area is one of the contributors in the increase of CO_2 emissions. Padang, a big city in Indonesia with a large population within it is potential contributor of CO_2 emissions. Unfortunately, there was no database collected of CO_2 emissions from this activity. The CO_2 emissions from domestic activities are divided into two i.e primary and secondary CO_2 emissions, known by the term 'carbon footprint'. The primary CO_2 emissions are resulted from domestic energy consumption, while the secondary CO_2 emissions are resulted from household electricity consumption. Questionnaire of sampling was conducted to get the CO_2 emissions data. The number of samples was obtained based on the equation of Slovin were distributed evenly at Padang City. The CO_2 emissions were calculated based on Puslitbangkim 2002. The calculations showed 92.327,59 ton CO_2/year of primary CO_2 emissions and 317.287,2 ton CO_2/year of total secondary CO_2 emissions. While the total CO_2 emissions reaching up to 409.614,79 ton CO_2/year. Based on the calculations the highest number of emissions were in the District Koto Tangah. While the highest number of secondary CO_2 emissions were conducted in the Indarung area.

Keywords: Carbon footprint, CO_2 emissions, domestic energy consumption, household electricity consumption, residential area

1. Introduction

Global warming and climate change are phenomena of increasing concentration of Greenhouse gases (GHGs) in the atmosphere due to human activities, such as fossil fuel use, land use, forest changing, as well as agricultural activities and livestocks. One of the greenhouse gases that have the largest contribution to global warming and climate change are carbon dioxide (CO_2) (Maulyani, 2009).

The Kyoto Protocol 1997 that has been ratified by 141 countries, including Indonesia, states the need to reduce emissions by 5,2 percent from the level emissions in 1990. The commitment from various countries to control CO_2 emissions is needed to implement the Kyoto Protocol. Indonesia itself has a comprehensive national action plan to reduce CO_2 emissions that is associated with climate change which are mitigation and adaptation. In supporting the action plan, some data is urgently needed related to energy consumption, especially activity in the residential as one of the main sources of CO_2 emissions. (Renandia, 2009).

Integrated prevention efforts among the relevant area in a particular area need to be done to overcome the problems of pollution. Pollution control directly from emission sources is an effective attempt to overcome the impact of these emissions. Meanwhile, the availability of systematic information about the sources of the emissions and emission load for a particular region in Indonesia is still lacking, making it difficult to estimate and evaluate emissions that is required to make the air pollution control policy decision. Therefore, a study of the emissions inventory from various sources is required (Adolf, 2008).

Emission inventory is accounting the amount of information about the quantity of overall air pollution located in a geographic area within a specified time span, usually a specific year.

The emission inventory will be used as the basis for preventive measuring against air pollutions and help to analyze some activities that contribute to increase pollution in the geographic area in which the study area (Canter, 1996).

Padang as one of the big city in Indonesia has a total population that is quite high. Based on a data from Dinas Perindagtamben, Padang City (2010) has 182.822 households within 11 sub-districts namely Bungus Teluk Kabung, Lubuk Kilangan, Lubuk Begalung, Padang Selatan, Padang Timur, Padang Barat, Padang Utara, Nanggalo, Kuranji, Pauh and Koto Tangah. The high number of households with various household activities leads to a high level of pollution and it will eventually cause an increase to the earth's temperature. Energy used by humans in all activities especially household activities is very high. The increasing use of energy used, also resulted a sharp increase of of fossil fuel use such as kerosene, coals, gases as an energy sources. It has led to increased exhaust gases like CO_2 which is the main contribution to greenhouse gases. Hence the resulting of increasing in emissions is also very high which causes CO_2 levels in the atmosphere is unstable.

The resulting of emissions in Padang City can be seen in human activities in residential. Population growth resulted in so many activities in residential that can lead to increasing of CO_2 in atmosphere. Beside the views of so many human activities that cause increasing of emission, the type of fuels used for cooking and electric power plan also play the important role in emissions resulting. But there is no valid data that shows the number of CO_2 emissions in the Padang city that come from household activities. Therefore a research is needed to be carried out into how CO_2 emission's amount in Padang city from household activities.

The research of emission inventory of CO_2 from domestic activities carried out by the domestic energy consumption and household electricity consumption. The results of this research can be used to aid the decision making process in effort to control air pollution in Padang City, mainly due to domestic activities.

2. Research Method

The data that's going to be collected for this research is primary and secondary data. The primary data comes from questionnaires and interviews with 400 respondents (household) which were determined by the equation of Slovin with 182.822 households, while secondary data is used come from various department in Padang City such as the number of households in Padang City based on the use of fuels for cooking from Dinas Perindagtamben, electricity usage in Padang City from Perusahan Listrik Negara, the value of emission factor from Puslitbangkim 2002). These values are used as data for a calculation to determine how much CO_2 emissions resulted in residential of Padang City. Primary CO_2 emissions are resulted from the domestic energy consumption for cooking (LPG, kerosene, and woods), while secondary CO_2 emissions are resulted from household electricity consumption. The results of CO_2 calculations form the basis of CO_2 emissions level scaling in each sub-district.

a. To calculate the primary CO_2 emissions for each respondent (household):

   Puslitbangkim 2002

   $$CO_2\ Emission = EF\ x\ Fuel\ Consumption \quad (1)$$

   Description:

   EF = Emission factor from Pulitbangkim (2002)

   EF of Kerosenes : 2,5 CO_2kg/kg

   EF of LPGs : 3 CO_2kg/kg

Proceeding ISEE 2013
ISBN 978-602-95595-6-9

EF of woods : 0,37 CO_2kg/m^3

b. To calculate the average primary CO_2 emissions for each sub-district

$$The\ average = \frac{Primary\ CO_2\ Emission\ in\ each\ sub-district}{The\ total\ of\ respondent} \quad (2)$$

c. To calculate primary CO_2 in each sub-district

$$Primary\ CO_2\ emission = Average\ CO_2\ emission\ x \sum rHouseholds \quad (3)$$

d. To calculate secondary CO_2 emissions in each sub-district

$$Secondary\ CO_2\ emission = EF\ x\ Household\ electricity\ consumption \quad (4)$$

Description:

EF = Emission factor from *World* Resources *Institute* (WRI) and *World Business Council for Sustainable Development* (WBCSD, 2001).

EF for Indonesia : 454 CO_2/kWh

e. To obtain total CO_2 emissions is calculated by the value of overall primary CO_2 emissions and secondary.

$$Total\ CO_2\ emission = Primary\ CO_2\ emission\ x\ Secondary\ CO_2\ emission \quad (5)$$

Processing data in this research is done based on the calculation of CO_2 emissions from domestic energy consumption and household electricity consumption as well as the analysis of the calculation results itself. Data analysis in this research is such a descriptive analysis of a simply overview of the results. It is represented in forms of graphs, tables, and mapping and will be showed the comparison of the results of calculations based on domestic energy consumption and household electricity consumption.

3. Result and Discussion

3.1 Data of Energy Consumption for Household Activities in Padang

The data of energy consumption for household activities is resulted from secondary data analysis done before such as the data of energy consumption for cooking and household electricity consumption in Padang City.

3.1.1 Data of Domestic Energy Consumption for Cooking

The result of processed data from each fuels showed an overview of the high and low CO_2 emission loads in Padang City. The more the fuel consumptions are used so the more CO_2 emission loads are emitted. The amount of fuel consumptions depend on the number of household members, the level of welfare, the size of the house, and culture within the area. For more details of fuel consumptions for cooking activities in Padang City can be seen in Table 1 and Figure 1 with equal size of LPG and Kerosene that has been set is 1 kg of LPG = 1,74 litres kerosenes.

Table 1 Fuel Consumptions for Cooking in Padang City

No	Fuel	Fuel Consumption (Kg/month)
1	LPG	7,96

2	Kerosene	34,82
3	Wood	142,14

Based on Table 1, woods as fuel for cooking requires a considerable amount of burning, it is 142,14 Kg/month for one household due to wood itself need large enough quantities so that the heat energy can be resulted to perform adequate cooking activities. While the needs for kerosenes compared to LPGs, Kerosenes requires higher amounts (in Kg) to be able do burning.

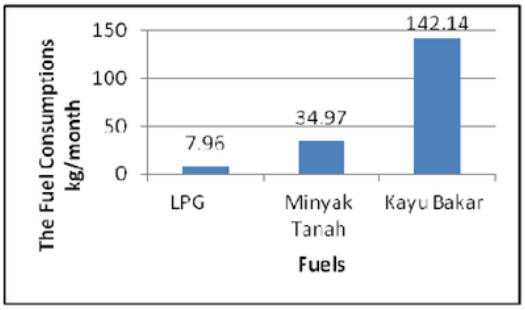

Figure 1 Fuel Consumptions fo Cooking in Padang City

3.1.2 The Data of Household Electricity Consumptions

The calculation of power consumptions is done by PT PLN (Persero) Branch Padang every year in December. They serve four areas in Padang City and nine areas for other areas. The number of electricity custromers increased significantly each year except for the reduction in the number of customers in 2009 due to the earthquake that occurred in Padang City. While in 2011, there was ascension of customers due to the number of customers building got repaired after the earthquake. Table 2 shows household electricity consumptions in Padang City.

Table 2 Household Electricity Consumptions in Padang City

No	Year	Number of Customer (KK)	Daya Tersambung (VA)	Electricity Consumption (kWh)
1	2007	353.365	478.468.270	100.927.706
2	2008	368.019	508.984.930	115.673.758
3	2009	368.546	507.051.730	102.456.136
4	2010	386.210	547.029.850	129.585.989
5	2011	411.397	598.941.850	142.270.309

3.2 Carbon Dioxide Emission Loads in Padang City

Carbon dioxide from residential is divided into two i.e primary CO_2 emissions from domestic energy consumptions for cooking activities and secondary CO_2 emissions from household electricity consumptions. The primary CO_2 emissions were calculated based on Puslitbangkim (2002) meanwhile secondary CO_2 emissions were calculated based on the Riswandi's research for Pekanbaru City.

3.2.2 CO_2 Emission Loads Based on Domestic Energy Consumption for Cooking Activities in Padang City (Primary CO_2 Emissions)

The calculation of carbon dioxide emission loads from domestic energy consumption for cooking (primary CO_2 emissions) are based on the amount of consumption of each fuels per month for each respondent (house) that represented in each sub-district in Padang City (Primary CO_2 emissions/house/month). From this calculation would be known the total

Proceeding ISEE 2013
ISBN 978-602-95595-6-9

amount of primary CO_2 emissions/sub-district/month). Table 3 shows the results of calculation of primary CO_2 emission.

Table 3 Carbon Dioxide Emission Loads Based on Domestic Energy Consumption for Cooking in Padang City (Puslitbangkim 2002)

No	Sub-district	CO_2 Emission Loads ($KgCO_2$/month)			Total CO_2 Emission Loads ($KgCO_2$/month)
		LPG	Kerosene	Wood	
1	Bungus Teluk Kabung	42.090,9	208.885,6	0,0	250.976,5
2	Lubuk Kilangan	67.389,0	497.709,1	20.979,1	586.077,1
3	Lubuk Begalung	145.962,0	730.197,9	14.485,5	890.645,4
4	Padang Selatan	175.333,8	431.869,1	0,0	607.202,9
5	Padang Timur	153.755,4	504.298,0	29.637,0	687.690,4
6	Padang Barat	116.616,0	269.425,2	0,0	386.041,2
7	Padang Utara	128.563,8	377.742,0	95.904,0	602.209,8
8	Nanggalo	105.491,1	409.2768	20.979,0	535.746,9
9	Kuranji	376.824,4	824.006,9	46.453,5	1.247.284,77
10	Pauh	72.754,00	368.385,8	20.812,5	461.952,3
11	Koto Tangah	222.373,3	1.215.765,2	0,0	1.438.138,6
Total		1.607.153,8	5.837.561,7	249.250,5	7.693.966,0

As presented in Table 3, it is known that the primary CO_2 emission loads based on Puslitbangkim 2002 in Padang City amounted to 7.693.966,03 $KgCO_2$/month or 92.327,59 $tonCO_2$/year with each amounted to 1.607.153,82 $KgCO_2$/month of LPG or 19.285,84 $tonCO_2$/year of LPG, kerosene amounted to 5.837.561,71 $KgCO_2$/year or 70.050,74 $tonCO_2$/year and wood amounted to 249.250,50 $KgCO_2$/month or 2.991,01 $tonCO_2$/year.

This number shows that kerosene has an important role for resulting CO_2 emissions in Padang City. This is caused by the amount of kerosene users which are more than woods or LPG users in Padang City. People of Padang City mainly use kerosene as fuel for cooking because of misunderstanding of people by using kerosene is much more efficient that wood and also cheaper that LPG.

Koto Tangah Sub-district is the largest emitter of CO_2 emission in Padang City. It emits 19 % of total primary CO_2 emissions in Padang City. It amounted to 1.438.138,6 kg CO_2/month or 17.257.663,2 $tonCO_2$/year. This is mainly caused by Koto Tangah Sub-district is the larest sub-district in Padang City which lead largest number of household that used kerosene and woods as fuel for cooking. The following sub-districts which are emitted large enough primary CO_2 emissions are Kuranji dan Lubuk Begalung Sub-district.

The comparison of CO_2 emission from the use of LPG, kerosene and woods in eleven sub-district in Padang City shows the district with the largest of CO_2 emissions from LPG as fuel is located in Kuranji Sub-district, it is amounted to 376.824,4 $KgCO_2$/month or 4521,89 $tonCO_2$/year. This is caused by Kuranji Sub-district is the second of highest number after Koto Tangah Sub-district.

3.2.2 CO_2 Emission Loads Based on Household Energy Consumption in Padang City (Secondary CO_2 Emissions)

The calculation of carbon dioxide emissions from household electricity consumption (secondary CO_2 emissions) is based on the number of the emount of electricity consumption (kWh) at Desember, 2011 for each area in Padang City. Each area distributes electricity to each sub-district. Table 4 shows the calculation of secondary CO_2 emissions.

Table 4 CO_2 Emission Loads Based on Household Electricity Consumption in Padang City

No	Rayon	Number of Customer	Electricity Consumption kWh	Emission Factor gr/kwh	Secondary CO_2 Emission TCO_2/mnth
1	Belanti	47.970	19.911.700,1	454,0	9.039,9
2	Tabing	41.145	9.867.153,4	454,0	4.479,7
3	Indarung	53.293	19.935.123,2	454,0	9.050,5
4	Kuranji	43.154	8.525.238,0	454,0	3.870,6
Total		185.562	58.239.214,7		26.440,6

Table 4 presents the total of electricity consumption per month is derived from four areas, are Belanti, Tabing, Kuranji and Indarung Area. Belanti and Indarung Area is two of area which consumed more electricity than the other areas. Electricity consumption amounted to 9.050,55 $TonCO_2$/month in Indarung area while Belanti area is about 9.039,91 $TonCO_2$/month. Figure 2 shows the rest.

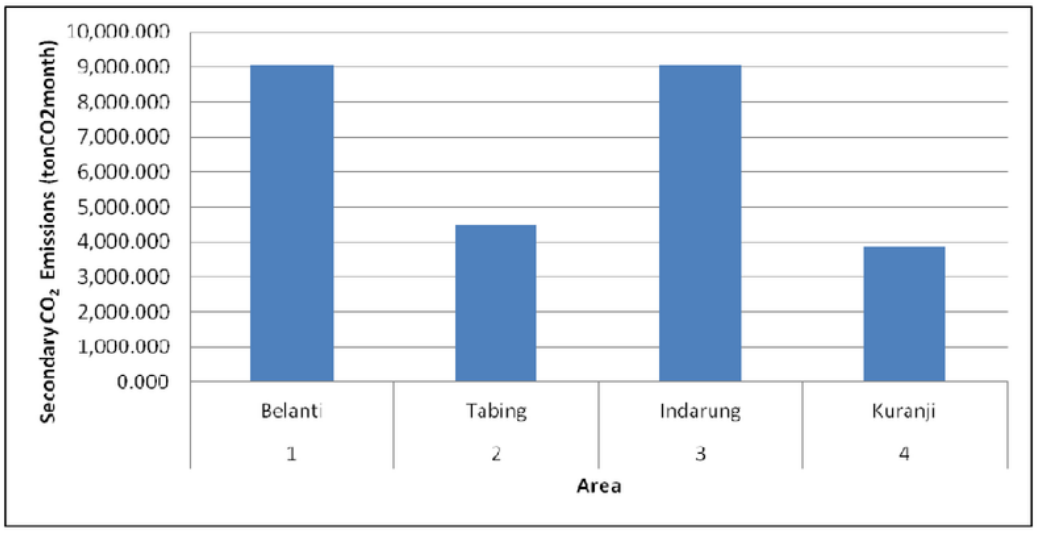

Figure 2 Secondary CO_2 Emmision Loads in Padang City

Household electricity consumption include various use such as cooking, lighting other needs that use electricity. The more electricity used, it will result in much more indirect CO_2 emission load.

Factors that affect the amount of electricity consumption in one house are welfare of the family and the size of house. Indarung's electricity consumption take a lead with 34,23 % of electricity consumption followed by Belanti Area with 34,19 % of total secondary CO_2 emissions. Indarung and Belanti area as the main emitter of secondary CO_2 emission have so many customers than the other areas that lead so much electricity consumption.

Proceeding ISEE 2013
ISBN 978-602-95595-6-9

3.2.3 Total Carbon Dioxide Emmisions Charges Based on Domestic Energy Consumption and Household Electricity Consumption

The value of total emissions of carbon dioxide (total CO_2 emmisions) is calculated from the consumptions of energy in Padang City which are domestic energy consumption and household electricity consumption. Primary CO_2 emmisions are derived from the emission charge calculation based on Puslitbangkim (2002). The resulting of total CO_2 emmisions calculation can be seen in Table 5.

Table 5 Total Carbon Dioxide Emmisions Charges Based on Domestic Energy Consumption and Household Electricity Consumption

No	Sub-district	CO_2 Emmisions Charges		
		Primary CO_2 Emmisions $KgCO_2$/mounth	Secondary CO_2 Emmisions $KgCO_2$/mounth	Total CO_2 Emmisions $KgCO_2$/mounth
1	Bungus Teluk Kabung	250.976,5	9.050.545,93	10.778.244,93
2	Lubuk Kilangan	586.077,1		
3	Lubuk Begalung	890.645,4		
4	Padang Selatan	607.202,9		
5	Padang Timur	687.690,4		
6	Padang Barat	386.041,2	9.039.911,85	11.858.803,05
7	Padang Utara	602.209,8		
8	Nanggalo	535.746,9		
9	Kuranji	1.247.284,77	3.870.458,06	5.579.695,13
10	Pauh	461.952,3		
11	Koto Tangah	1.438.138,6	4.479.687,64	5.917.826,24
Total		7.693.966,0	26.440.603,48	34.134.569,35

The following Tabel 5 shows the value of Carbon Dioxide in Padang City that derived from domestic energy consumption and household electricity consumption is 34.134.569,35 $KgCO_2$/month atau 409.614,83 Ton CO_2/year. It shows Padang Selatan Sub-district, Padang Timur Sub-district, Padang Barat Sub-district, Padang Utara Sub-district and Nanggalo Sub-district lead in total carbon dioxide emissions.

Household electricity consumption contributes to the most carbon dioxide emissions in Padang City for about 26.440.603,48 kg CO_2/month or 317.287,24 tonCO_2/year. It's followed by kerosene consumption. Figure 3 shows the rest.

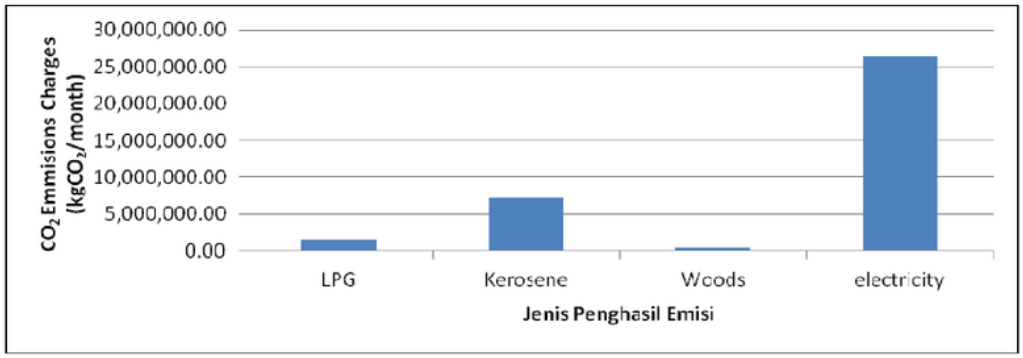

Figure 3 Total Carbon Dioxide Emmisions by Source In Padang City

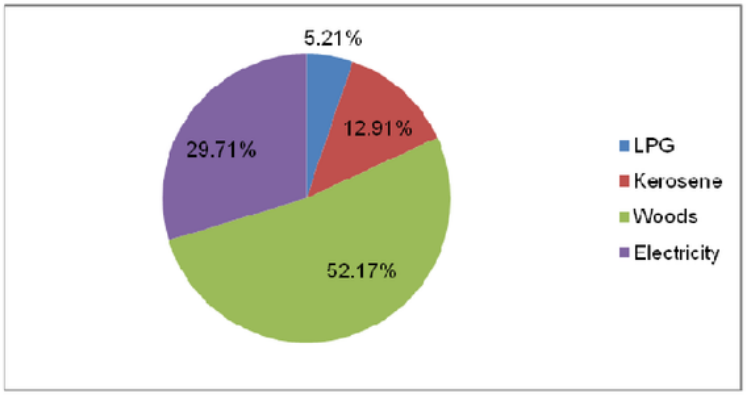

Figure 4 Average Carbon Dioxide Emmisions by Source in Padang City

3.3 Carbon Footprint in Padang City

The mapping of this study use color-coded to indicate the amount of emissions at each of sub-district. The color-coded it self will show which one the sub-district that produce the largest emissions, medium and low emissions. It will be used by giving a specific range as symbol that represent the color it self.

3.3.1 Primary Carbon Footprint

The mapping of primary carbon dioxide emissions use color-coded by assigning colors that are differentiated by the level of emissions emitted in Padang City. So it can be divided into high-level (≤ 1.500.000 $KgCO_2$/month) is represented by the black color and low-level (≥ 499.999 $KgCO_2$/month) is represented by the blue color. The Range of primary carbon dioxide emissions can be seen in Table 6.

Figure 5 shows Koto Tangah Sub-district is one of the sub-district which emits the largest primary emissions in the Padang City. It emits more than 1.500.000 kg of CO_2/month from the domestic energy consumption. Meanwhile Bungus Teluk Kabung Sub-district and Padang Barat Sub-district emit the lowest primary carbon dioxide emissions which is lower than 4.999.999 $kgCO_2$/month.

Table 6 Range of Mapping Primary CO_2 emmisions in Padang City

No	Color	Range	Primary CO_2 Emmisions $KgCO_2$/month	Sub-district
1	Blue	≥ 499.999	250.976,5	Bungus Teluk Kabung
			461.952,3	Pauh
			386.041,2	Padang Barat
2	Green	500.000-9.999.999	586.077,1	Lubuk Kilangan
			607.202,9	Padang Selatan
			687.690,4	Padang Timur
			602.209,8	Padang Utara
			535.746,9	Nanggalo
			890.645,4	Lubuk Begalung
3	Red	1.000.000-1.499.999	1.247.284,77	Kuranji
			1.438.138,6	Koto Tangah
4	Black	≤ 1.500.000	-	-

Proceeding ISEE 2013
ISBN 978-602-95595-6-9

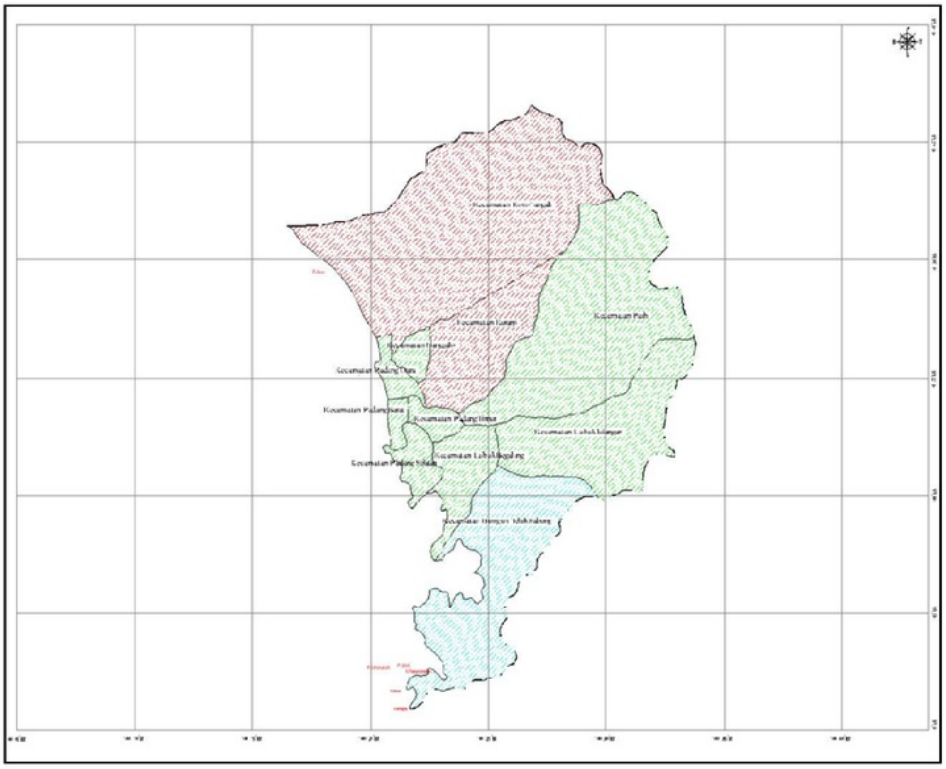

Figure 5 Primary Carbon Footprint in Padang City

3.3.2 Secondary Carbon Footprint

The way of mapping secondary carbon footprint has almost the same way with primary. The difference between mapping secondary carbon footprint and primary is the way of range determining. The range of secondary carbon dioxide is determined by the level of emissions emitted. So it can be divided into high-level (≤ 7.500.000kgCO_2/month) that represented by black color and low-level (0-2.499.999kgCO_2/month) that represented by blue color. The Range of secondary carbon dioxide emissions can be seen in Table 7.

Figure 6 shows Belanti area and Indarung area is two of emitter that emits the largest secondary carbon dioxide emissions in Padang City. It emits more than 7.500.000 kgCO_2/month, meanwhile Tabing area and Koto Tangah area is two of emitter that emits the secondary lowest carbon dioxide emissions. It is about 2.500.000-4.999.999 kgCO_2/month.

Table 7 Range of Mapping Secondary CO_2 emmisions in Padang City

No	Color	Range	Secondari CO_2 Emisions KgCO_2/month	Area
1	Blue	0-2.499.999	-	-
2	Green	2500.000-4.999.999	3.870.458,06	Tabing
			4.479.687,64	Koto Tangah
3	Red	5000.000-7.499.999	-	-
4	Black	≤ 7.500.000	9.039.911,85	Belanti
			9.050.545,93	Indarung

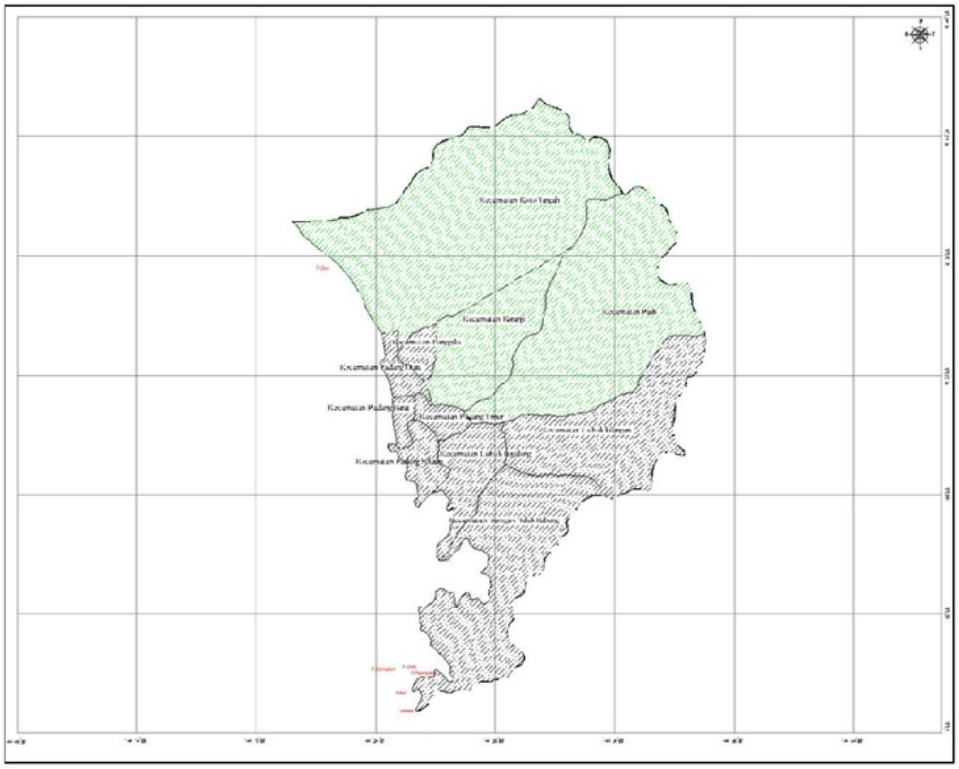

Figure 6 Secondary Carbon Footprint in Padang City

3.3.3 Total Carbon Footprint

The way of mapping total carbon footprint has almost the same way with primary and secondary. The difference between them is the way of range determining. The range of total carbon dioxide is determined by the level of emissions emitted. So it can be divided into high-level (≤12.000.000kgCO_2/month) that represented by red color and low-level (0-5.999.999 kgCO_2/month) that represented by blue color. The range of secondary carbon dioxide emissions can be seen in Table 8.

Figure 6 shows Belanti area and Indarung area is two of emitter that emits the largest in total carbon dioxide emissions in Padang City. It emits more than 12.000.000 kgCO_2/month, meanwhile Tabing area is the emitter that emits the lowest in total carbon dioxide emissions. It is about 0-5.999.999 kgCO_2/month.

Table 8 Range of Mapping Total CO_2 Emissions in Padang City

No	Color	Range	Total CO_2 Emissions KgCO_2/bulan	Area
1	Biru Muda	0-5.999.999	5.579.695,13	Tabing
			5.917.826,24	Koto Tangah
2	Hijau Muda	6.000.000-11.999.999	11.858.803,05	Belanti
			10.778.244,93	Indarung

Proceeding ISEE 2013
ISBN 978-602-95595-6-9

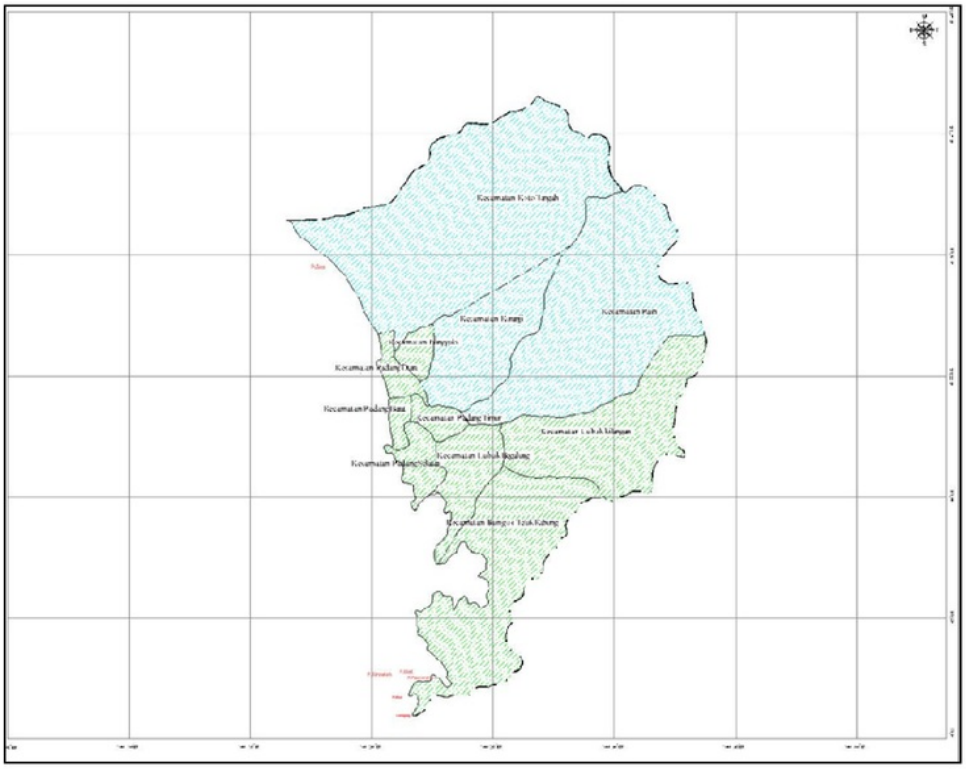

Figure 7 Total Carbon Footprint in Padang City

4. Closure

4.1 Conclusion

Based on survey result and calculations can be concluded as follows:

1. CO_2 emmision loads from domestic energy consumption for cooking emits about 92.327.592 ton CO_2/year which is divided into LPGs amounted to 19.285,84 ton CO_2/year, kerosenes amounted to 70.050,74 ton CO_2/year and wood about 2.991.01 ton CO_2/year, meanwhile CO_2 emission loads from housesold energy consumption is amounted to 317.287,2 ton CO_2/year so the total CO_2 emissions from domestic activities in Padang City is about 409.614,83 ton CO_2/year;
2. The results of carbon footprint mapping based on domestic energy consumption for cooking (primary CO_2 emissions) and household electricity consumptions are resulted Koto Tangah sub-district as a largest emitter of primary CO_2 emissions, meanwhile Belanti Area and Indarung area is two of area that emited secondary CO_2 emissions the most.

4.2 Suggestions

The suggestionss can be given to further progrees of this research are:

1. Making emission inventory in Padang City due to manufacture of building materials, the transport of building materials and the using of equipment during the construction process;

2. In order to make this emission inventory valid should be calculated based on the type of house, number of family one house and the income of the family;
3. Do make an emission inventory of greenhouse from other sources such as landfill, the mining sector, so that it can be calculated the total of all greenhouse gasess emitted into earth's atmosphere.

BIBLIOGRAPHY

Canter. 1996. *Evironmental Impact Assessment*. New York: Mc. Grew Hill.

Djajadilaga, Maulyani dkk, 2009. *Emisi Gas Rumah Kaca dalam Angka.* Jakarta. Kementrian Negara Lingkungan Hidup Republik Indonesia.

Leopold, Adolf, 2008. *Inventori Emisi Gas Rumah Kaca (CO_2 Dan CH4) Dari Sektor Transportasi Di Kota Dan Kabupaten Bandung Berdasarkan Konsumsi Bahan Bakar Dan Jarak Tempuh Kendaraan*. Thesis Program Studi Teknik Lingkungan, Institut Teknologi Bandung.

Tegar, Renandia, 2009. *Studi Carbon Footprint (CO_2) Dari Kegiatan Permukiman Di Kota Surabaya Bagian Tengah (Pusat Dan Selatan).* Tugas Akhir Jurusan Teknik Lingkungan, Institut Teknologi Surabaya.

ISBN 978-602-95595-6-9

Mapping of Greenhouse Gas (CO2) Due To Domestic Energy and Household Electricity Consumption in Padang City

ORIGINALITY REPORT

9%	8%	5%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Trisakti University Student Paper	9%

Exclude quotes	On	Exclude matches	< 3%
Exclude bibliography	On		