Air pollution and Pm 2.5 in Thailand

By TTO

Introduction

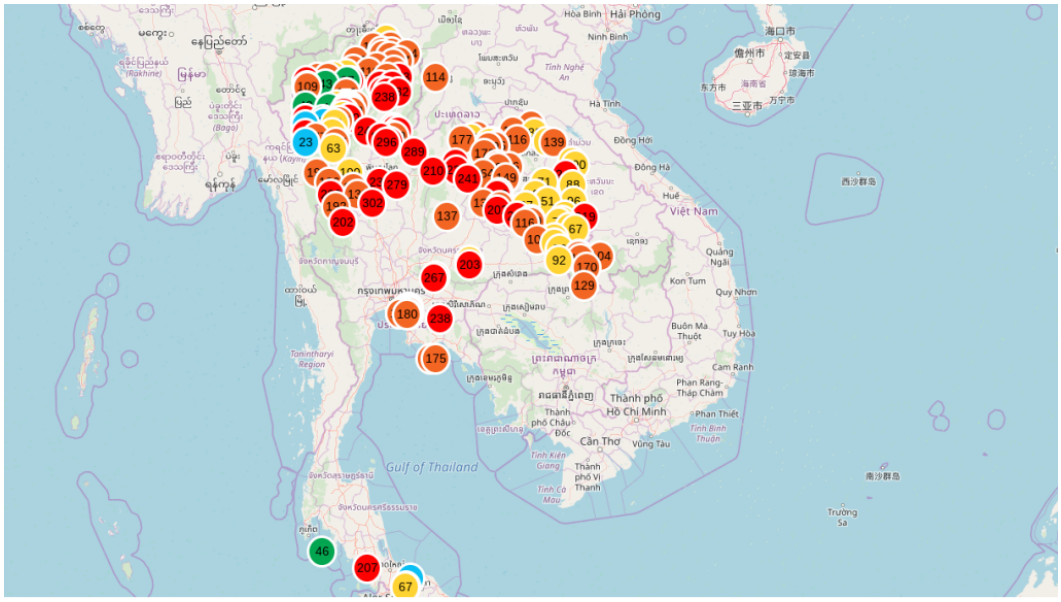
Air pollution is not a new problem for the Thai people. It just so happened that due to the ease of access to information via the internet, the public has become more aware of the causes and effects of PM2.5 and air pollution. The air pollution tends to be seasonal as the numbers surge during winter time. Even though Bangkok and Chiang Mai may have high PM2.5, it is still relatively low compared to its neighboring countries in Asia.

Thailand had an average of 70 US AQI in 2020 and ranked 34 out of 106 countries with the worst air quality in the same year. The PM2.5 concentration was 2.1 times above the WHO annual air quality guideline value. As of writing, Bangkok and Chiang Mai have an AQI of 53, but for 2021, Chiang Mai is ranked 39 among 106 countries.

AQI, Air Quality Index, measures the quality of air by monitoring the levels of four main pollutants: ground level ozone, particle pollution (PM2.5 and PM10), and toxic gases (NO_2, CO_2, and SO_2). PM2.5 is used to measure the particles in the atmosphere that are smaller than 2.5 micron. An AQI of 150 or higher is considered unhealthy. Last year, Chiang Mai reached 190 AQI.

There are four main factors that contribute to the increasing volume of PM2.5 in Thailand. First is the exhaust fumes that come from old vehicles that are still allowed to be used on the road. Secondly, the construction work in major cities add to the pollution as the dust from the materials spreads to the atmosphere. The third factor is crop burning in provinces, and last is the factories and industrial complexes that release their exhaust in the air.

Due to PM2.5, people in Bangkok have been used to wearing masks even before the government required the wearing of masks for the prevention of the spread of COVID-19. Air pollution also had effects on the local economy. The government had halted construction projects in 2019 in order to reduce the emission of fine particulate matter in the atmosphere. Schools were also required to close their operations for a few days to protect the health of the young people.



(Air Quality Index Visual Map)

Challenge

The major concern about PM 2.5 is its ability to travel through the respiratory tract and deep into the lungs, not immediate harm to health but cumulative exposure over time can lead to various health disorders. In the mitrigate step WHO (World Health Organization) has played a major role to intervene in unusual activity in each sector. The start of the PM 2.5 pandemic mostly in each country also has also been mentioned China, in industry sector coal plants were highly mentioned in harming air pollution. The highly negative effect of coal bends all of the country and Thailand also wants to use more renewable energy that does not harm the environment. Technology information that can be utilized to mitigate air pollution is being researched and developed.

The energy sector, WHO is working to increase the amount of energy emitted. Low pollution, enhanced output, and the use of renewable energy such as solar energy, hydropower, and wind energy, as well as fostering the creation of a combined production base, such as generating electricity and heat energy, are all priorities. Thailand aims to limit open-air grilling and to reduce emissions of air pollution from grilling activities creating stores and homes, recommending that an air purifier be installed, not currently governed or regulated. Both government and commercial sector organizations aim to use more solar cells to support the use of less fuel-emitting electricity, and the use of renewable energy to generate power grows

WHO determines strategies to manage transportation networks that use sustainable energy sources or clean power, such as using the train between cities, driving a low-emission car, cycling, or walking. The making of legislation Fuel with a sulfur concentration of no more than 10 ppm is acceptable. Thailand has been pressed to utilize air-conditioned buses powered by natural gas.

Urban planning section suggestions for increasing green space in metropolitan areas, as well as effective control of residential energy consumption systems and quality. Bangkok and surrounding areas, such as Nonthaburi Province, are planning to expand the green area to minimize dust pollution by setting targets to plant trees to create green space and address PM 2.5 dust issues. There are trash reduction, waste separation, and waste disposal recycling guidelines, as well as waste management recommendations. Biological processes, such as waste digestion into biogas and waste incombustibles, employ emission-reducing technologies. Thailand has a standard for controlling pollutant air from crematoriums and setting cremation standards, operating in rules or regulations governing garbage management.

Causes and Effect

The problem of air pollution is growing concern for the general public in Thailand about the negative impact on health conditions arising from agriculture to industrialization because PM2.5 can easily enter the human body through the respiratory increasing cardiovascular, respiratory illness, and lung cancer mortality, including special cases such as chronic obstructive pulmonary disease and pneumonia mortality system and deep into the lungs and bloodstream which can seriously affect human's health. However, PM2.5 is typically caused by human activities. Vehicle emissions in cities, biomass burning and transboundary haze in rural and border areas, and industrial discharges in crowded industrialized zones are three main causes of air pollution. Household activities can even cause the pollution of air, such as smoking, which produces toxic air, nitrogen, and lighting up joss sticks and candles.

All of these activities cause polluted air and considerably affect health. Incomplete fuel combustion and other carbon compounds from vehicles, construction, and industrial processes create carbon monoxide (CO), nitrogen dioxide (NO2), and dust, causing harm to respiratory systems and making people cough and sneeze. Some patients might be affected such as headaches and dizziness and might increase the risk of lung cancer, especially heart disease patients. In the case of inhaling huge amounts of pollution, it could result in death. In addition, dust may cause increased rates of premature death

because of a lot of toxic substances that are found in dust. Moreover, some industrial factories that use combustion of fuel with Sulfur or metal mining which includes Sulfur will create Sulfur dioxide (SO2) that can cause respiratory illness, as well as irritation to the eyes and nasal mucosa. Lead (Pb) is one that can cause kidney disease, and damage directly to the central nervous system. The industrial factories, mining or smelting lead, that require lead for manufacturing such as producing batteries.

Children, the elderly, and pregnant women will be riskier to PM2.5 than adults. Exposure to PM2.5 in a long term might be the important risk factor of increasing cardiovascular, respiratory illness, and lung cancer mortality, including special cases such as chronic obstructive pulmonary disease and pneumonia mortality

Tracking

As usual, many countries have imposed the air quality standards for PM2.5 for the purpose of protecting health impacts from the PM2.5 in short term and long term for instance the United State (US), Canada, United Kingdom(UK), Australia, New Zealand and EU countries. All of these countries have been required to impose the Air Quality Guideline(AQG) in order to manipulate the PM2.5 for 24 hours in a short period and 1 year in a long period by the World Health Organization(WHO). Moreover, they also have to impose the quantity of Interim Target(IT) as three levels using in case of being unapproachable to guideline quantity. By the Interim Targets method, plenty of countries use the method to measure the advancement of solutions continuously.

Accordingly, the method of measuring PM2.5 in the atmosphere can be evaluated by the Gravimetric method which belongs to the US.EPA standard called the Federal Reference Method(FRM). The steps of gathering the sample of air quality can be separated into two processes.

First, by collecting air quantity by air sampler, this kind of method will absorb the atmosphere through the inlet, which is a way that air flows into. After that, the air absorbed will be sorted out by impactor. The dust that has no bigger size than 2.5 micron will be screened so as to gather on a filter paper named polytetrafluoroethylene(PTFE) all the sampling time.

Second, each filter paper, collected from the dust from the atmosphere, will be weighted since before and after taking a sample such that we can observe the actual weight of PM2.5, and the amount of air capacity from the sample will be calculated by measuring instrument. The PM2.5 concentration in the atmosphere can be computed with total PM2.5 weight divided by air capacity as a result in micrograms per cubic meter.

Currently, In the sense of Thailand, we use the air quality index(AQI) as an indicator to easily determine how Thai's air quality is. The data from the Air4Thai website shows satisfactory details that most parts of Thailand contain average air quality index's range around 0-25, Certain parts, on the other hand, have a high API range up until 50 API, which means there is good enough air quality to do outdoor activities and travel. Additionally, A few provinces normally stated around the capital area contain the highest number of API above 50 or around 50-100. The people living in these areas with respiratory disease have been warned to get outside for a long time.

Policy

As we can see that Thailand government try to solve the problem of the pm 2.5 and air pollution for the long time before we conclude that policy recommend, we see that even though Thailand have the law about air pollution, but we can see that Thailand is one of the top AQI (Air Quality Index).

We see that the policy that launched when the PM 2.5 crisis happened was not efficient, for example spraying water to reduce is not the efficient way to reduce so we can see that the problem is deep in the infrastructure. How are we going to solve the air pollution and Pm 2.5?

A major contributor to air pollution in Thailand is forest fires and opening burning of crop residue both are human activities, the government has made the national master plan which be agreed in 2003, target of this plan is not burning no more that ha/year of the forest area by 2030 and imposed the policy to northern Thailand during 20 February to 17 April. The other contributors are transportation and manufacturing. For the suggestion we will start with the manufacturing.

For the manufacturing that seek to reduce the emission for the less pollutant we can use cost effective pollution control policies this policy can simply on controlling the total amount of emission that minimize the cost control so we can use Emission charge is a fee, levies on each unit of pollutant emitted into air since it has a fee that will affect in firm cost which will increase it by multiplying the fee to the amount that firm emitted the pollutant and other policy that have the similar purpose is CAC (Command-and-control) policy which established to set legal ceiling on the allowable concentration of the pollutant in the outside. To reduce the emission, the social cost of carbon (SCC) is added as a cost item for projects that induce carbon emissions, and the benefit is reduced in carbon emission.

Next is for the transportation segment so the policy that already have is the give the mask or promote people to use the public transportation but that was not the root cause for the policy that we going to suggest first is the replacement of fuel from Euro 4 to Euro 5 this is for the short-term, so we can impose the policy that will affect in the long-term is increase electric vehicle until Thailand can replacement all of the normal vehicle we can the example from USA that Colorado give 3000 dollar credit for the person that purchase electric vehicle and USA have goal that 50 percent of the car that purchase will be electric car, we can impose the policy for Thailand and we can use USA as an example we can impose tax reduction or tax refund for the person that use electric vehicle we can use WTP to what is will to pay for the vehicle to charge to Electric vehicles but this policy is for the long-term which we can see from Thailand economic and society this policy might not be done in nearly we can set the policy to achieve by 2060.

We can develop the infrastructure and we can use the land allocation to manage the we can use the bid rent function to achieve most efficient since most transportation is in the city so that we can develop the infrastructure that can reduce the transportation by vehicle and people can walk to work or have leisure time in the walk distance and create a lane for the non-engine vehicle which can be one gimmick that attract tourist to come to visit wish can help in economy and reduce the pollutant in Thailand.

For the biomass which is forest fire and open field crop burning which happen from humans, we can put the punishment that is hard enough to punish and make people that break get a sentence and as the first paragraph for the policy said the policy that could be used.

The government can launch policies to help reduce the air pollution but the problem will also need the individual to be encouraged and alert in the problem that we face with it.

Reference

-Kundhikanjana, W. (2019, March 17). *Identifying the sources of winter air pollution in Bangkok part I*. Medium. Retrieved November 11, 2021, from https://towardsdatascience.com/identifying-the-sources-of-winter-air-pollution-in-bangkok-part-i-d4392ea608dc

-Nanuam, W. (2019, January 17). *Construction halted to curb toxic smog*. https://www.bangkokpost.com. Retrieved November 11, 2021, from https://www.bangkokpost.com/thailand/general/1612318/construction-halted-to-curb-toxic-smog

-Kristy Hartman and Laura Shields, 2021. State Policies Promoting Hybrid and Electric Vehicles. https://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspx

-Jaee Nikam, Diane Archer , Chirat Nopsert, 2021. Regulating air quality in Thailand- a review of policies. https://cdn.sei.org/wp-content/uploads/2021/03/regulating-air-quality-in-thailand-a-review-of-policies--sei-policy-brief.pdf

-Daiju Narita, Nguyen Thi Kim Oanh , Keiichi Sato , Mingqun Huo , Didin Agustian Permadi, Nguyen Nhat Ha Chi ,Tanatat Ratanajaratroj and Ittipol Pawarmart, 2019. Pollution Characteristics and Policy Actions on Fine Particulate Matter in a Growing Asian Economy: The Case of Bangkok Metropolitan Region.

-Air4thai.pcd.go.th. 2021. *Air4Thai*. [online] Available at: <http://air4thai.pcd.go.th/webV2/> [Accessed 10 November 2021].

-Infofile.pcd.go.th. 2021. [online] Available at: <http://infofile.pcd.go.th/air/PM2.5_040309.pdf> [Accessed 10 November 2021].

-The Study on Thailand's Particulate Matter 2.5 (PM 2.5) Management in Accordance with The World Health Organization (WHO) Guidelines. (2020). *Vajira Medical Journal*, *64*. doi: 10.14456/vmj.2020.34

-*Impact of PM2.5 on the elderly | Bangkok Hospital*. Bangkokhospital.com. (2021). Retrieved 10 November 2021, from https://www.bangkokhospital.com/en/content/pm2-5-dust-and-the-elderly.

-*Thailand PM2.5 Crisis – Interrisk Asia*. Interriskthai.co.th. (2021). Retrieved 10 November 2021, from https://www.interriskthai.co.th/thailand-pm2-5-crisis/.

-*PM 2.5 Exposure and Health Management Measures for the Thai Population - Mahidol Engineering*. Eg.mahidol.ac.th. (2021). Retrieved 10 November 2021, from https://www.eg.mahidol.ac.th/egmu_eng/news-events/events/218-pm-2-5-exposure-and-health-management-measures-for-the-thai-pop%20pulation.