

**UNIVERSITI TEKNOLOGI MARA**

**AN URBAN MATERIAL FLOW  
ANALYSIS AND CARBON  
FOOTPRINT ASSESSMENT OF  
MELAKA STATE**

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## ABSTRACT

Cities are growing at an unprecedented rate, and it will cause several environmental impacts. Relationships between social and ecological systems, cities and their hinterlands, sustainability of resource usage, and social lifestyle in densely populated urban regions are a central focus of this study and field. Thus, material flow analysis (MFA) was used to quantify the material exchanges between the socioeconomic system of a city and its natural surroundings. The study illustrates the material flow of domestic consumption (food, electricity, and water) to depict the input and output of materials in the city of Melaka. MFA improves the understanding of economic systems by pointing to source reduction and the substitution or recycling potential of substances, energy, and materials. Carbon dioxide is the primary greenhouse gas that shows how the climate is changing around the world. Cities are the main part of the carbon emission because of the urbanisation of the city. Thus, the carbon footprint of Melaka is calculated. The study found that the input and output from the MFA is not in the equilibrium state. The output value of food and electricity consumption is larger than its input. Meanwhile, the output value of water consumption is slightly smaller than its input. This was due to eating lifestyles and the high use of electronic devices. The total carbon footprint of Melaka State from electricity and water consumption in 2019 was 28.8 million tCO<sub>2</sub>e. By understanding the profile of carbon emissions, it helps in developing strategies for further enhancement of the economic value. The findings in this study show that Melaka citizen needs to practice a low carbon lifestyle to minimise the impact of climate change. This will protect Melaka's cultural and natural heritage and transform it into a region that is socially and economically stable, attractive to live and work in, and physically resilient to environmental change.

*Keywords: Urban metabolism, greenhouse gas, urbanisation.*

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Urbanization is a dynamic system that adapts to growth and advancement. Cities consequently continue to grow and expand. Melaka State, located roughly halfway between Kuala Lumpur and Singapore, has a special place in the worldwide dialogue concerning the sustainability of our shared urban future. The Strait of Malacca, one of the bustling maritime lanes in the world and a connection between China and India, is strategically located in the historic urban centre of Melaka, a UNESCO World Heritage Site (WHS). With its 2016 affiliation in the Global Platform for Sustainable Cities (GPSC), Melaka had made considerable strides toward a more sustainable urban growth trajectory (Mohammad, 2020). In order to help Melaka State achieve the targeted level of urban sustainability, GPSC launched the sustainability outlook diagnostic in 2017 in collaboration with the United Nations Industrial Development Organization (UNIDO) and the Malaysian industry-government group for high technology (MIGHT) (Global Platform for Sustainable Cities, World Bank).

However, uncontrolled and unplanned urban expansion has several adverse consequences. This situation can be seen clearly and deteriorated in the fourth industrial revolution. The world's natural resource base is coming under growing tension due to the rising scarcity of natural resources, which is having negative ecological effects. At the global level, the SDGs of the United Nations include SDG12 on promoting responsible consumption and production patterns, which includes indicators and targets on natural resource usage, food waste, chemical management, and waste generation (United Nation, 2015). In addition, SDG11 and SDG8 are directly associated with lowering pressure on human settlements. For example, reducing waste output and pollution in cities and economy.