

An approach to develop city waste management strategy in developing countries: A case study of Negombo City in Sri Lanka

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Keywords: Waste Management Strategy, Municipal Solid Waste (MSW), Life Cycle Assessment (LCA), Sustainable Development Goals (SDGs) and Negombo City, Sri Lanka

INTRODUCTION

Proper Municipal Solid Waste (MSW) management is a global issue and mismanagement of it has a severe impact on the environment, society, and economy. Despite knowing the challenges in the MSW, cities are unable to address the waste management problem in a more integrated approach due to a lack of proper waste management strategy. Hence, it is vital for each city to develop a proper waste management strategy to address the challenges in MSW and also manage the MSW in a more resource-efficient manner. This paper aims to provide a step-wise guideline on the development of the city strategy as a case study of Negombo City and also quantify the potential impact of waste management of Negombo City on the environment under Business as Usual (BAU) and also under the application of activities in line with the Negombo City strategy. Four scenarios are developed and Life Cycle Assessment (LCA) tool is used to evaluate the potential environmental impacts from each scenario. In addition, the paper also investigates the linkage between the MSW and Sustainable Development Goals (SDGs) and highlights the contribution of MSW to SDGs.

In overall, the paper highlights the importance of waste management strategy and delivers the guidance to the researchers, implementers, and policymakers in designing an efficient and robust waste management strategy toward achieving SDGs and global climate goals.

MATERIALS AND METHODS

Based on the waste management status report for Negombo, Negombo City Strategy report and experience working with the Negombo city and relevant stakeholders in formulation of city strategy for Negombo, a step-wise guidance for development of city waste management strategy in developing country was developed (Karunarathana et al., 2019). Further, Life Cycle Assessment (LCA) was used to estimate the potential climate impacts on environment from the waste sector. The Estimations of potential climate impact were achieved using an Emission Quantification Tool (EQT) developed by the Institute for Global Environmental Strategies (IGES) (IGES, 2018). The linkage between different SDGs goals and Negombo City Strategy goals were analyzed and discussed.

RESULTS AND DISCUSSION

Figure 1 shows the major steps adopted during the strategy formulation process. It is vital to get the city officials on the board for this process, especially the heads of the city i.e. Mayor, Commissioner etc. Once we get them on the board, orientation and core team formulation in consultation with the city is another essential steps among all the steps in the strategy formulation process. Orientation with the city officials is significant step as it helps to understand about the city, identify all the stakeholders and potential members for core team formulation. Likewise, core team formulation is equally important for the strategy formulation process, therefore, selection of core team members especially the local partners and experts must be properly conducted considering their capacity for expected roles and responsibilities during the strategy formulation process. Similarly, Figure 2 illustrates the nexus between six goals under the Negombo Strategy and the SDGs which highlights that the goals if properly implemented can contribute to the several SDGs out of which SDGs 1,3,7, 11 are the ones where Sri Lanka is facing challenges in implementation. In addition, Figure 3 presents the potential GHG and Black Carbon (BC) emissions from each tonne of generated waste in current (BAU) scenario and also in future scenarios (Scenario I, II, and III) where city applies the actions under the strategy for their short-term, mid-term and long-term timeframe respectively. The total potential climate impact for per tonne of generated waste in the city under BAU, Scenario I, Scenario II and Scenario III are 1087.79 kg

CO₂eq/tonne, 645.35 kg CO₂eq/tonne, 380.14 kg CO₂eq/tonne and -83.04 kg CO₂eq/tonne respectively. It illustrates the vast reduction of climate impact from per tonne of generated waste from BAU to Scenario III where the potential emission value is negative for Scenario III due to resource and energy savings through recycling and resource recovery. Likewise, Figure 4, shows the potential climate impact of GHG and BC emissions from the total waste generated in the Negombo City under BAU, Scenario I, Scenario II, and Scenario III as 62732.85 tonne CO₂-eq/tonne, 37217.33 tonne CO₂-eq/tonne, 21922.67 tonneCO₂-eq/tonne and -4788.92 tonneCO₂-eq/tonne respectively.

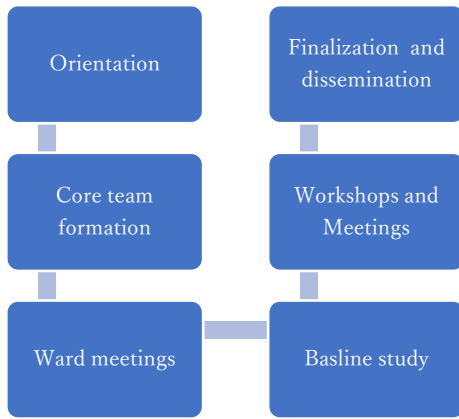


Figure 1: Major steps for waste management strategy formulation of Negombo City

| Goals | SDGs |
|---|-------------------|
| 1. Improving collection of all types of waste to keep the environment clean and green as well as improve the state of public health | 3, 11, 13, 15 |
| 2. Ensure all types of solid wastes generated are disposed of in environmentally sound, economically viable and socially acceptable manner to protect environment and reduce climate change impacts | 8, 11, 13, 15 |
| 3. Maximising the resource recovery of waste generated while promoting 3R (reduce, reuse and recycling) principles across the city | 1, 7, 11, 12, 13 |
| 4. Ensure citizen engagement for waste prevention and effective solid waste management through public outreach programmes and creating opportunities for engagement | 1, 10, 11, 12, 13 |
| 5. Enhance the financial sustainability of the NMC to manage solid waste effectively | 1, 8, 10, 11 |
| 6. Improve organizational capacity with appropriate regulations for managing solid waste in NMC | 10, 9 |

Figure 2: Negombo Strategy Goals and its linkage with SDGs

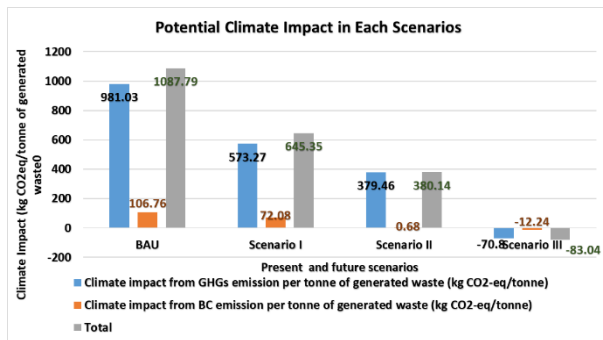


Figure 3: Potential Climate Impact for per tonne of generated waste in Negombo City

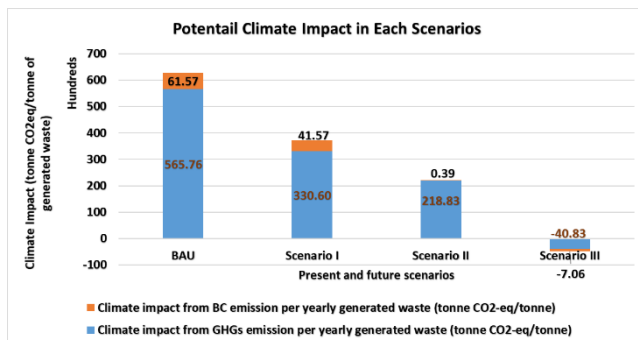


Figure 4: Potential Climate Impact for total waste generated in the Negombo City

CONCLUSION

The results highlight that promoting resource recovery from the generated waste and improving the final disposal site would assist Negombo City in improving its waste management as well as mitigating climate impact from the waste sector and it also contributes to the SDG goals. The city could reduce its GHG by 107% and BC by 111% from total waste generated in the city (due to resource and energy savings) from BAU Scenario, if the conditions in Scenario III is implemented, in which waste collection, resource recovery and final disposal are improved with introduction of Anaerobic Digestion(AD) for treatment and recovery of organic waste. Similarly, the waste management laid out in Scenario III would help the city to gain other co-benefits such as improved health of its citizens and also generation of income through recovery of materials from the generated waste stream.

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