REGRESSION ANALYSIS AND FORECAST STUDY OF PARTICULATE MATTER EMISSION TRENDS IN FOREIGN COUNTRIES

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ABSTRACT

Particulate matter is defined as suspended particles in the atmospheric air and existed in 2 major types which are identified by the sizing group, namely PM10 and PM2.5 particles. These particles bring with them adverse effects that do not just affect humans, but also the surrounding environment if they are exposed for more than the safe limit concentration of the elements present inside the particulate matter. Types of particulate matter ranges from coarse solids such as fumes and smog particles from coal combustion to sulphur and nitrogen derivatives such as oxides of sulphur and nitrogen. The adverse effects that may occur can lead to inflammation of the thoracic cavity, bronchitis, alteration of genomes in human neurons for affected fetus and can also cause death. In order to estimate on the particulate matter emission, regression analysis is used to identify the emission trends and predict the outcome of the concentration of emissions in the future. Regression is extensively used in order to identify lethal dosage of particulate matter and the trends of effects of particulate matter in a certain area. However, the use of regression mostly focuses on a certain very specific and intrinsic cases and are rarely used to estimate trends in a country-scale. In this research, regression analysis is conducted to in order to analyze the trends of particulate matter emissions in the United States of America, and to forecast the data until 2020 to estimate the future concentrations of particulate matter in the country and to provide mitigation options to control the emissions of particulate matter. From the research, the trends shows and exponential decrease for both PM10 and Pm2.5 particles for both present and forecasted data. Mitigations options provided include the use of clean energy sources such as natural gases and the implementation of hybrid technologies to reduce usage of fossil fuel combustion.

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LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 RESEARCH BACKGROUND

Particulate matter represents a complex mixture of organic and inorganic substances and have several types such as the suspended particulate matter, PM_{10}, $PM_{2.5}$ and $PM_{0.1}$. These particulate matters include fumes, aerosols and smogs. These particulate matters are divided into sizes of three categories as stated before as a means for regulatory and estimation purposes and these categories are classified as the respiratory fraction of particles(Englert, 2004). PM_{10} highlights particulates which are at 10microns or less, and are generally considered as coarse particles. This type of particulates originated from industrial sectors as the particulates formed after combustion process or dusts that came from vehicles on roads. PM_{10} are mostly likely visible especially during haze as they coagulate and form thick, black clouds of smoke that can hinder general eye-view(Harrison & Yin, 2000). $PM_{2.5}$ particulates are for particulate matters that are less than 2.5 microns, and this type of particulates are potent to human health as they can reach directly into the alveoli of the lungs due to the fact that primary and secondary line of defense for human's respiratory system can effectively block these particulates from entering the lungs. $PM_{2.5}$ originated from metallic vapours, particles released airborne after combustion and aerosols, and they are classified as fine particles(Schauer et al., 1996). $PM_{0.1}$ are used for particulates which are less than 0.1 microns, and they are classified as ultrafine particles These particulates can be directly absorbed into the bloodstream, however, data on this type of particulates are limited as they are still on an early stage of research.