Urban Transport in Vietnam: A Perspective from Environmental Pollution

Thi Hoa Nguyen, Thi Thuy Hoa Phan

Abstract—Environmental pollution has become a problem not only for one nation, one region but also for the common concern of all humanity. The process of socio-economic development of the countries in the world has led to tremendous impacts on the environment, causing the human environment to change and become increasingly degraded. important. These are climate change - global warming, depletion of the ozone layer and acid rain ... especially air pollution caused by transportation. In Vietnam, environmental pollution in big cities is becoming a pressing problem. The problem of overcrowding of transport in big cities, which has been very difficult, now adds a serious situation of pollution that is increasing to worrying levels. What a challenging problem that is posing on the shoulders of managers. The paper presents the realities of environmental pollution, especially air pollution from vehicle emissions. Besides, also initially offering solutions to reduce pollution caused by urban transport in Vietnam.

Index Terms—Urban transport, environmental pollution, urban environment, Vietnam

I. INTRODUCTION

In recent years, the number of private vehicles has increased rapidly, making air pollution in urban areas across the country increasingly serious. Transport activities are currently considered as a major and worrying source of pollution to the air environment in our country, especially in urban areas and densely populated areas where activities pine flourish [1].

For years, scientists at Yale University's environmental research centers and Columbia University in the US have been conducting environmental performance index (EPI) research in 132 countries, the results show that Vietnam is ranked 79th in this list. On the basis of the world standard of air quality index (AQI), if the air cleanliness is from 150 to 200 points, it will be considered polluted, from 201-300 [2]. Considered to be extremely urgent, seriously affecting the health of people. Meanwhile, in Vietnam, the two most polluted areas are Hanoi and Ho Chi Minh City, the AIQ of the day is at 122-178. As for the peak hours, when traffic jams or congestion occur, the AIQ index in large urban areas must reach over 200. This shows that Vietnam is standing at the pollution threshold, serious gas, causing immeasurable dangers to people's health. According to the EPI survey, Vietnam is among the 10 countries with the lowest air quality index (ranked 123) and is expected to fall to 125th position in the near future [3]. This is an alarming information to the air environment in our country today.

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Ho Chi Minh City Department of Transport has just reported to Ho Chi Minh City management about the environmental pollution caused by transportation activities is at an alarming level. Currently, the city has more than 8 million vehicles (of which more than 7 million motorbikes) are operating every day emitting a tremendous amount of emissions into the environment, increasing air pollution and the cause of disease risks for people in the area and people in traffic [4]. More specifically, there are many old and outdated vehicles that still exist and are naturally involved in traffic, which not only threatens the safety of life for road users but also affects the traffic safety. seriously affecting the air quality of urban centers and people's health [5].

According to the Institute of Transport Strategy and Development (Ministry of Transport), in the period of 2011-2016, transportation activities in our country consume a large amount of energy, accounting for 30% of the total national energy demand, 60% of total fuel consumption [6] and increase 10% per year [7]. In particular, road transport consumes the largest energy, accounting for about 68% of the total fuel of the industry [8]; 90% of transportation fuel is gasoline and diesel (only 0.3% is clean fuel) [9]. With the consumption of large amounts of fuel, transportation activities have emitted a large amount of GHG [10], increasing climate change [11]. Currently, on average transport each year emit about 30 million tons of CO2 [12]. In particular, road traffic emissions accounted for 86%, railways, waterways and air traffic accounted for 14% [13].

The operation process of means of transport discharges large amounts of substances such as dust, CO, NOx, SOx, gasoline vapors, lead dust, benzene ... causing air pollution [14]. Specifically, the concentration of dust in the air (quarter 2/2016) in cities such as Hanoi, Ho Chi Minh City, Hai Phong, Da Nang. at intersections is 3-5 times higher than the permitted standard; The average daily concentration of CO and NO2 in some large intersections has exceeded the standard from 1.2 to 1.5 times [15]. The statistics also show that the emission of road motor vehicles depends heavily on the quality of vehicles. For cars and motorcycles over many years of use of low quality, low fuel efficiency, high concentrations of toxic substances, dust in exhaust gas are the causes of serious environmental pollution [16]. In particular, motorcycles are the main contributor of polluted gases, especially CO emissions. Trucks and passenger cars of all kinds emit a lot of NO2. In addition, the noise generated from traffic activities also plays a major role in causing environmental pollution [17].

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Fig. 1. The HCMC Transport Department has reported that pollution caused by transport activities has become alarming

According to the HCMC Environment Protection Subdepartment, air pollution is mostly caused by suspended dust from transport activities. The average content per hour of suspended dust monitored in the third quarter of 2016 in 20 spots in HCM City was between 87.70- 715.93 μg/m3, while 43.75 percent of monitored value could not meet the Vietnamese standard QCVN 05:2013/BTNMT concentration of suspended dust is 300 µg/m3 per hour) [4]. The traffic jams in the city make the pollution even worse. The air pollution at Go Vap Roundabout, Nguyen Kiem, Xo Viet Nghe Tinh and Bach Dang streets is more serious because there are too many motorbikes, cars and buses which discharge emissions at the same time [18]. In districts 2, 9 and Thu Duc, the dust sometimes is so thick that it looks like fog. The same situation can be seen in Hanoi. Tay Son, Truong Chinh, Giai Phong and Nguyen Xien roads are dusty because of the heavy traffic there. The HCMC Transport Department has proposed to the HCMC People's Committee to urge the Prime Minister to approve the MOT's plan to control vehicles' emission. Under the plan, MOT will draw up a roadmap for applying emission standards for motor vehicles with the capacity of 175 cm³ and higher in 2018-2020 [19].

II. SITUATION OF AIR POLLUTION DUE TO URBAN TRANSPORTATION

The problem of air pollution caused by urban transport activities in our country comes from many different causes. First of all, that is the effect of urbanization associated with the industrialization process. The process of urbanization on the one hand will promote economic, social development and accordingly the urban population will constantly increase. Currently, the urban population in our country is growing rapidly and there is no sign of being controlled. In 2002, the new urban population accounted for 25% of the

national population, by 2012 the urban population reached 34% and in 2015 was 35.7% [20]. That has led to an increasing number of motorized vehicles in urban areas. According to data from the Traffic Police Department, in 2015, there were 50,682,934 vehicles in the whole country (2,932,080 cars, 47,760,854 motorcycles and motorbikes) [4]. Only the total number of motor vehicles managed in Hanoi is 5,591,729 vehicles (546,057 cars, 5,045,672 motorcycles, motorbikes) in Ho Chi Minh City. there are 7,420,395 vehicles (556,688 cars, 6,863,707 motorcycles and mopeds) [21].



Fig. 2. Sources of air pollution [22]

The quality of the transport is also a matter worth discussing. Most of the old cars and motorcycles in circulation do not have a control system for emissions. Meanwhile, many people in traffic in Vietnam still do not have the habit of periodic vehicle maintenance according to the manufacturer's recommendations. The vehicles after a while using the fuel injection system will be exposed, the risk of fire. Engines that do not run out of gasoline will also produce benzene in the exhaust. When the vehicle is regularly maintained, it will help the engine operate better, the fuel consumption is less so the vehicle emissions to the environment are also less. On the other hand, it also helps to make the vehicle structure better and safer during circulation. Therefore, many individual vehicles do not strictly implement the periodic maintenance and maintenance regime, which causes an increase in emissions to the environment with increasing levels of toxicity. In particular, many old and rotten vehicles still use traffic, not only threatening the safety of life for road users but also seriously affecting the air quality of the roads, urban areas, threatening people's health and life [14].

The volume of vehicles participating in traffic increases rapidly in the condition that infrastructure has not been improved much, the policy of moving hospitals, schools, large administrative agencies, bus stations ... out of the city. well done. The construction and new construction of traffic works have both prolonged and occupied a large surface of the road, the organization of traffic has encountered many difficulties, which greatly affected the traffic safety situation, landscape and urban environment causing serious cancer conditions. Although in 2015, Hanoi and Ho Chi Minh City did not have UTGT for more than 30 minutes, traffic congestion still occurred due to high traffic density, especially at rush hour. On the other hand, when heavy rains occur, flooding on some roads will obstruct traffic. When traffic congestion occurs, the level of pollution of gasoline vapors can increase 4-5 times compared to normal. Pollution of CO and gasoline vapors (HC) often occurs at large intersections. Therefore, transportation emissions becoming a major source of pollution to the urban air environment, especially in large cities like Hanoi and Ho Chi Minh City.

It can be affirmed that up to 70% of urban environmental pollution emissions originate from vehicles. In Vietnam, about 75% of cars run on gasoline, 25% of cars run on DO oil, 100% motorcycles run on gasoline. When vehicles use fuel to operate, the engine will emit a large amount of toxic gases that pollute the environment and directly affect the health of people in traffic and living along the road. traffic routes.

III. THE SOURCES OF EXHAUST GAS CAUSING POLLUTION FROM VEHICLES

The main polluting gases from the exhaust gas of vehicles such as CO, NOx (NO, NO₂, N₂O₃, N₂O₅), CnHm. Understanding vehicle emissions shows the direct effects of these gases on people's health:

Carbon monoxide (CO) affects the nervous and cardiovascular systems causing asphyxiation (interfering with oxygen transport to the tissues). Carbon monoxide is a colorless and odorless gas. The main symptom of carbon oxide poisoning (the onset of headache symptoms) occurs when the concentration of carbon oxide reaches 200 mg / m3 over a period of 2 to 3 hours. In case the carbon oxide exceeds the above concentration, there will be a dizzying feeling. The next stage of carbon oxide poisoning is drowsiness and leads to unconsciousness [14].

Nitrous oxide (NOx) is also an odorless, tasteless gas and greatly affects the airways of the human body. In particular, in the cities of nitrous oxide combined with hydrocarbons (CnHn) in the exhaust of vehicles under the effect of sunlight and creating oxidation due to light. Then the toxin of this compound is increased several times compared to the original compound [23]. Nitrous oxide poisoning begins with signs of a mild cold. In the case of nitrous oxide content increases, the flu will get worse, even leading to vomiting and headaches. If the content of nitrous oxide increases significantly, the symptoms of poisoning become more severe and can be life-threatening [24].

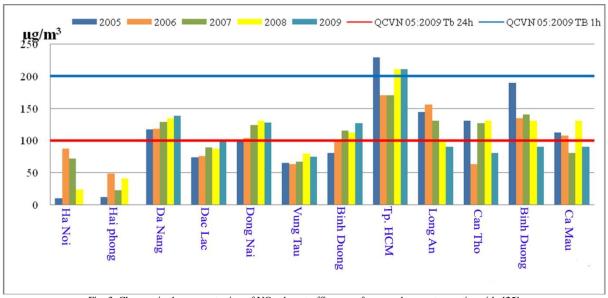


Fig. 3. Changes in the concentration of NO₂ along traffic axes of some urban centers nationwide [25]

Hydrocarbons (CnHn) have a characteristic unpleasant odor and have an anesthetic effect. Low levels of hydrocarbons reduce activity, causing headaches and dizziness. For example, exposure to benzene (C6H6) over a period of 8 hours at a concentration of approximately 600 mg / m3 will cause headaches, flu and discomfort in the throat [16]. In particular, children are the most heavily

affected by air pollution [26]. Children's illnesses related to air pollution tend to increase recently, notably asthma, respiratory infections, tuberculosis, pneumonia, cerebral palsy, cancer and birth defects.

In addition, the average concentration of dust (TSP and PM10) in the air in Vietnamese urban areas is 1.5-3 times higher than the permitted technical standards of the

surrounding air environment, some places. serious pollution is 5-7 times higher than the permitted standard but there is

still no satisfactory solution to improve the situation.

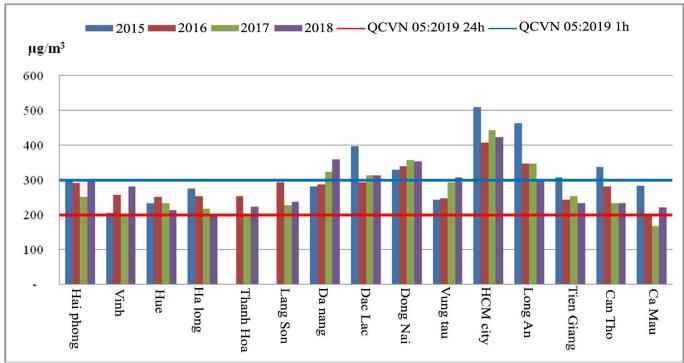


Fig. 4. Evolution of TSP dust concentration in ambient air in residential areas of some urban areas during 2015-2018 [24]

IV. SOLUTIONS TO REDUCE ENVIRONMENTAL POLLUTION FROM VEHICLE EXHAUST

Air pollution is a complicated issue, involving many fields and activities of urban areas: construction, land use, transportation, daily-life activities, industry, energy, ... The control and minimization of urban air pollution must be based on a series of synchronous solutions [18]. In order to limit the air pollution in urban areas caused by transportation activities, the following measures must be taken:

Firstly, strictly implement the provisions of the Ministry of Transport's Circular No. 70/2015 / TT-BGTVT dated November 9, 2015 on inspection of technical safety and environmental protection of transport vehicles. motorized road. For the traffic police force, it is necessary to strengthen the patrol and control of vehicles in and out of the city, especially for the case of drivers of vehicles that are out of date and will use the traffic procedures. collecting vehicles in accordance with the Government's Decree No. 171/2013 / ND-CP. At the same time, the traffic police force should coordinate with the Traffic Inspectorate to strengthen inspection and handling of vehicles transporting construction materials in the city and have strict sanctions on vehicles. violate.

Secondly, public transport in the areas of large cities actually only meets 7-10% of the travel needs of the people. Therefore, it is necessary to focus on the development of bus systems, fast buses (BRT-Bus rapid transit), high-speed trains ... in order to target the proportion of public transport in the total transport volume for the region. The urban area must account for at least 25% in the coming time to contribute to restricting traffic accidents and reducing traffic accidents. The development of public transport and the

restriction of private vehicles by road users must be considered as a core solution to minimize the emissions of vehicles into the environment. Currently, Hanoi and Ho Chi Minh City are implementing urban railway project and BRT system. The goals of these projects are directed to the development of public transport. Therefore, it is necessary to monitor projects on schedule and meet environmental standards when put into operation.

Thirdly, encourage the development of clean energy vehicles such as natural gas, liquefied gas, fuel alcohol, biodiesel and electricity. At the same time, the collection of environmental fees for means of transport should also be considered as a solution to raise people's awareness and responsibility to the environment today.

Fourthly, traffic management needs to be compatible with the environment, there must be a comprehensive monitoring system to monitor traffic situations and environmental conditions existing in the areas of urban areas. Conduct periodic and regular cleaning of traffic environment by spraying water and sweeping roads especially in the dry season [27]. Cars must be sprayed with water and washed before coming into the city and motorized vehicles must be washed when coming out of construction sites in urban centers.

Fifthly, bus terminal areas are crowded with vehicles and passengers, so bus stations must sign a commitment to protect the environment and invest in an air filtration system. Building a system of waiting rooms and roofs to ensure the health of passengers. In addition, it is necessary to increase the area of greenery in wharves and yards to make the environment clean.

In order to reduce the negative impact of transportation activities on the environment, the Ministry of Transport encourages the implementation of programs and projects on improving the efficient use of transport fuels. In particular, the project of eco-vehicle control management system (EMS) was implemented in Hanoi in 2017, with activities including: Improving vehicle control skills and control consciousness Eco media for taxi drivers. At the same time, an EMS vehicle control management system will be installed in taxis to accurately monitor, monitor and evaluate the feasibility and effectiveness of emissions reduction [28]. According to the calculation results, in the case of 1,000 taxis participating in driving EMS, it will increase fuel efficiency by 10%, thereby reducing about 1,000 tons of CO2 per year.

In addition, the Ministry of Transport is also implementing a project to study the conversion of fuel use from diesel to natural compressed air (CNG) for road motor vehicles, firstly buses across the country. Currently, the project has been piloted in Ho Chi Minh City. Ho Chi Minh City, with 50 buses code 01 using CNG fuel, has a long operating route of nearly 9 km Ben Thanh - Cho Lon route. According to the Department of Transportation City. Ho Chi Minh City, the time of testing buses running on CNG shows that the engine runs smoothly, the harmful emissions are reduced by 53-63%, CO2 causes the greenhouse effect by 20%, no dust and black smoke, the fuel is thoroughly burned, especially saving 30-40% of fuel. Expected, by the end of 2017, TP. Ho Chi Minh City will invest 800 buses using CNG.

By 2020, the country will have 5-20% of buses and taxis using compressed natural gas (CNG), liquefied petroleum gas (LPG) and solar energy (according to Decision No. 1456). / QD-MOT on Action Plan to respond to climate change of the Ministry of Transport in the period of 2016-2020), in the coming time, the transport sector needs to implement solutions such as:

Planning to develop transport infrastructure system in the direction of reducing environmental pollution. Accordingly, it is necessary to plan the road network in key areas, especially large cities, to create favorable conditions for road users. At the same time, focusing on integrating GHG emission reduction into planning, plans, investment projects, transport development. In addition, it is necessary to develop mechanisms, policies and encourage the use of energy-efficient transport.

Implementing vehicle emission control program. Strengthening the stations and patrol, control on the road to ensure the motorbike during use is always maintained, repaired and inspected on time for emission standards when participating in road traffic. Vehicles within the scope and subject to regulations but failing to carry out emissions inspection, without certificates will be handled for administrative violations.

Application of intelligent transport technology, green transport technology to reduce GHG emissions in circulation and transport of goods. On the other hand, it is necessary to review and gradually eliminate ineffective, environmentally friendly technologies, facilities and equipment. Piloting and expanding the application of renewable energy, low energy-consuming technologies (solar batteries, LEDs ...) into lighting and traffic signals.

V. CONCLUSION

In general, the most worrying factor in Vietnamese cities is dust, especially fine dust. That fine dust is caused by vehicles. As for other pollution such as SO2, CO, NOx ... it is still approximately the permitted standard. But dust is 3-5 times higher than standard for poker.

This method is true because gasoline has lead when mixed (biofuel) to increase the octane index. However, the current development is not much. And the engine (used) in Vietnam is still the type built for fossil fuels. If you change the carburetor, change the alpha ratio, you can use. However, there are currently no buyers so biofuel production suffers a loss. When used, the durability of the current engine is reduced. Therefore, it is necessary to change the engine accordingly.

Must be made from the root is planning residential areas to increase public transport area up. Need to change your mind, not a motorbike. One method that has long been used to keep the air fresh is to plant trees so that they absorb carbon dioxide and release oxygen for human to breathe. But while vehicles are increasing, the area of greenery is shrinking.

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