

Greenhouse Gas (GHG) Emissions Reduction Targets in Asian Cities

Royce Oh¹, Kevin Chung², Minkyung Kim³

¹ Amador Valley High School, USA

² Korea International School, Korea

³ ESF Discovery College, Hong Kong

Abstract

The impacts of climate change have been apparent worldwide, and Asian cities have experienced climate extremes never seen. Asia is most influenced by climate change, with intense heat waves and cyclones affecting millions. In particular, South Asia is expected to be the most affected region, but they also have the least infrastructure or plans implemented. Little is known about how cities in the region set climate mitigation targets and align with the global temperature goal of 1.5°C under the 2015 Paris climate treaty. This study explores the cities' greenhouse gas reduction targets in Asia. In the end, we rely on the 2021 ICLEI-CDP data for cities' emissions targets and carbon mitigation plans. Our major findings suggest that only a quarter of the cities have disclosed the temperature goal. Among them, 54% of the cities have a temperature goal of 1.5°C, 25% have a 2°C goal, and 15% of the cities answered their unawareness of the temperature goals. We also find that 46% of the cities in South Asia did not disclose their temperature goals, and in East Asia, most cities (76%) did not disclose their goals. In both regions, the 1.5 °C goal was chosen by most of the cities. Without mitigation, the climate crisis in the region is likely to exacerbate climate-induced impacts, limiting regional stability and sustainable growth.

Keywords

Climate Change, Asia, Paris Climate Deal, 1.5-degree Celsius Temperature Goal, Greenhouse Gas (GHG) emissions reduction

INTRODUCTION

Cities account for more than 50% of the global population, around 70 % of global energy consumption, and more than 70% of the world's carbon dioxide (CO₂) emissions from energy consumption originate from cities (IPCC, 2014; IEA, 2021). Due to high carbon intensity, some cities have decided to play a critical role in delivering national pledges and advancing CO₂ reductions under the Paris Climate Agreement. However, their current impacts are mostly unknown, and there is a lack of information about how cities are committed to climate mitigation, particularly in some regions like Asia where climate vulnerability is high (Allen et al., 2018).

In these regions, a lack of information could prove to be very dangerous. Recently in Bangladesh, large and persistent floods affected 7.2 million people, and displaced about 4 million (IFRC, 2022). Prolonged monsoon seasons caused numerous rivers in Bangladesh to flood. These monsoon seasons have been proven to be caused by climate change. According to a study, in the future, rain patterns during the monsoon season in the region are going to increase in severity, which would cause flooding and destroy crops (Katzenburger, 2021). As climate change continues to grow, these monsoon seasons would grow more erratic and destructive. This is why it is imperative that cities create plans that both adapt to these climate events and attempt to avoid physical climate impacts and economic losses.

In this study, we explore the cities' greenhouse gas reduction targets in Asia. We specifically look at climate temperature goals in South Asia and East Asia and consider whether they are aligned with the Paris climate goal or not. We further analyze different factors and correlations that these climate temperature goals have in order to understand the planning process and how the cities choose their goals. Finally, we looked at 9 different cities that all adopted climate action plans and analyzed the similarities.

BACKGROUND

(1) Impacts of Climate Change in Asia

If climate change continues to grow, Asia would become the most affected region in the world, experiencing heat waves, floods, droughts and typhoons. Rising sea levels would affect Asia's large coastal cities, and could even submerge some (Kugleman, 2021). Droughts would shorten the already scarce water supply and can lead to migration to other regions due to this lack of resources.

The first major effect would be change in the environment. Asia has cities with very high population densities around the coast. Rising sea levels and typhoons would flood these large cities, and coastal erosion could affect wildlife and fishing along these coasts. South and East Asia both rely on fish for nutrition and jobs, and a loss of this industry would devastate both the region's economies and food security. Climate change events, such as a drought, would also reduce the amount of water resources available to countries. Some countries rely on one main water source and if this dries up it could result in countries fighting for resources. It is also highly possible for other climate disasters to cause people to migrate away. In fact, predictions say nearly 62 million people will be displaced by 2050 because of climate events (Wazir, 2022).

The adverse health effects caused by climate change are also prominent. Air pollution is projected in 2022 to cause 450,000 people to die because of outdoor and household air pollution in Southeast Asia (Teng, 2022). Moreover, numerous diseases can arise from climate change. For instance, malnutrition, malaria, diarrhea, heat strokes, and heart attacks all grow in occurrence when climate change becomes more severe. For example, in Mumbai, long heat waves cause millions to be at risk of heat related diseases, and even proved deadly for some (Frayer, 2022). Rising temperatures also give ticks and mosquitos more time to reproduce, which can spread diseases much easier. Warmer and more humid temperatures can cause fungi and algal blooms which can infect crops and water supply (U.S. Department of Health and Human Services, 2022)

Lastly, South Asia also has weak infrastructure to deal with climate events and would likely fail to provide the necessary means to help South Asians. Limited financial support for climate change also restricts the amount of climate action plans or resources available, which will include both mitigation and adaptation. In fact, South Asia received almost three times as much global funding to support climate mitigation projects compared to climate adaptation projects (Teng, 2022). More climate mitigation projects would allow for the country to reduce their own GHG emissions quicker. However, in the event of an actual climate-induced disaster, if there is less focus on adaptation projects, the inhabitants are at risk. These inhabitants would be more vulnerable to the disaster as there would not be a well-funded reaction plan.

South and East Asia in the future will undergo climate change events and will be heavily affected. They also do not have a clear or efficient way to deal with these events. It is essential that governments mitigate and adapt to their changing environment to lessen these impacts that are being inflicted on this region. By making efficient and good plans available that countries can then learn and plan from, climate mitigation will only get easier.

(2) Paris Climate Agreement

The Paris Agreement is a global treaty to address climate change. The goal is to limit global warming below 2°C, even further to 1.5°C. These temperature goals are the minimum allowable temperature increase to prevent the worst climate change scenarios. Indeed, many cities and countries have signed up for the 1.5°C temperature goal, which is stricter than the 2°C temperature goal. Even though they are setting these goals up and contributing to the global society to work together, it is known that the actions taking place are not enough to achieve the goal (Climate ActionTracker, 2022). For instance, each country can set its own greenhouse gas reduction targets. However, even if all countries participating in the Paris Agreement achieve their national targets, greenhouse gas emission in 2030 will be only 1% lower than today, and by the end of this century, the temperature will rise by 2.6°C (UN, 2022).

Asia is the world's largest GHG emitter, accounting for 53% of global emissions. China accounted for 27% of the global greenhouse gas emission in 2021. However, 60% of the world's population are living in Asia, and per capita emissions in Asia are not as high as other regions or countries (World Bank, 2022). Also, Asian countries are contributing to GHG emissions reductions, by setting the net zero emission goal and developing new technologies that have higher energy efficiency. China has especially announced that coal-fired power plants will not be built anymore.

Countries in Asia are highly affected and vulnerable to climate change, such as Bangladesh and Afghanistan or any other country in South Asia. According to the World Bank's Country Climate and Development Reports (CCDRs) including cities in Pakistan, Bangladesh, and Nepal, these countries have found and are finding many solutions to minimize climate change. These solutions include innovative community approaches to coastal resilience, scaling up renewable energy, and regenerative forestry.

Currently, the Paris Climate Goal is not quite achieving the goal set. The reports from 2022 show that the current level of greenhouse gas emission and usage will increase the temperature by 3°C by the end of the century. Because both MEDCs (more economically developed countries) and LEDCs (less economically developed countries) are using greenhouse gas to grow their economy, it seems like it is nearly impossible for every country to lower their greenhouse gas emission level to where it would slow global warming and limit the temperature increase by a maximum of 2°C.

METHODS

In this study, we relied on data for cities from the 2021 Cities Emissions Reduction data collected by Carbon Disclosure Project. The data included 1032 cities, and we used the dataset and relied on frequency distribution to learn about the characteristics of cities with emissions targets. The questionnaire included if a city set emissions targets and if the target aligns with the global 1.5-2°C pathway set out in the Paris Agreement.

Also, city governments were asked if the target is aligned to a requirement for a higher level of government. To determine if cities with carbon emissions target, we put the country's development status, being guided by the World Bank's Country Classifications by Income Level (World Bank, 2022). Lastly, we counted frequencies of cities by population size to determine if city resources create variances in cities' adoption rate of emissions target.

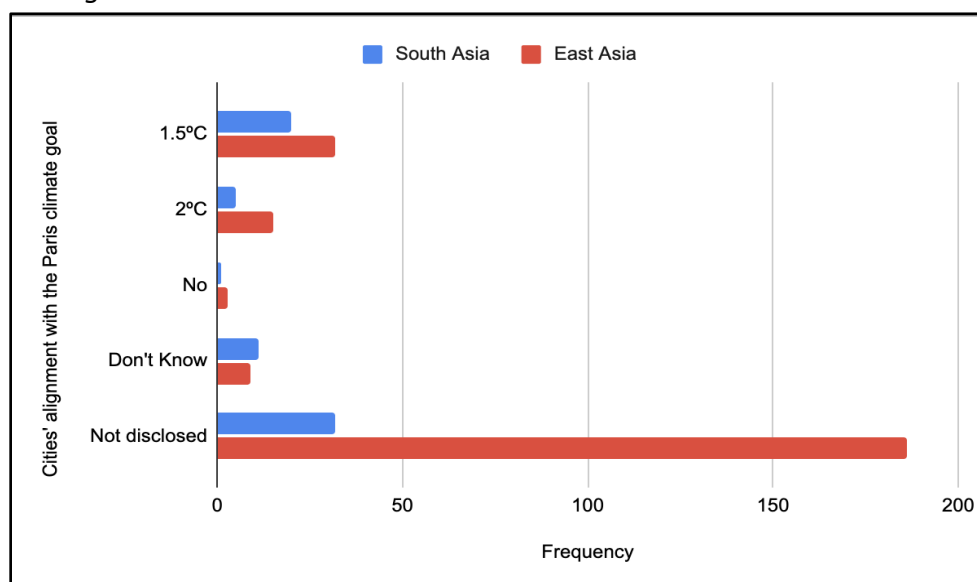
RESULTS

(1) Cities' GHG Emissions targets Alignment with the Paris Climate Goal

We find that 54% of the cities have the temperature goal of 1.5 °C, 25% of the cities have the 2°C goal, and 15% of the cities answered their unawareness of the temperature goals. We also find that in South Asia, 46% of the cities did not disclose their temperature goals, and in East Asia, most cities (76%) also did not disclose their goals.

Figure 1.

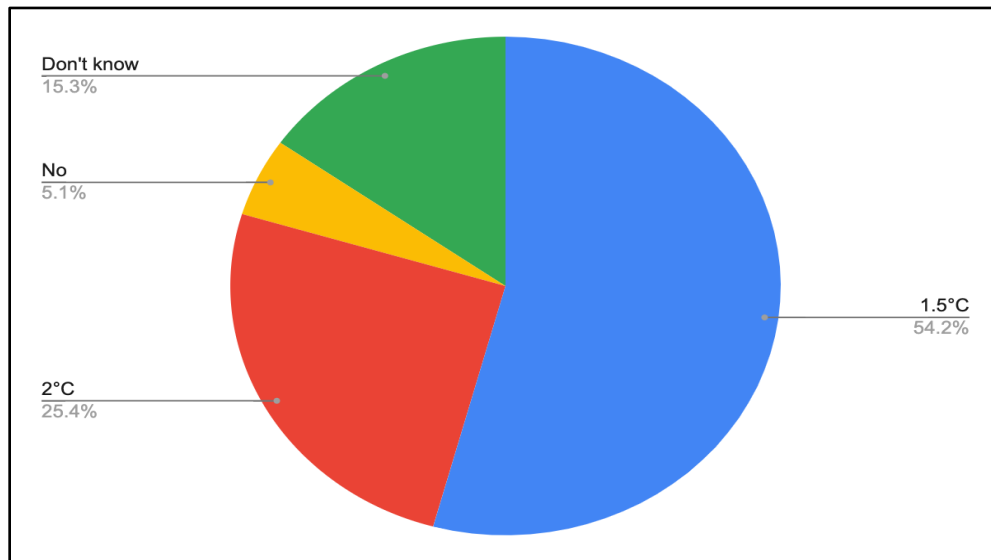
(a) Cities Alignment with the Paris Climate Goal in South and East Asia



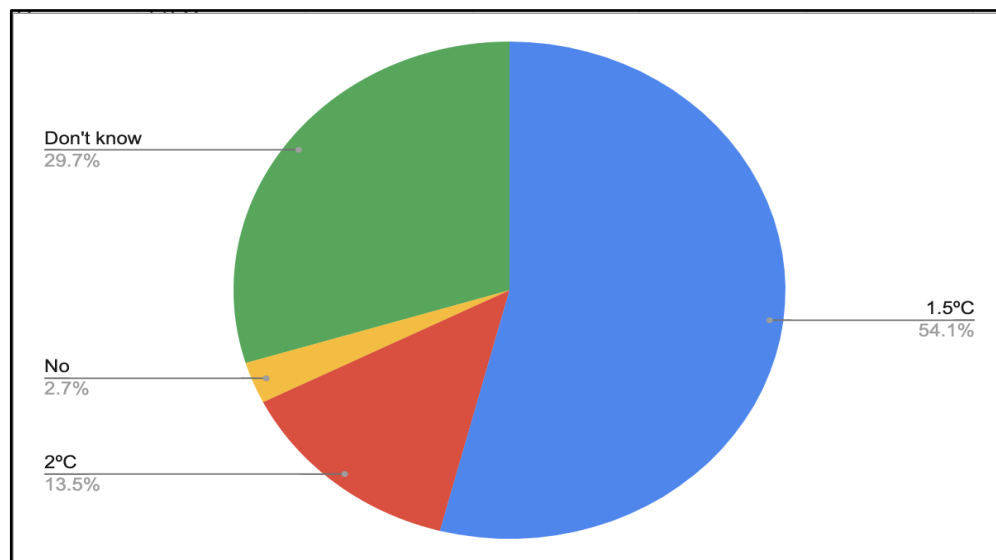
In both south and East Asia, 1.5 °C was the most chosen, with both out of all the cities that responded at 54%. However, in East Asia, there is a greater percentage of cities that have a climate goal with a combined 80% compared to the 67% in South Asia. No climate goal still is the least abundant response (Figure 2).

Figure 2.

(a) Cities with temperature goals in East Asia



(b) Cities with temperature goal in South Asia



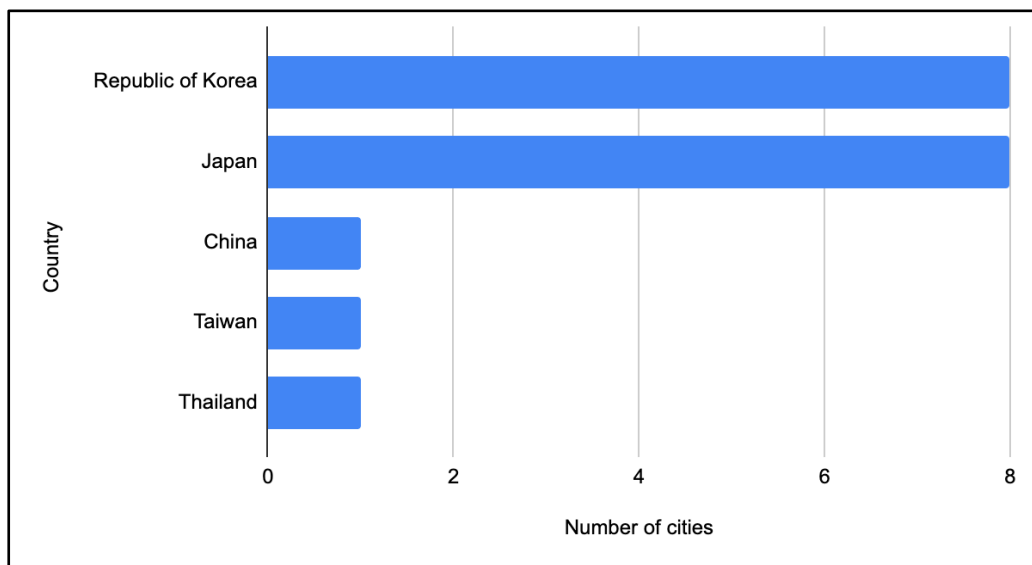
(2) Cities in East Asia with 1.5-degree temperature goal by country

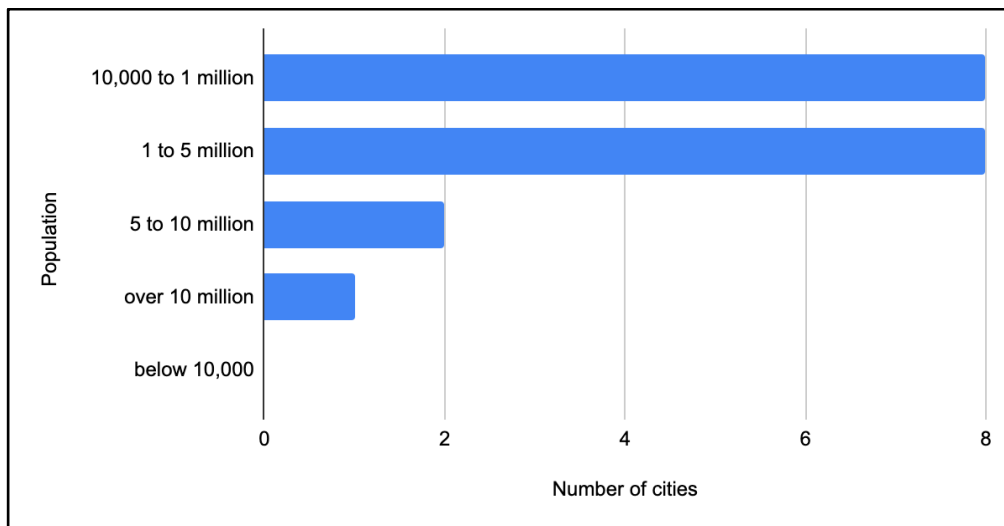
Korea and Japan had the most cities with the 1.5°C temperature goal with each 9 and 7 cities involved. Meanwhile, there was only 1 city for the rest of the countries from the data that employed the 1.5°C temperature goal. Interestingly, most of the cities out of 245 cities on the list are in Japan, however only 8 of them have disclosed their temperature goal or have specific goal. As it is shown in (Figure 3), both Korea and Japan have only 8 cities that disclosed their goals.

Figure 3 (a) and (b) shows the cities with a 1.5°C temperature goal by their population size. The result shows that most of the cities with this temperature goal have a population size between 100,000 to 5 million. 8 cities have a population between 100,000 to 1 million as well as 1 million to 5 million. Only 3 cities have a population of more than 5 million, and none had fewer than 10,000.

Figure 3.

(a) Cities with 1.5-degree temperature goal by country in East Asia



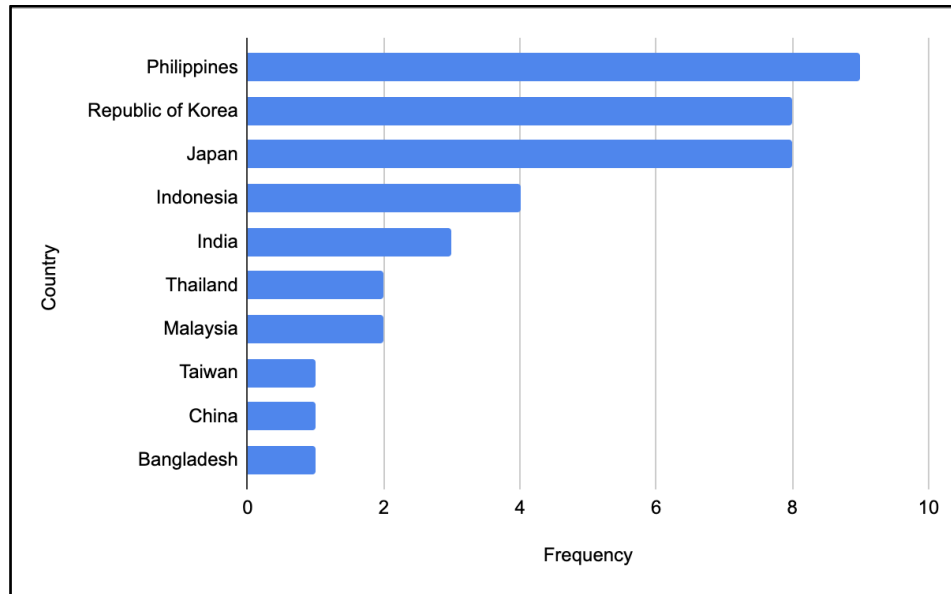
(b) Cities with 1.5-degree temperature goal by population size in East Asia**(3) Cities with 1.5-degree temperature goal by country in South Asia and East Asia**

We found that the Philippines, Japan, and Korea had the most cities with the 1.5°C temperature goal in South and East Asia with 7, 6, and 5 respectively. Taiwan, Greater China and Malaysia only had 1 and 2, respectively. However, it is surprising to see that Taiwan, Greater China and India make up relatively small amounts of 1.5°C goals out of all the countries even though these cities would hold the most impact on GHG emissions because of their large population (Figure 4).

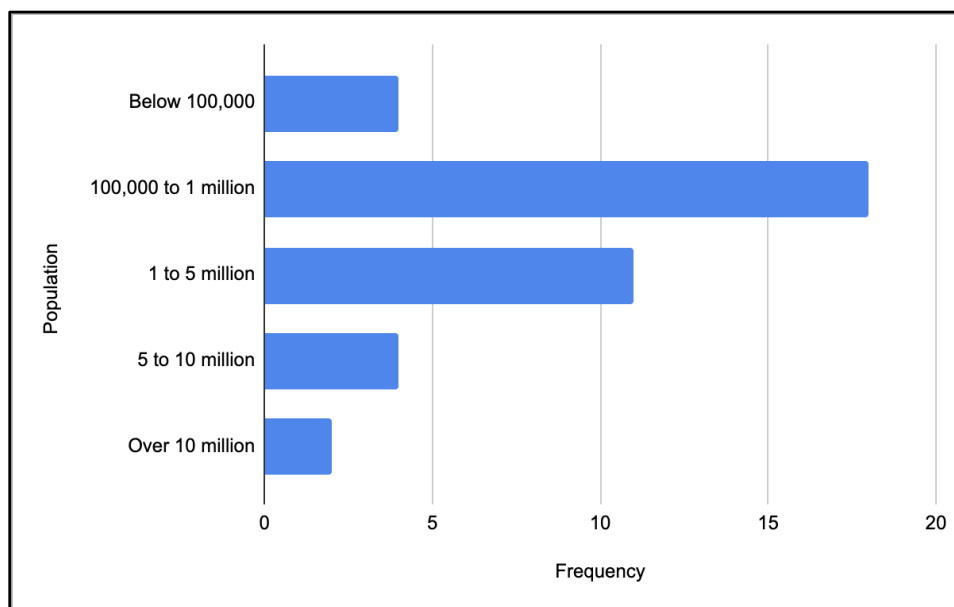
In Figure 4(b), most of the cities in South and East Asia had 1.5°C temperature goals with populations between 100,000 to 1 million at 21. However, cities with populations over 10 million had the least number of cities at 4. This graph follows the trend stated above, where the most populous places seem to have the least amount of 1.5°C goals. The trend in smaller cities having more temperature goals may be dependent on how easy it is to stop carbon emissions, the bigger the city is the harder it is to initiate a city-wide climate change policy.

Figure 4.

(a) Cities with 1.5°C temperature goal by country in East and South Asia



(b) Cities with 1.5°C degree temperature goal by population size in East and South Asia



DISCUSSION

The direct correlation between the current population and the frequency to employ 1.5 °C temperature goals is valid from Figure 4. These trends can be explained by how a higher population will have more on-going pollution, requiring an extensive method to compensate for that pollution. Second, both East Asian and South Asian countries more likely to employ a 1.5 °C temperature goal than a 2 °C temperature goal.

From Figure 2, it is clear that South Asia and East Asia have a huge difference in disclosing 2°C temperature goals. 25.4% of the East Asian countries disclose the 2°C temperature goal while 13.5% of South Asian nations disclose the 2°C temperature goal. The difference in this disclosure indicates that East Asia has a strong economic background while South Asia chooses economic growth before any climate mitigation goals. Usually, MEDCs (More Economically Developed Countries) are located in East Asia while LEDCs (Less Economically Developed Countries) are located in South Asia. Since more MEDCs are located in East Asia, the government in this region will rather choose to bring environmental solutions to integrate in each industry.

From Figure 2, East Asian cities had a handful of cities that did not disclose the alignment of the Paris Climate Agreement. To examine the specific data that was used to create the graph, Japan was the only and main country that did not disclose any of the results. There is one main explanation that could answer this phenomenon: how this Paris Climate Agreement was unnecessary for Japanese cities as a choice for environmental regulations. From the given data, most of the cities from Japan are known to be conscious of GHG emission problems. However, most cities in Japan are not aiming to directly reduce GHG emissions but indirectly solve the emission problem with a different energy resource that could be practical to help emissions. In fact, Japan's Prime Minister Suga declared Japan's realization of carbon-neutral by using the Current 2030 Strategic Energy Plan, which is to increase the portion of nuclear power use. According to their logic, Japan will use more nuclear power and less energy power that creates GHG emissions. By replacing these traditional energy resources, Japan seeks to indirectly reduce the GHG emissions.

CONCLUDING THOUGHTS

East Asian countries had over 150 times when they did not disclose their climate mitigation goal. 54.2% of the East Asian countries employed a 1.5°C goal and 25.4% of the nations used a 2°C goal. In Southeast Asian countries, about 54.1% of nations employed a 1.5°C goal and

13.5% used a 2°C temperature goal. From Figure 3, the Republic of Korea and Japan had the greatest number of cities, 8 cities, that employed a 1.5 °C temperature goal in East Asia. In East Asia, cities with a population of 10,000 to 1 million and 1 to 5 million frequently used the 1.5°C temperature goal out of all East Asian countries. Lastly, from Figure 4, there were two graphs: One, relationship between Cities with 1.5°C temperature goal by country in East and South Asia; and two, cities with 1.5°C degree temperature goal by population size in East and South Asia. From Figure 4(a) Philippines had the greatest number of cities that employed the 1.5°C temperature, and from Figure 4(b), cities with the population of 100,000 to 1 million had the most frequent utilization of the 1.5 °C temperature goal.

There are several ways cities could improve their climate mitigation efforts. As the first solution, cities can build global databases of climate mitigation goals. This would be possible by requesting nations for annual reports on the level of GHG emissions. One way to incentivize nations to post their annual reports is by giving suggestions for climate mitigation plans from expertise around the world or deploying expertise to Southeast Asia so that they can contribute to helping countries in this region to develop a better way to reach the target goal. In short, this solution will not only help nations in Southeast Asia with climate mitigation goals but also it will help all nations to fully disclose their GHG emissions data and target goals.

Another solution is improving environmental management and sustainable natural resources on a national scale. This is a good way that it is easy to approach and does not need much technology compared to some other solutions. Many countries in South Asia have already introduced this way and are working on recovering their rainforest and other resources. Some other projects related to this solution are upgrading the country's water infrastructure and developing clean mechanism-eligible renewable energy in order to secure their forestry. These steps involve the country's government and fundings and it does not require much technology, resources, and money to achieve its goal.

As a third approach, cities would develop climate mitigation plans reviewed and planned before they are implemented. The more inputs or data is being considered in one plan, the more likely that the plan will be effective; more professionals can provide their own idea for an effective climate mitigation plan. Furthermore, having multiple opinions from different sectors of the country can also be beneficial. Climate change could affect a lot more than the environment, it can affect the economy, public health, and social conditions. Thus, having a plan that takes all these views into account then develops a plan could improve the functionality and the universality of a plan.

Lastly, one approach can be to develop a way to change and protect the plan. For example, the Asian Development Bank (ADB) in their Governance and Anti-Corruption Action Plan regularly monitored the plans and had a way to implement them with financial resources. These measures were made to make sure the plan was being implemented smoothly and can be subject to change if something is wrong. This plan also shields the misuse of resources provided by the ADB as substantial financial resources are invested. Simply having a good climate mitigation plan will not solve all the problems. Ensuring that a climate mitigation goal has strong backing or support, and having a strong institution or government that looks over the plan will help create a mechanism that keeps cities' climate plans up to their maximum capabilities.

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Publication Date:

The report is published on 6-2-2023.

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