A study on Mitigation of Greenhouse Gas Emissions from Power Production Sector in Sri Lanka

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by

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Abstract

It is well known that the Greenhouse gas emissions (GHG) to the atmosphere due to antropogenic activities lead to global warming resulting various adverse effects. Therefore, it is required that countries reduce GHG emissions in future. The UN Frame Work Convention on Climate Change has dealt with measures to prepare inventories of the GHG emissions and contemplate action to reduce GHG emissions. This thesis presents a study of GHG emissions from Power production sector in Sri Lanka and possible options for mitigation of GHG emissions from this sector.

First an overview of energy consumption of Sri Lanka was studied. The Carbon dioxide (CO_2) emissions from power production sector for years 1990 to 1995 were estimated according to the guide lines of the International Panel on Climate Change (IPCC). Based on historical data, the future electricity demand for each consumption sector was estimated. Viable power production options were analyzed. A Baseline Scenario was developed using the commercial package Markal_ Macro. Mitigation scenarios were thereafter studied. Two categories; namely Demand side management and Supply side Management were studied. Under the demand side management, introduction of efficient end use demand devices such as energy efficient lamps, refrigerators, and industrial motors in the place of existing devices was studied. Supply side management involved the introduction of new power production technologies such as natural gas power plants and combined cycle power plants

which emit less GHG emissions per unit power production. Since all these options need additional investment and maintenance cost the economic viability of these options were incorporated in the Markal-Macro analysis. A separate study was also carried out to exploit the viability of introducing electric trains and natural gas power plant as mitigation measures for transport and power production sectors respectively.

It has been observed that with utilization of energy efficient end use demand devices, the expected values of CO_2 emissions in the baseline scenario can be reduced significantly resulting a percentage a reduction of CO_2 emissions in the range of 19% to 33% during the period of 2000 to 2020. Simultaneously with efficient technological mix for power production these reduction can be further increased to obtain an overall reduction of 23% to 43 % during the same period.

Introduction of appropriate technological mix for power production alone also yield desirable reduction of CO_2 emissions resulting a 5% to 24 % CO_2 emissions reduction relative to the Baseline emissions for years 2000 to 2020. Addition of natural gas power plant for power production sector as a mitigation option has failed to achieve a desirable result mainly due to its associated high fuel import cost to the country. Railway electrification was appeared to be more desirable option as far as both economic and CO_2 emissions reductions were concerned. However due to the limited use of electric trains compared to the other transport facilities available this option did not made a major impact on the overall CO_2 emissions reduction from the transport sector emissions.