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Globalization & Environmental Degradation: Bangladeshi Thinking As A Developing Nation By 2015

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This paper analyzes the scenario pollution implication of globalization process such as trade liberalization in the Bangladeshi economy toward a developing nation by 2015. In this paper globalization (trade liberalization) related air emissions such as CO_2, SO_2, and NO_x have been estimated for the year 2000 and 2015. In the first part, the quantitative assessment of this paper reveals that the selected emissions are quite high in 2015 compared to 2000, which indicate an alarming rate to unseating for sustainable economy by 2015. And, in the second part this paper thrashes out Bangladeshi motivation of the environmental implication as a developing nation. In this globalization era however one important factor which can not be ignored off is trade liberalization for economic development and the use of energy for power generation. So, this paper suggests that to achieve sustainability emphasis must be given utilization of clean technology with environmental rules and regulations and environmental taxation policy so that negative impact on the environment could be reduced.

Field of Research: Environmental Economics

1. Introduction

Globalization is heralding a new era of interaction among nations or economies in the modern age. Now globalization is an on-going process of global integration that encompasses (i) economic integration through trade, investment and capital flows; (ii) political interaction; (iii) information and information technology and, (iv) culture (Theodore Panayotou, 2000).

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The process of globalization is now around the world. Globalization combines elements of international and multinational as a more advanced stage of integration between countries. Previously it has given limited recognition because of the fact that the country is irrelevant when it comes to global activities. Rather globalization is reality now. Globalization means an increase in the relative importance of the external vis-à-vis the internal sector of the economy and the impact on globalization includes on trade, unemployment, the distribution on income, environment etc. Researchers think of globalization as primarily a synonym for global business such as the whole world now one without regulatory barriers to transfers of resources between countries.

Recently, while economic growth through globalization such as trade liberalization are perhaps the most commonly used indicators of human advances and development, due to welfare loss environmentalists and policy makers have been concerned by the consequences of negative impact of globalization and trade and overuses of the natural environment for the domestic production. Considerable studies have addressed that the increased in trade is directly or indirectly responsible for environmental degradation. All the dimensions of globalization somehow affect the natural environment. It contributes to economic growth by trade expansion between countries and thereby affects the environment in many ways that adversely affects of an economy. Globalization accelerates structural change, thereby altering the industrial structure of countries and hence resource use and pollution levels increases (i.e. see table 1). It transmits and magnifies market failures and policy distortions that may spread and exacerbate environmental damage. More compactly, globalization intensifies trade liberalization and trade related activities (i.e. see table 1) and trade activities effect on the environment when all goods and services produced in the economy directly and indirectly associated with uses of power and energy (various petroleum oil, gas[i]) which are obvious for all countries. According to the types of fuel utilized, emissions of that energy are obvious as well. Having got the reason for environmental degradation, almost all researchers have to establish the link between globalization and technological innovation and transfer, there remains to establish the link between technological changes on the one hand and environmental quality and resource use on the other. Countries and people have the potential to drive significant benefits from the globalization process but there is still the problem of realizing this potential. One major problem is much attention has been paid to the economic benefits of globalization but precise attention has not been given to the social and environmental implications. Therefore the question is come out-whether globalization is always better for an economy and environment.

Table 1 Direction of Bangladeshi global business in the world economy from 1997 to 2001

Country/Category	Export				Import			
	1997-98	1998-99	1999-	2000-01	1997-98	1998-99	1999-	2000-01
North America	97341	101620	104589	306476	13750	22053	23679	22019
South America	817	815	516	812	6144	13584	22613	19437
Europe	102265	114337	114038	141544	46980	49834	52541	62377
Asia (excl. Middle East)	4363	5813	6912	6419	46396	53776	68771	82868
African Countries	1206	1716	706	824	1388	1087	896	1544
Middle East	7672	7670	6670	11197	16461	17960	27714	25824
Asia (India)	471	390	869	1325	47227	59278	24763	47571
Asia (China)	2243	632	583	642	33009	31767	38661	48010
Asia (Japan)	5602	3838	4100	5508	21744	27057	28119	31848
Asia (Korea)	756	653	839	1351	19309	13521	24998	22119
Oceania	1730	1761	2042	1540	17887	12817	13461	13497
EFTA (excl. U.K.)	89092	98265	98104	121206	32605	29537	33143	31801

Sources: Foreign Trade Section, B.B.S.

During the past few years, attempts have been made of the globalization process through some development parameters. A number of studies addressed the role of globalization and the environment (Tobey, 1990; Smarzynska and Wei, 2001; Busse, 2004, Grether and de Melo, 2004; Dean, 2005 Antweiler and others, 2001; Machado, and others 2001; Munksgaard and Pedersen 2001; Dietzenbacher and Kakali, 2004 ; Kakali and Debesh, 2005; Al-amin et al 2006, 2007a, 2007b, 2007c,) but no or very few attention has been applied to inquiring about this relationship in the Asian developing countries such as Bangladesh. However, globalization process is ongoing in Bangladesh and it has already exposed in the global market (i.e. figures of table 1 indicating globalization process). Therefore, in this paper we will help to fill the gap of globalization process and the environmental degradation in the Bangladeshi economy. Alternatively we see how much selected air emissions generated in the Bangladeshi economy as a result of economic globalization (such as trade liberalization, export-import and domestic production related activities). Our primary objective of this paper is to quantify the environmental impact of globalization process of 2015 toward the sustainable development in Bangladesh. And the secondary objective is to review the motivation of toward environmental sustainability. The paper is organized as follows. A summary literature with background is summarized in section 1. In section 2, we present the underlying model, which is based on input-output techniques to find out 2015 emission pollution. Results for pollution hypothesis in Bangladesh are carried out in Section 3. In section 4 major environmental acts are presented. The conclusion is given in Section 5.

2. Methodology

Towards the achievement of the first objective, the employed methodology of this paper is based on Leontief's input-output framework (e.g. Miller and Blair, 1985; Dietzenbacher and Mukhopadhyay, 2004) where the structure of an economy is analyzed in terms of interrelationships between production sectors. Generally the input–output model describes the relationship among economic sectors are described through the use of a system of linear equations, which represent the identity between the total output produced and the output purchased and consumed by all other sectors of the system. In other words, everything produced by a sector is purchased and consumed respectively by the other ones as inputs or by the consumer as final demand. In matrix notation this system of linear equations can be expressed as;

$$x = Ax + f$$

This equation is the fundamental equation of the open Leontief system, which states that the gross output x, is the sum of all intermediate demand Ax and final demand f. The solution of the I-O model can be written as $x = (I – A)^{-1} f$, where (

$(I - A)^{-1}$ known as 'Leontief inverse' or multiplier matrix, A input coefficients, and I is a nxn identity matrix.

2.1 The Emission Model

An environmental extension of the input-output model can be obtained by incorporating a matrix ***e*** which includes for each sector, direct and indirect resources use for one unit of their monetary output. The multiplication of the environmental matrix ***e*** and the Leontief inverse $(I - A)^{-1}$ gives the multiplier matrix ε, which shows the (direct and indirect) resources intensity of each sector:

$$\varepsilon = \boldsymbol{e}\,\boldsymbol{(I - A)}^{-1}$$

To study how much pollution is generated using energy in an economy, we need to multiply pollutants emission factor (shown below), using the guidelines of the 'Intergovernmental Panel on Climate Change' (IPCC)[ii]. The conversion factors are estimated as follows:

$$\begin{pmatrix} Emissions\ per \\ mtoe\ of\ fuel \end{pmatrix} = \begin{pmatrix} Fuel's\ emission \\ factor \end{pmatrix} \times \begin{pmatrix} Fraction\ of \\ pollution\ oxidized \end{pmatrix} \times \begin{pmatrix} Molecular\ weight \\ ratio\ of\ emission \end{pmatrix}$$

More concretely, to estimate the environmental emissions, the final step is how much input of fossil fuels, and coal are required to produce x, therefore is required (directly and indirectly) to satisfy final demand f. Using input coefficients[iii] corresponding fuel oil, and coal sectors of A and for any exogenously specified final demand of f, the total emission such as carbon, sulphur and nitrogen emission (CO_2, SO_2, and NO_x respectively) can be written as:

$$\begin{bmatrix} c' \\ s' \\ n' \end{bmatrix} = \begin{bmatrix} c_1 & c_2 \\ s_1 & s_2 \\ n_1 & n_2 \end{bmatrix} \varepsilon\,\mathrm{f} \quad \text{or} \quad \begin{bmatrix} c' \\ s' \\ n' \end{bmatrix} = \begin{bmatrix} c_1 & c_2 \\ s_1 & s_2 \\ n_1 & n_2 \end{bmatrix} e_{ij}\,(\mathrm{I} - \mathrm{A})^{-1}\,\mathrm{f}$$

where, c', s', n' express the vectors of total emissions of CO_2, SO_2, and NO_x at the sectoral level, respectively, and $c_1 \ldots . n_2$ are conversion factors for CO_2, SO_2, and NO_x and e_{ij} energy intensity of sector i to j[iv].

2.2 Scenario Analysis Of Globalization Process For 2015

This section makes use of scenario analysis for 2015, based on the I-O model presented in section 2.1. Doing so, we needed little quantitative assessment which described in section 2.1 and 2.3.

2.3 Forecast Of Final Demand For 2015

According to our plan for emission estimation for 2015, we forecast Bangladeshi FD (final demand) from 2000-2015 as 2000[v] holding the base year as following:

$$FD_t = FD_{2000} (1+ r_{FD})^t \quad t = 2000, 2001,.....2015.$$

where, FD is the final demand and r_{FD} is the annual final demand growth rate.

2.4 Data Preparation

The study uses an input-output approach based on the input-output table 2000 of Bangladeshi economy[vi] and industrial classification system of the energy statistics is used as a base for defining the classification of the present study. We aggregated the whole Bangladeshi economy into six sectors according to estimate our desired result[vii]. The CO_2, SO_2 and NOx emissions from fossil fuel combustion estimate by IPCC, 1996 (Inter governmental panel on climate change) guideline. The information of energy balance 2000 of Bangladeshi economy is taken from energy balances of Non-OECD countries (1999-2000) from OECD publications. And the export-import data collected statistics department, Bangladesh Bank.

3. Results For Pollution Hypothesis

Bangladeshi economy over the last two decades has occurred within the framework of a liberal trade and small investment regime as a small open economy. The scenario analysis focuses on the Bangladeshi economy for the year 2015 as a result of growth and trade holding base year 2000 (other policies remain same until 2015). The simulation, carried out in this paper for exploring the air emission of the entire Bangladeshi economy especially for trade related activities. Table 2 illustrates the CO_2, SO_2 and NO_x emissions in six sectors economy due to increase export activities and Figures 1 shows the differences CO_2 emission between 2000 and 2015. From table 3 we can validate that the CO_2 emission is the highest in the industry (192.7 t[viii]) sector using coal energy followed by services (5.43 t) and agriculture (2.95 t) sector using coal. On the other, the CO_2 emission is also highest in the industry (3900.80 t) followed by services (377.22 t), agriculture (187.63 t) and utility sector (177.25 t) using oil energy. Likewise, as a result of trade liberalization the SO_2 emission is the highest both coal and oil and in the industry sector. However in the case of NO_x

emissions, industry sector is emitting the highest both coal and oil energy use followed by services, agriculture and utility sector (see Table 2).

Table 2. Exports related emission in the Bangladeshi economy in 2000 ('tones)

Sectors	Emission / ' tones CO_2		Emission / ' tones SO_2		Emission / ' tones NOx	
	Coal	Oil	Coal	Oil	Coal	Oil
1.Agriculture	2.95	187.63	0.03	2.00	0.26	0.22
2.Industry	192.71	3900.80	1.72	41.53	16.96	4.54
3.Utility	0.12	177.25	0.00	1.89	0.01	0.21
4.Mining	0.00	0.00	0.00	0.00	0.00	0.00
5.Transport	0.00	0.00	0.00	0.00	0.00	0.00
6.Services	5.43	377.22	0.05	4.02	0.48	0.44

Source: Authors' calculations

At the look of the import related activities and energy use, Table 3 indicates that CO_2, SO_2 and NO_x emissions are very similar as export related sector (see Table 2) and almost all other sectors for both coal and energy use, except one economic sector that is utility sector. Table 3 quantifies that the CO_2 emission is highest in the utility (26475.05 t) sector using oil energy use followed by industry (1845.29 t), agriculture (240.18 t) and services (204.54 t) sector. On the other hand SO_2 and NO_x emission are also highest in the utility sectors followed by industry sectors for oil energy use.

Table 3. Import related emission in the Bangladeshi economy in 2000 ('tones)

Sectors	Emission / ' tones CO_2		Emission / ' tones SO_2		Emission / ' tones NOx	
	Coal	Oil	Coal	Oil	Coal	Oil
1.Agriculture	3.78	240.18	0.03	2.56	0.33	0.28
2.Industry	91.16	1845.29	0.82	19.64	8.02	2.15
3.Utility	18.31	26475.05	0.16	281.84	1.61	30.81
4.Mining	0.00	0.00	0.00	0.00	0.00	0.00
5.Transport	0.00	0.00	0.00	0.00	0.00	0.00
6.Services	2.94	204.54	0.03	2.18	0.26	0.24

Source: Authors' calculations

In this section we quantify total emission (both oil & coal energy use) in the Bangladeshi economy for total final demand (domestic production) of 2000. The figures of table 4 indicate that the total CO_2 emission is highest in industry sector which is 28535.38 t (i.e. coal and oil row sum) followed by utility sector (11737.77 t), services sector (5390.06 t), transport sector (4449.67 t), and agriculture (2257.71 t) and SO_2 emission also is the highest in the industry sector which is

301.49 t followed by utility sector (124.94 t), services sector (57.25 t), transport sector (47.34 t) and agriculture sector (23.97 t) and NO_x emission is also highest in the industry sector (149.82 t) followed by utility sector (14.35 t), services sector (12.91 t), transport sector (6.98 t) and agriculture sector (5.66 t).

Table 4. The CO_2, SO_2 and NO_x emissions of Bangladesh in 2000 ('tones)

Sectors	Emission / ' tones CO_2		Emission / ' tones SO_2		Emission / ' tones NOx	
	Coal	Oil	Coal	Oil	Coal	Oil
1.Agriculture	34.98	2222.73	0.31	23.66	3.08	2.58
2.Industry	1343.36	27192.02	12.01	289.48	118.20	31.62
3.Utility	8.11	11729.66	0.07	124.87	0.71	13.64
4.Mining	0.26	17.52	0.00	0.19	0.02	0.02
5.Transport	20.82	4428.85	0.19	47.15	1.83	5.15
6.Services	76.44	5313.62	0.68	56.57	6.73	6.18

Source: Authors' calculations

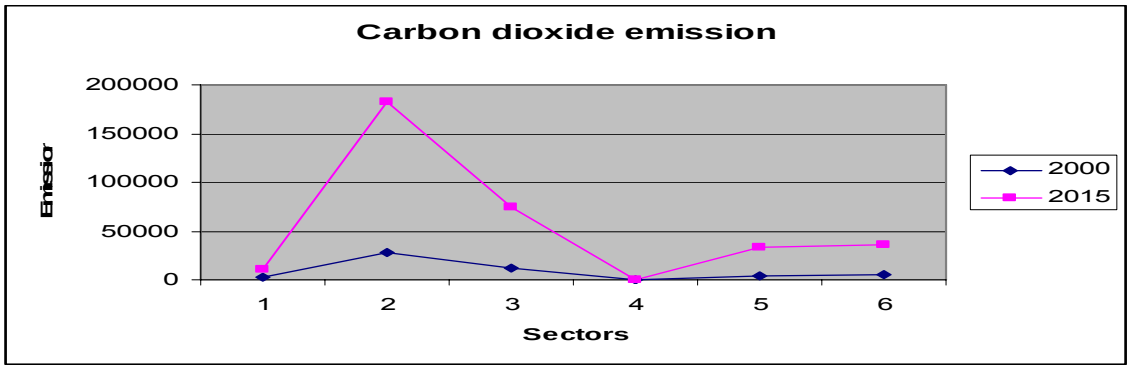
In this section we hypotheses the total scenario emission (both oil & coal energy use) in the Bangladeshi economy for the year 2015. Table 5 illustrates the CO_2, SO_2 and NO_x emissions scenario for 2015.

Table 5. The CO_2, SO_2 and NO_x emissions scenario for 2015 in Bangladesh ('tones)

Sectors	Emission / ' tones CO_2		Emission / ' tones SO_2		Emission / ' tones NOx	
	Coal	Oil	Coal	Oil	Coal	Oil
1.Agriculture	99.61	10730.09	0.89	114.2284	8.76	12.47893
2.Industry	5165.79	177270.93	46.20	1887.159	454.53	206.1633
3.Utility	30.32	74330.20	0.27	791.291	2.67	86.44487
4.Mining	1.31	147.07	0.01	1.565652	0.12	0.17104
5.Transport	92.19	33243.98	0.82	353.9027	8.11	38.66223
6.Services	302.38	35635.06	2.70	379.3572	26.61	41.44301

Source: Authors' calculations

Figure 1. The CO_2 emission between 2000 and 2015 ('000 tones)



Source: Authors' calculations

The simulation indicate that in 2000 the total CO_2 emission (major sectors) of industry sector was 28535.38 t which will be 182436 t in 2015, utility sector was 11737.77 t which will be 74360.52 t, services sector was 5390.06 t which will be 35937.44 t, transport sector was 4449.67 t which will be 33336.17 t, agriculture sector was 2257.71 t which will be 10829.70 t. Likewise, in 2000 the SO_2 emission of industry sector was 301.49 t which will be 1933.36 t in 2015, utility sector was 124.94 t which will be 791.56 t, services sector was 57.25 t which will be 382.06 t, transport sector was 47.34 t which will be 354.72 t and agriculture sector was 23.97 t which will be 115.12 t and in 2000 the NO_x emission of industry sector was 149.82 t which will be 660.69 t in 2015, utility sector was 14.35 t which will be 89.11 t, services sector was 12.91 sector which will be 68.05 t, transport sector was 6.98 t which will be 46.77 t and agriculture sector was 5.66 t which will be 21.24 t. The scenario allows us to realize that CO_2, SO_2 and NO_x emission will increase in all aspects. Concerning the estimated growth in the Bangladeshi economy for the 2015 and above mentioned targeted growth and final demand, the estimated result shows that in all aspects the energy uses from the coal and oil will emit air emissions in an alarming rate which is unseating for sustainable economy by 2015 and to fulfill the Kyoto target.

4. Bangladeshi Motivation Of Sustainable Development

The state of environment in Bangladesh is generally perceived as unsatisfactory. Air pollution, water pollution, and land degradation are major environmental problems of Bangladesh. These problems are linked with traffic management, urbanization, waste disposal mechanism, and management of surface and ground water. Dhaka (Capital city of Bangladesh) has one of the highest air polluted city in the region. Recent data shows air pollution level in Dhaka 2 to 3 times higher than the maximum allowable level. With continuous growing uses of electricity and gasoline, continuing migration from rural to urban areas, air

pollution is going to affect an increasing percentage of the population in the coming years. The negative environmental impact already exits in the Bangladeshi economy. The average temperature has raised 2.5^0 -3^0C compared to last there decades (IPCC, 1996).

The environmental concerns about the negative impact of the environment have grown in the past few years. Citizen groups and NGOs are working together on many issues to bring about a change in the environment for the near future. As a developing country Bangladeshi environmental air quality management and monitoring system not well established and poor air quality threatens human health and causes other forms of environmental damage. As well as Bangladesh as a low-lying coastal floodplain is one of the most vulnerable countries in the world to the impacts of air pollution and climate change. Such vulnerabilities have been recognized by several international studies including the Intergovernmental Panel on Climate Change (IPCC). Likely Effects of environmental damage & Climate Change in Bangladesh in the near future as follows:

- Impact of ecosystem
- Impact on Agriculture
- Impact on Forest & Biodiversity
- Effects on Human Health
- Sea Level Rise
- Effects on Fisheries
- Drainage Congestion
- Impact on Fresh Water Availability
- Disturbance of Morphological Processes
- Increased Intensity of Natural Disasters (extreme events).

Although the environmental state of Bangladesh is not satisfactory, but in response to growing concerns about the adverse impact of deteriorating air quality and climate change, the government of Bangladesh over the last couple of years have implemented a number of scatters policy measures and initiatives to curb air pollution. Though, these measures are not sufficient to curb the negative environmental impact but one of the most unbeaten policy interventions in this regard is the gasoline lead elimination in the Bangladeshi economy and elimination of two stroke gasoline engines and this is one step forward toward proper sustainability. In June 1999, Bangladesh became the first country in South Asia to stop the addition of lead to gasoline altogether. Recently high levels of urban air pollution have attracted growing attention from government to civil society and an example of such attention regarding Kyoto Protocol agreement. Bangladesh signed the Framework Convention on Climate Change (FCCC) and the Kyoto Protocol at the Earth summit in Rio de Janeiro, Brazil in 1992 and ratified it 1994.

On the other hand, formal education has already included courses on environment as a part of the curriculum. Non-formal education has also included

environmental awareness in the curriculum. A good number of very active and well informed environmental nongovernmental organizations (NGOs) are collecting and analyzing data, and challenging government to play a more active role. In addition, Bangladesh has also signed some international issues related to the environment in 90s which mentioned below:

- Convention on the Biodiversity (CBD) 1992 (ratified by Bangladesh on 3 May 1994).
- Framework Convention and Climate Change (FCCC) 1992 (ratified by Bangladesh on April 1994).
- Ramsar Convention on Wetlands of International Importance, 1971 and amended in 1982 and 1987 (Bangladesh has become Party to this convention on 21 May 1992 after the Sundarban is declared as a ramsar site)
- Convention on the Control of Wild Flora and Fauna, (CITES), 1973.
- Basil Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal, 1989 and the Amendments of 1995 (Bangladesh ratified this on 1 April 1993).

Further controlling pollution of Bangladesh, the government of Bangladesh provided an act in 1995, act no.1 of 1995, included conservation of the environment, improvement of environmental standards and control and mitigation of environmental pollution and amended by Act no. 12 of 2000 and 9 of 2002. Recently 'The government Policy on the Environment' aims at continued economic, social, and cultural progress of Bangladesh and enhancement of the quality of life of its people, through environmentally sound and sustainable development. Due to poor implementations of rules, environmental regulations have not been very effective in controlling pollution and preventing damage in these regards but these should be taken in place for controlling environmental impact and sustainability in the near future like 2015. Bangladesh may follow some advanced economy's environmental policy design such as Japan, Netherlands, Sweden, Norway or Malaysian Clean Development Mechanism (CDM) for improvement of environmental standards and control and mitigation of environmental pollution which could be a good exercise for controlling air emission and mitigating of environmental pollution. Table 6 shows the Malaysian Examples of Potential Projects for CDM.

Table 6 Examples of Potential Projects for CDM

Sector	Type of Projects
Renewable Energy	• Biomass power generation – on-grid and of-grid • Biogas • Solar: Solar water heating; solar photovoltaic systems • Hydro: Mini-hydro power
Energy Efficiency Improvement	• Improving efficiency in electricity production; improving combined heat and electricity production • Improved boilers; more efficient process heat and steam systems • Fuel switching
Waste Management	• Power and heat production from wastes • Gas recovery from landfills • Anaerobic waste water treatment
Transportation	• Efficiency improvements for vehicles • Switch to fuel systems with lower emissions
Forestry	• Aforestation projects • Reforestation

Source: Country Report Malaysia, 2006

5. Conclusion

The vital issues of today are global warming, problem of greenhouse gases and climate change that affect the sustainable development. Scientists working in Antarctica have confirmed that levels of key greenhouse gases that contribute to global warming are higher today than at any time in the past 650,000 years—and human and globalization are responsible for the increase. However, in this globalization era, one important factor which can not be ignored off is the use of energy for economic development. However, the environmental issues do appear as energy like fossil fuel (oil and natural as), coal and coke are used for power generation and fossil fuels that is generally use in electricity generation, transportation and other industrial sectors. The scenario analysis points out that in 2015, the CO_2 emission of industry and manufacturing sectors will increase more than 100%, which indicate an alarming rate to unseating for sustainable economy and for Kyoto target. We all know that trade is the part of development of the modern economy and in the globalization era, trade is considered as the power of economic development. So, we can not imagine modern economy without trade. Therefore, to achieve sustainability emphasis must be given utilization of clean technology, biomass power generation, efficiency improvements for vehicles, solar water heating, solar photovoltaic systems, and aforestation projects with environmental taxation policy and environmental rules and regulations, so that negative impact on the environment could be reduced.

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End-Notes

[i] We use gas plus petroleum oil as oil in our empirical calculations

[ii] In the case of crude petroleum (oil), the carbon emission factor equals 0.77 mt of carbon per mtoe of oil, and 99.25% of the carbon oxidized. The molecular weight of CO_2 is 44.01 and that of Carbon (C) is 12.011 thus the molecular weight ratio equals 44.01/ 12.01= 3.66 mt of CO_2 per mt of C. Consequently, the combustion of one mtoe of oil results in generation of 0.77 ×0.9925 × (44.01/12.01)=2.80 mt of CO2 emission. Multiplication of this number by mtoe/(million RM) ratio of oil industry gives mt of CO_2 that is generated by the combustion of one million RM of oil.

[iii] Total energy use divided by the total output

[iv] For more details of input coefficients and conversion factors, see Dietzenbacher and Mukhopadhyay (2004)

[v] Because Bangladeshi latest I-O table 2000 and we must go with it for emission calculation

[vi] This is the latest I-O table of Bangladeshi economy, due to that we had to use 2000 data for Bangladesh.

[vii] Bangladeshi 2000 input-output table consists 86x86 sectors. We aggregated this table into six sectors for estimation of selecting air emissions.

[viii] t = ton