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POTENTIAL FOR CO2 EMISSIONS IN TRANSPORTATION SECTOR AND REDUCTION STRATEGIES ANALYSIS RELATED TO GREENHOUSE GAS IN SEMARANG

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ABSTRACT

Semarang is the capital of Central Java Province and also one of the metropolitan city in Indonesia with population of 1,559,198 (Semarang in Number 2012). The high number of population and economic growth has an attraction for the community activities in Semarang and surrounding. Moreover, with the spatial planning concept which provide residential areas and commercial activities and services spread all over Semarang, it increase the distance and activities needs. One of the most influenced sectors with the increasing activities is the transportation sector. It can be seen by the increasing number of private vehicles and congestion in almost all main roads. In the Climate Change issue, one of greenhouse gas (GHG) emissions contributor is the transport sector. Based on Semarang in Number 2012, with the year 2010 as a base line for emission count, it showed that the number of private car as many as 33,523 vehicles, oplet/microbus 859 vehicles, motor bikes 119,019 vehicles, buses 443 vehicles, trucks 913 vehicles and taxi as many as 1,265 vehicles. These numbers of vehicles was served by 2,786.28 kilometers of road which consists of national, provincial and municipal road, and also by the local road for about 2,691 kilometers. The total fuel consumption for the activities of those vehicles is 302,928.00 litre of Premium and 154,925,500 litre of solar. From the data presented,we calculated that the CO_2 Emissions is 111,020,367 ton CO_2e. From the data above, private cars and motorcycles reached 97% of the total transportation used in Semarang. With a considerable amount of transportation emission of 1,110,204 ton CO_2e, the effect on climate change through greenhouse gas (GHG) are quite high. Therefore,Semarang city needs a sustainable transportation strategy to reduce emission form the transport sector, such as Bus Rapid Transit (BRT) operation, use of fuel gas, and integrated public transportation systems that will make people interested in using public transportation. From the operations of BRT system in Semarang, with three corridors from 2010- 2014, as many as 9,169,925 people are served by BRT (Dishubkominfo, 2014). Seeing from this condition, the need to increase integrated transportation system to decrease people from using private vehicles which in turn reduce CO_2 emissions in Semarang become increasingly important.

Keywords: BR T CO_2 emission, greenhousegas, transportation

INTRODUCTION

Semarang city is the capital of Central Java Province which has the strategic value of its history of location and infrastructure. The strategic value can be summarized by its multiple transport nodes either by land node, sea node and air node in the city of Semarang. Semarang Masterplan Transportation (2008) pointed out that land node transportation can be found with four terminals, i.e. Mangkang, Terboyo, Penggaron and Sukun. In addition to other existing transportation services such as Tawang and Poncol Station as other land node. In sea transport node there are Tanjung Mas as a center of activity for ship's passengers and goods, in addition to Ahmad Yani International Airport as air transport node.

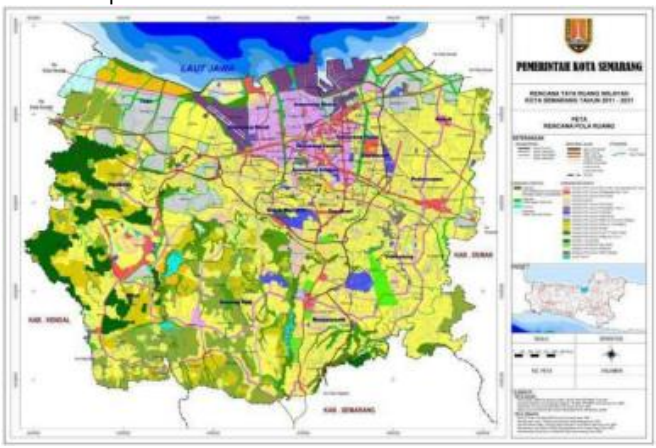

Figure 1. Masterplan Regional Spatial Planning of Semarang 2011-2031 (sources: Semarang local regulation number 14 year 2014, 2011)

Semarang City Regulation Number 14 Year 2014 about Master plan of Regional Spatial Planning of Semarang 2011- 2031 explains how the concept of Semarang development about spatial pattern, spatial structure and sustainable strategic area. The spatial pattern leads to develop trade and service, public housing development and green open spaces. The spatial structure with the increase of facilities and infrastructure development especially for hinterland area attract investors and community hinterland to perform their activities to come in Semarang.

In Data of Semarang number 2012, 2013, explained that City of Semarang has extensive area 373.73 km^2 which served by 16 districts and 177 sub-district. Total Population is 1,559,168 people with average growth 1.2 % every year. As well as number of population and development to the sub urban area until it is bring growth of PDRB 22,736,136.19 rise 6.4% from last year, its means that the City has been able to explore economic value that can increase Regional Original Revenue (PAD) to make development City more better.

The development of a region would require such a dynamic, thus it is a usual was supported by a transport system. Miro, 2012, explained that transport system is a unity of the components that support each other and work together in the procurement services transportation that serve the region from local level (village and city) to the national and international levels. According to Sukarto, 2006, the concept sustainable transportation becomes expectation and challenges to develop and apply it effectively. Williams, 2005, explained study has also linked transportation that is how to deal with consumption of oil-based fuel, greenhouse, safety, traffic jams and socio- economic toward high sustainable without bring next generation problems on the whole world.

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Semarang in number 2012, with the year 2010 as a base line for emission count, it showed that the number of private car as many as 33,523 vehicles, oplet/microbus 859 vehicles, motor bikes 119,019 vehicles, buses 443 vehicles, trucks 913 vehicles and taxi as many as 1,265 vehicles. From data percentage above, private vehicles and motorcycles reached 97% of the other vehicles. Today, Semarang has much of traffic jam location, usually it happens in morning and afternoon at peak hour. This condition caused of vehicle number is rise every year like mention above and low of public transportation service in Semarang.

In Transportation Master plan of Semarang, 2008, explained that the main activities pattern people in Semarang is movement from the house to the workplace, or trade or place of education, because his character who regularly and daily. In the master plan also described several strategies to planing transportation system among other things is the increasing equipment and infrastructure such as public transportation, node transportation infrastructure, outer ring road. The gap of Master plan and public transportation is about services, they have many services in centre of city but lack in suburbs of the city. Explanation about public transport service model in Semarang describes in figure below.

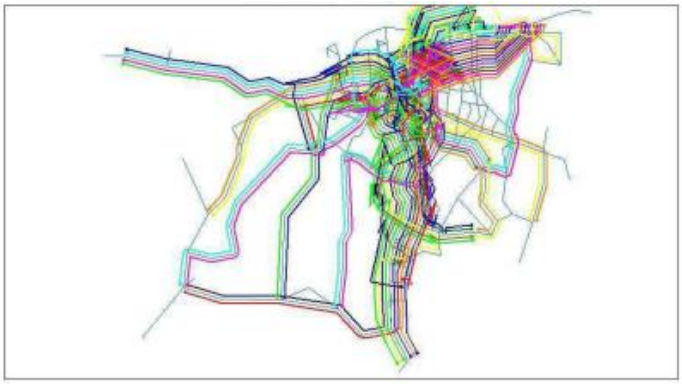

Figure 2. Semarang Public Transport Networking Model fsources: Semarang Masterplan Transportation, 2008)

With the sprawl of housing area make people to choose private vehicle specialy motorcycle than public transport because more easier to make activity to another area. In other condition, people are very easily to get private vehicle for their activity. Semarang transportation is no integrated yet, so they must move to another mode in some are. This condition not only about time but also make mobility is more expensive.

As well as increasing the numbers of vehicles in Semarang have an impact on fuel use and increasing numbers of CO_2 emissions. Handajani, 2011, explained that fuel consumption city was very influenced by the number of people, Bruto Regional Domestict Income **(PDRB),** the number of vehicles and length of the road. In the research explained that the City Semarang's consumption of oil-based fuel diesel fuel. Tao and Hung, 2003, explained that every private vehicles have an impact for around 20-25% CO_2 emissions globally.

UNFCCC, 2006 explain that CO_2 emission (Carbondioxide) is greenhouse gas (ghg) particle which is contribute to climate change. Susandi, 2004 explain that in Indonesia from transportation secctor give 5% from total emissions. And the other is from forest (fire and new land opening).

Torok, 2005 explained about vehicle's contribion to pollution. The change from fossil to be mechanic and 40% fossil energy change and make environmental hot and decrease. Liu, 2006 more indeed about air pollution is in urban city area, and emission will differ depend on the road and traffic condition.

Dedinec et.al, 2013 explain how to analyse mitigation potential from transportation sector in developing countries. They use greenhouse gas costing model with business as usual (BAU).

This research have an objective analyse related between transportation and emission CO_2 in Semarang and sustainable transportation strategy to reduce CO_2 emissions.

METHODS

The research method was based on the analysis from references such as master plan transportation, local transportation regulation and (others thus related to) Semarang transportation document.

RESULTS AND DISCUSSION

Based on IPCC 2007, in a simple emissions of greenhouse gases is a combination of human activities with maximum coefficient that shows emissions that are contained in a unit of activity. Data human activities are usually called Data activities (Activity Data) while the maximum emissions in each unit in so-called factor emissions (Emission Factor). It is mathematically the emission can we count:

Emission = Activity data X Emission Factor

The greenhouse gases local action plan (RAD GRK) of Semarang year 2012 counted an impact of CO_2 emissions and reached at 1,110.204 ton CO_2e as a result of increasing number of private vehicles and change of life style both in Semarang and that passed by the City of Semarang. These Emissions contribute to the greenhouse gases effect, and it may cause global warming that if no necessary measure is performed, this will lead to decreasing environmental and health conditions. Calculation of CO_2e emission based on baseline data from year 2010 with 'do nothing' activities predicted increased emission, and the results are shown in Figure 3.

In Semarang one of strategy sustainable transportation is build bus rapid transit (BRT) Trans Semarang system, which is mandate from local regulation number 14 year 2011 and local transportation strategy. In that regulation Semarang must built six corridors from 2011-2031. But in actually Semarang supportedthe program and build three(3) corridors between 2011- 2014.

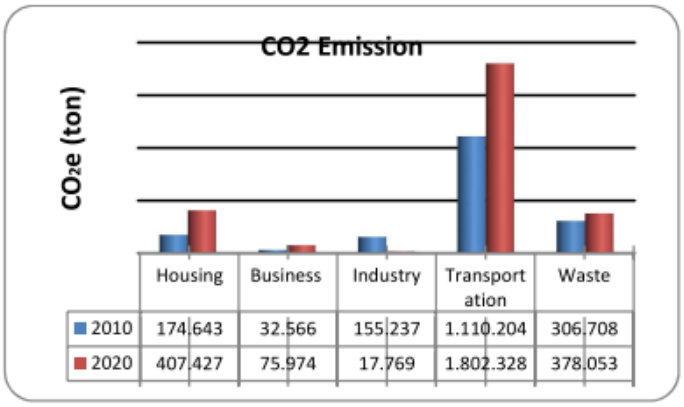

Figure 3. COC Emission in Semarang based on community sector (Source:Pemerintah Kota Semarang & Giz Paklim, 2012)

Now day the operations of BRT trans Semarang system in Semarang have three corridors. From Semarang transportation agency data explained that as many as 9.169.925 people were served by BRT. Seeing from this condition, many people in Semarang changed from private vehicle and other vehicle to the public transportation.

The other Sustainable strategy needed is how to support the people from BRT can walk and using bicycle line and also how to build integrated system between park area in some place with halt or public transport place.

Kapoen, 2005, said that to make sustainable transportation, it must integrated between spatial planning and transportation planning.

Deakin, 2001 explained what the strategy of sustainable transportation were vehicle technology/fuel, road/vehicle operation improvement, demand management.

Geng et. al., 2013, explained in their reseach about how urban public transportation sector gave benefit for Sehnyang city in China.

GIZ Sutip, 2014, in their asessment result about transportation in Semarang explained that for sustainable transport was need to develop BRT Trans Semarang, build trans kedungsepur (hinterland of Semarang) system and make center of integrated moda system.

Looking for this condition, sustainable transportation still need support more comprehensively by government. From the province and also national government to make more integrated system transportation from local transportation to the inter regional system.

With this strategy, we have sustainable transportation 1+en to make people move from area to the other easily. And people will try to use public transportation than the private vehicle. With more people using public transportation, there will reduce fuel consumption and the final is will be reducing CO_2 emission.

CONCLUSION

Semarang contributes approximately 1,110.204 ton CO_2e emission. In Year 2011-2014 as high as 9,169,925 people are served by BRT (three corridors). Semarang Municipality needs to support the policy focus on public transportation service to reduce private vehicle and CO_2 emission. Semarang municipality needs to make coordination with Provincial Government, National Government and transportation communities to get the best strategy and to support budget to build the sustainable transportation

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