Identifying key sectors for Green Growth in India: An Environmental Social Accounting Matrix multiplier analysis

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Abstract

This paper has adopted method of Environmental Social Accounting Matrix (ESAM) and its multiplier to construct a sector specific green growth index to identify key sector for green growth in India. This index comprises of sector wise implications on GDP growth, growth in employment, income growth, GHG emissions and energy use. Results of this analysis show that the cereal productions other than rice and wheat can be given higher priority to promote green economic growth. Meanwhile the hydro electricity production will be in high priority for this followed by other industrial activities. Finally this study has shown that the existing pattern of government expenditure is sub-optimal as its reallocation based on their green growth index increases GDP by 1%, reduces GHG emission by 1.57% and increase employment by 2.57%.

Key words: SAM, Environment and growth, GHG,

JEL Classification: E16, Q44, Q54,

1. Introduction

At the outset, green growth has become the centre piece of development strategy of many countries including India. The recently released 12th Five Year Plan document of India has talked at length on achieving economic growth concomitant with conservation of natural resources, minimising environmental pollution, promotion of clean source of energy and improvement in energy efficiency in all sectors. It has budgeted substantial fund for improving environment. However, the plan document has been silent regarding the quantification of the environmental impact of various sectoral investment goals. Nor it has been attempt to justify whether the target growth rate (9% during the period 2012-17) would be achieved with minimum environmental damage.

Given the importance of green growth, many countries nowadays produce environmentally extended social accounting matrix (ESAM) so that one can quantify the environmental effect of desired sectoral investment or growth[1]. Since ESAM is an extension of a Social Accounting Matrix (SAM), the multiplier derived from ESAM will produce direct and indirect induced impact of the policies on economic growth and environment, which may be used for understanding sectoral impact of investment/growth on environment. To our best knowledge, no attempt has been made to construct ESAM for India.

Therefore, this study is an attempt to construct an ESAM for India. The multiplier analysis derived from the ESAM would enable us to estimate various multipliers to see the direct and indirect induced consequences of a sector on various economic and environmental indicators. However, the selection of multiplier depends on the developmental perspective considered by the researcher. Since our key focus is green growth for Indian economy, various multipliers effects derived from ESAM have been integrated together to estimate sector specific Green

[1] The countries for which these are available are Netherlands, Bolivia, Chile, China and UK (Keuning (1992); Alarcon, van Heemst and de Jong (2000); Gallardo and Mardones (2013); Jian Xie (2000); Stanislav Edward Shmelev (2010)).

Growth Index (GGI) for India. Such analysis enables us to understand key sector for green growth in India. Again as the green growth is common but differentiated responsibility of every country across the world, such analysis would help in policy making process for India.

Following this introductory sections, the rest of the paper is organised as follows. The section 2 describes conceptual framework of our proposed ESAM for India. The sectoral scheme and construction procedure is described in section 3. The section 4 demonstrates the derivation of ESAM multiplier and section 5 describes application of ESAM multiplier to estimate GGI for India to identify key sectors for green growth. Section 6 describes an illustrative example of ESAM multiplier model in policy making process. As a part of this, we have analysed the impact of fiscal reallocation on economic growth as well as GHG emissions in India. Finally section 7 gives some concluding remarks of this study.

2. Environmentally Extended Social Accounting Matrix (ESAM): Framework

The structure of our proposed ESAM followed from the National Accounting Matrix including Environmental Accounts (NAMEA) for the Netherlands for the year 1992 (Keuning, S. J. 1992). Like NAMEA our proposed ESAM also takes into account a substances account, and an account for environmental themes as an extension of a Social accounting matrix of India. The detail structure of this ESAM is described in the following Table 1[2].

[2] See Keuning, S. J. (1992), for detail description about the NAMEA structure

Table 1: Schematic Structure of Environmentally Extended Social Accounting Matrix

			Production	Factors of production	Institutions	Indirect taxes	capital account	Rest of the world	Substances (GHG)	Depletion of Natural resource		Env.theme
										Renewal of Energy resource	Renewal of land	
			1	2	3	4	5	6	7	8	9	10
Production		1	Intermediate consumption		Consumption of goods and services		Change in stocks and capital formation	Exports	Emission of pollutants from production			
Factors of production		2	Payment for factors					Net factor income from abroad		Discovery of Energy capital	Renewal in land through conservation	
Institutions		3		Value added income	Transfer from other institutions	Total tax receive		Net current transfers	Emission of pollutants from consumption			
Indirect taxes		4	Taxes on intermediate		Taxes on purchase		Taxes on investment					
capital account		5		Depreciation	Savings			Foreign savings				
Rest of the world		6	Imports									
Substances (GHG)		7	Absorption of substances in production		Absorption of substances in consumption							Accumulation of substances
Depletable Substances	**Depletion of Energy Resources**	8		Extraction of Energy stock								Net Reduction in natural stock
	Depletion	9		Depletion of land due					Emission from			Net depletion in

3. Sectoral Scheme and method of construction

At the outset, the core of an ESAM/SAM is the input output table and supplementary environmental data. Since the input-output table for India is available for the year 2006-07, we have chosen 2006-07 as the base year of the ESAM.[3] The input-output table for the year 2006-07 gives inter-industry flow for 130 sectors of the Indian economy. However, the relevant data are not available for all the 130 sectors of the Indian economy to construct an ESAM for India. Therefore, we have decided to take into account broad sectors on the basis of their energy and emission intensities. Also we have decided to model different types of energy and electricity production sectors as separate entities since the same are relevant for climate change analysis. We have grouped these 130 production sectors into 35 production sectors to construct ESAM for India for the year 2006-07. Our ESAM incorporates 3 factors of production and 9 categories of occupational households. Table 2 gives the description of ESAM sectors and its concordance with 130 sectors of the input-output table while Table 3 gives description of households' classes.

Table 2: Map of Concordance between ESAM sectors and sectors of Input-Output Table

Serial No.	Sector Code	Sectors for SAM	Sectors of IO table 2006-07
1	PAD	Paddy Rice	1
2	WHT	Wheat	2
3	CER	Cereal, Grains etc, other crops	Part of (3-7,18,19, 20)
4	CAS	Cash crops	8,9,10-17
5	ANH	Animal husbandry & prod.	Part of (21, 22, 23, 24)
6	FOR	Forestry	Part of 25
7	FSH	Fishing	26
8	COL	Coal	27
9	OIL	Oil	29

[33] Recently an input-output table for 2007-08 has been published. However, other required environmental data are not available for 2007-08. So, we have constructed ESAM for the year 2006-07.

Serial No.	Sector Code	Sectors for SAM	Sectors of IO table 2006-07
10	GAS	Gas	28
11	MIN	Minerals n.e.c.	30-37
12	FBV	Food & beverage	Part of (38-45)
13	TEX	Textile & Leather	46-54, 59, 60
14	WOD	Wood	56
15	PET	Petroleum & Coal Prod.	63,64
16	CHM	Chemical, Rubber & Plastic prod.	58,61,62,65,66, 69-73
17	PAP	Paper & Paper prod.	Part of 57
18	FER	Fertilizers & Pesticides	67,68
19	CEM	Cement	75
20	IRS	Iron & Steel	77,78, 79
21	ALU	Aluminum	80
22	OMN	Other manufacturing	55, 74, 76, 81, 82, 95-105
23	MCH	Machinery	83-94
24	HYD	Hydro	107
25	NHY	Thermal	107
26	NUC	Nuclear	107
27	BIO	Biomass	Part of (3-7,18,19, 20), Part of (21, 22, 23, 24), Part of 25, Part of (38-45), Part of 57
28	WAT	Water	108
29	CON	Construction	106
30	LTR	Land transport	110, 113
31	RLY	Rail Transport	109, 113
32	AIR	Air Transport	112, 113
33	SEA	Sea Transport	111, 113
34	HLM	Health & medical	122
35	SER	All other services	114-121, 123, 124-126, 127-130

Table 3: Households and other Institutions of ESAM

Agent code	Description
RNASE	Rural non-agricultural self employed
RAL	Rural agricultural labour
ROL	Rural other labour
RASE	Rural agricultural self employed
ROH	Rural other households
USE	Urban self employed
USC	Urban salaried class
UCL	Urban casual labour
UOH	Urban other households

3.1. Method of Constructing ESAM of the year 2006-07

The method of constructing ESAM has two parts, namely construction of the SAM and extension of SAM with environmental indicators. To construct SAM for India, we have followed the same methods described in the paper by Pal, Pohit and Roy (2012) (see Figure 1 for successive steps).

Figure 1: Construction procedure of SAM

Consider 130 sectors commodity X Commodity IO table for India for the year 2006-07 from central statistical organization of India

↓

Extend 130 sector commodity X commodity IO tale with hydro, non-hydro, nuclear, biomass and road transport non-motorised sectors.

↓

Decompose services Incidental to transport sector according to the transport sector on which this services are associated

↓

Aggregate the extended IO table with the help of the concordance map

↓

Decomposition of sector wise gross value added (GVA) into labour, capital and land income and also estimate net labour income and capital income from abroad.

↓

Distribute private final consumption expenditure (PFCE) and the total indirect taxes imposed on household final consumption among the household classes.

↓

Estimate direct taxes paid by the different household classes

↓

Estimate factor income, transfer income (domestic & foreign), tax income (for government only) and income from public debt for the 12 institutions.

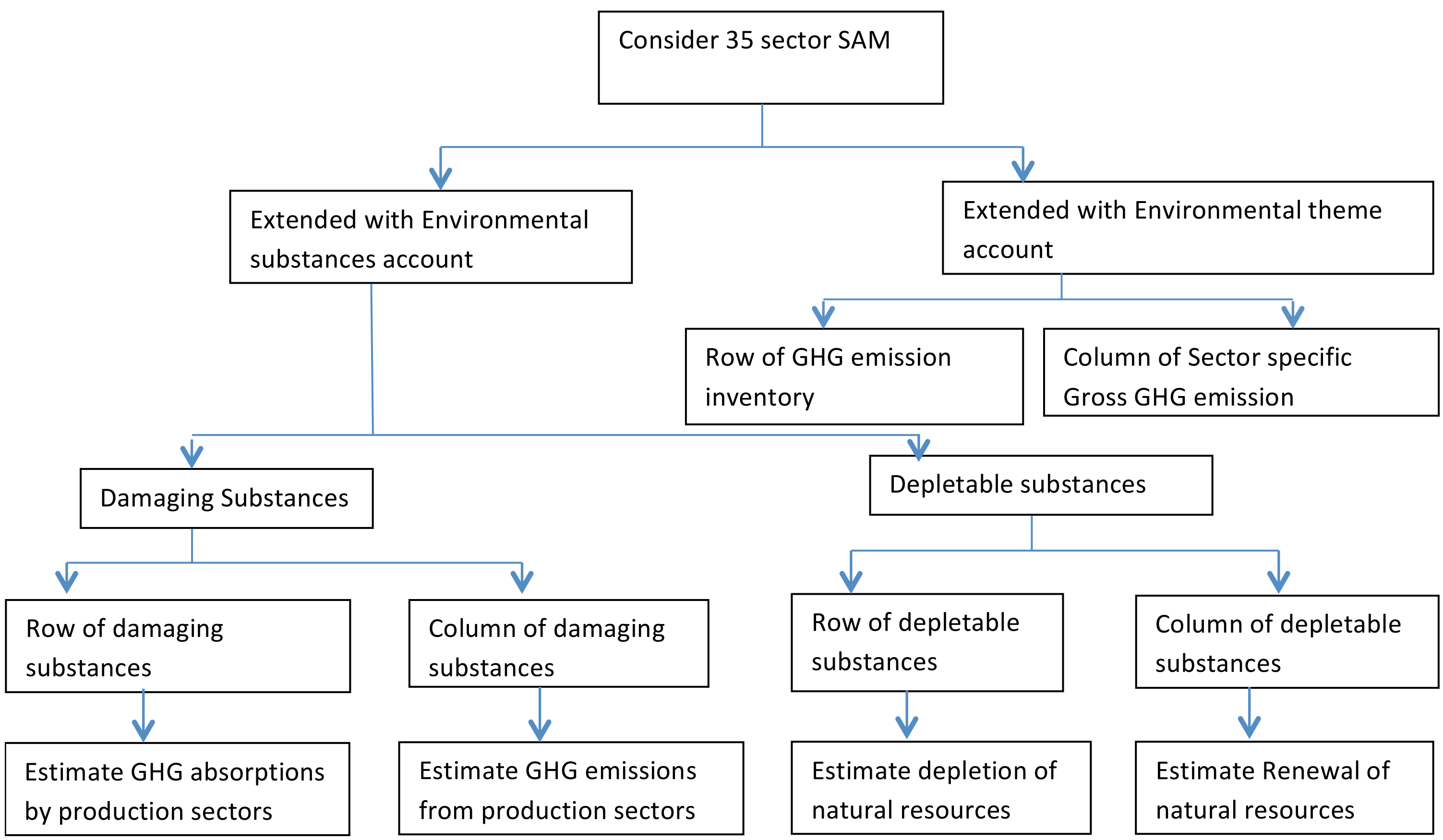
↓

Estimate capital account to show savings and investment of the economy

Primarily we have followed government official sources to obtain relevant data for extending input output table for SAM. Additionally, we have followed the data available in previous SAMs of India published by various researchers.

Once we constructed 35 sectors SAM for India for the year 2006-07, our next step is to extend this SAM to construct ESAM for India. The method of extension is given in the following Figure 2.

Figure 2: Extension of SAM to construct ESAM



To complete the construction of ESAM for India, we have to estimate sector specific data as mentioned in Figure 3. Below, we have described detailed method of estimating sector specific data for ESAM for India.

3.2 Estimation of Environmental Data

As noted earlier, our focus is to capture GHG emissions in our ESAM. To estimate column and row of damaging substances accounts, we have estimated sector wise emission and absorption of GHGs for the Indian economy. Additionally we have attempted to incorporate depletion and renewal of natural resources like; coal, crude oil and land in our ESAM and the relevant data need to be sourced.

3.2.1 Estimation of sector specific GHG emissions

India has published its second communication on greenhouse gas emission, which provides updated information on India's greenhouse gas emission from different sectors for the year 2007 (MOEF, 2010). The same source is used to estimate India's sector specific GHG emissions for the year 2007. Since our sectors do not exactly match with that of MOEF report, we have derived a concordance between the two which is given in Table 5.

Table 4: Mapping between ESAM sector and sector of MOEF report

Sector of ESAM	MOEF Sectors
Pddy rice	Agriculture, Rice Cultivation, soils
Wheat	Agriculture, soils
Cereals	Agriculture, soils
Cash crops	Agriculture, soils
Animal husbandry	Agriculture, Enteric fermentation, Manure management
Forestry	No emission
Fishing	Agriculture
Coal	Fugitive Emission
Oil	Fugitive Emission
Gas	Fugitive Emission
Food & Beverages	Food Processing, Industrial waste water
Textiles & Leather	Textile & Leather, Industrial waste water

Sector of ESAM	**MOEF Sectors**
Wood	Non-specific industries
Minerals n.e.c	Mining & qurrying
Petroleum & Coal tar product	Other energy Industry, Industrial Waste water
Chemical, Rubber & Plastic Products	Chemicals, Industrial waste water
Paper & Paper products	Pulp & paper, Industrial waste water
Fertiliser & Pesticides	Non-specific industries, Industrial waste water
Cement	Cement
Iron & steel	Iron & steel
Aluminum	Aluminum
Other manufacturing	Ferroalloys, Lead, Zinc, Copper, Glass & cermic, soda ash, Non-specific industries
Machinery	Non-specific industries, Industrial waste water
Thermal	Electricity, Industrial waste water
Hydro	No emission
Nuclear	No emission
Biomass	No emission
Water	No emission
Construction	Non-specific industries
Land transport	Road Transport
Railway transport	Railways
air transport	Aviation
Water transport	Navigation
Health and medical	No emission
Other services	Commercial /Institutional

Since the concordance map indicates absence of one to one correspondence between the two in many sectors, we need to derive a scheme to disaggregate the GHG emissions for the MOEF sectors. The method of disaggregation is described in the following Table 5.

Table 5: Method of disaggregating source wise GHG emissions in India

Corresponding sector	Items to be disaggregated	CO2	N2O	CH4
Paddy, Wheat, cereals, cash crop and fishing	Energy based emission from Agriculture sector	Petroleum Fuel consumption shares have been used	N.A	N.A
Same as above	Emission from Soil	N.A	Fertilizer Consumption shares have been used	N.A
Paddy rice	Rice cultivation	N.A	N.A	Directly treated as emission from paddy
Coal, Oil and Gas	Fugitive emissions	N.A	N.A	Emission coefficients (CH4 /output) are obtained from MoEF and quantity of output are obtained from Energy statistics (CSO,2007)
Food & beverages, Textiles, Petroleum, chemical, Paper, fertilizer, Machinery and Thermal electricity	Industrial waste water based emission	N.A	N.A	Share of Industrial waste water generated by the specified industries are estimated from MoEF data
Wood, Fertilizer and Pesticides, Machinery, and Construction	Emission from Non-specific Industry	Energy use share obtained from our SAM have been used for disaggregating		
Urban Households classes	Municipal solid waste			Amount of solid waste are estimated from MoEF data and households wise shares have been used for disaggregating
Urban Households classes	Domestic waste water			Amount of waste water are estimated from MoEF data and households wise shares have been used for disaggregating
Rural Households	Burning of crop Residue	Biomass consumption share obtained from SAM have been used		
All households	Residential	Share of fuel use including coal and petroleum are obtained from SAM for disaggregating		

Emission due to land use change

Apart from the production and consumption process, the change in land use pattern also causes GHG emission in India. The MOEF (2010) shows that the emission of 10.49 million tons of CO_2 is occurred due to decrease in grassland area by 3.4 million hector between 2006 & 2007. In our ESAM we have put this data under the column head of *CO_2 emission* corresponding to the row head of *depletion of grass land.*

So far, we have discussed about the method of estimating GHG emission from production sectors as well as from land use change for India. These estimated data are used to construct column of the substances account for our proposed ESAM. Next, we need to estimate the row of this same account. To construct row of this account, we have to estimate abatement or absorption of this substances into the economic activities. The methodology is discussed in the following paragraph.

3.2.2 Estimation of Abatement or Absorption

In India, the data on greenhouse gas abatement are not available for production and consumption activities. However, MOEF reports that the forest area and crop land removes 67.8 and 207.52 million tons of CO_2 respectively in 2006-07 (MOEF, 2010). In our ESAM, there is a separate account for forestry sector. So we have accounted this data on CO_2 removals in the row of damaging substances corresponding to the column of forestry sector.

There are 4 agricultural sectors in our ESAM which are responsible for CO_2 removal from crop land. So, the same is distributed among the 4 agricultural sectors. To distribute this, we have used crop wise share in gross cropped area of the year 2006-07 as available from Ministry of Agriculture, India (2007).

The data obtained in this way are used to complete the row of damaging substances corresponding to the column of agricultural sectors.

3.2.3 Estimation for Depletable Natural resources

The crude oil, coal and land are considered as the depletable natural resources in our analysis. The production data in physical unit on crude oil and coal have been taken as measures of the quantities of depletion of these two types of resources. the data are available from energy statistics of India (CSO 2006). The data obtained in this way can be interpreted as 'free' intermediate consumption (without direct cost) used in the production process of the coal and crude oil sector and therefore, we have put this data in the row of this depletable substances account corresponding to the column of crude oil and coal sectors.

To construct the column of this depletable substances account, we have used data on new discoveries of crude oil and coal reserve in India in the year 2006-07. The source of information is TERI (2009).

In case of land use change, we have used data from MOEF (2010) which provides data of changes in different types of land use between the years 2006 and 2007. The same study also gives the data on land conservation in India during 2006 and 2007. The data obtained in this way are used to construct the row and column of the land use change as an account of the *depletable natural resources* in our ESAM.

3.2.4 Estimation for Environmental Themes

The column of this account shows sector specific gross GHG emissions of India in 2006-07. This gross GHG emission is CO_2 plus CO_2 equivalent of N_2O and CH_4 emissions. To estimate CO_2 equivalent of N_2O and CH_4 emissions, we have multiplied sector specific

N_2O emission by 310 and CH4 emission by 21 (MOEF, 2010). The column total of this account gives us GHG inventory in India for the year 2006-07. In our ESAM we have treated this as a natural capital of the economy and incorporated this data in the row of this account corresponding to the column of factor input.

Following the above mentioned procedure, we have extended the SAM to construct ESAM for India for the year 2006-07 and this is shown in the Appendix 1 at the end of this paper. Once we obtain the ESAM for India, our next task would be to estimate various multipliers for prioritizing key sectors for the Indian economy to achieve green growth. As mentioned in Table 1, we have to estimate following multipliers namely, Value Added Multiplier for GDP; Households Income Multiplier for poverty impact; Output multiplier for sectoral growth; Employment Multiplier for employment; Emission multiplier for environmental impact and Energy Multiplier for depletion of energy resources. The method of estimating this multiplier and their applications is described below.

4. ESAM Multiplier Model

ESAM multiplier analysis basically follows SAM multiplier analysis (Pal, Pohit and Roy, 2012). Let A be the domestic expenditure coefficient matrix, X be the matrix of sector-wise gross output and Y be the matrix of exogenous variables. In this case we have assumed Government expenditure, Foreign Trade and Gross Capital Formation as exogenous variables. Therefore, SAM can be written as,

$$X = AX + Y \qquad (1)$$

or

$$X = (I - A)^{-1}Y \qquad (2)$$

$$X = M.\ Y \qquad (3)$$

Where, matrix M is the SAM multiplier matrix which shows the direct and indirect induced impact on the economy due to unitary changes in the exogenous factor. The multiplier presented here are the accounting multipliers, which are based on average coefficients and not marginal coefficients. This implies that the structure of the economy does not change and the incremental income or output will be distributed in the same proportion as the average obtained in matrix A (Pradhan et.al, 2006). Basically, the structural change depends on change in technological pattern of the economy, and the change in ownership of primary factors. The effect of this structural change can be captured in the dynamic model. Now as we are considering static model for this analysis, assumption of fixed structure is reasonable for this study.

However the above multiplier analysis does not consider the multiplier impact on GHG emission. To capture this we have estimated pollution trade-off multiplier following the approach described in Robert Koh (1975). The pollution trade-off multiplier measures the direct and indirect induced impact on pollution level due to the exogenous change in the economy. The mathematical expression of the pollution trade-off multiplier is given as follows:

$$E = P * X \qquad (3)$$

Where, E is matrix of sector wise emission,

P is the sector wise emission coefficient matrix

Replacing equation (2) into equation (3),

$$E = P * (I - A)^{-1} * Y \qquad (4)$$

$$\frac{\partial E}{\partial Y} = P * (I - A)^{-1} = T \qquad (5)$$

Here T is the pollution trade-off multiplier matrix which indicates direct and indirect induced impact on emission due to any exogenous changes into the economy.

5. Estimation of Green Growth Index for India

In this study, the GGI comprises of various economic environmental indicators. The key economic indicators selected in the study are like- Gross domestic product, employment, households' income. Meanwhile, the selected environmental indicators are like – energy and GHG emissions multiplier. After this we have taken into account the multiplier effect of every sector on these indicators and add up those to estimate sector specific GGI for India for the year 2006-07. The multiplier effects are obtained from the various blocks of SAM multiplier and pollution trade-off multiplier matrix as obtained in previous section 4. Again though the policy makers in India may have different priorities for above mentioned indicators, here we have followed a balance approach by considering equal weights for each indicator to add up them for GGI. The following table 6 describes various multiplier, their rationality and sources for the year 2006-07.

Table 6: Various Multipliers, their rationality and source

Multipliers	**Rationality**	**Representative blocks of M Matrix**
GDP Multiplier	Indicates overall economic growth	Factor – Activity
Households Income Multiplier	Growth in households income is an indicator for poverty alleviation.	Households – Activity
Energy Multiplier	Energy use is key for GHG emissions.	Primary energy (Coal, oil, gas) – Activity
Employment Multiplier	Employment generation is crucial for inclusive growth in developing countries	Sector wise no. of person per unit of output * (Activity-Activity)
GHG emissions multiplier	GHG emission causes global climate change and India is highly vulnerable due to that	Pollution trade-off multiplier

As the above table shows, except employment multiplier all other multiplier values can be obtained directly from estimated SAM and GHG emissions multiplier. As the employment multiplier shows the increase in number of employment due to increase in exogenous injection, we need some additional information about number of employment per unit of output. In this study we have estimated sector wise number of employment from the data published in www. Indiastat.com. After estimating all the multipliers required for this study, we have applied these to identify key sectors of the Indian economy for green growth. Once we obtain all the indicators, the GGI can be obtained as shown in following Table 7.

Table 7: Estimation of GGI for each sector

	ESAM Multiplier					Unit Free Score						
Sectors	**GHG (Tons/Rs.lakh)**	**Employment (Person/Rs.lakh)**	**Income (Rs.lakh)**	**GDP (Rs. Lakh)**	**energy (Rs. Lakh)**	**GHG**	**Employment**	**Income**	**GDP**	**energy**	**Green growth index**	**Rank**
	1	2	3	4	5	6	7	8	9	10	11	12
PAD	17.12	3.72	1.49	1.85	0.13	1.68	2.13	1.56	1.45	0.65	4.18	7
WHT	12.52	4.23	1.59	1.96	0.14	1.23	2.43	1.67	1.54	0.69	5.16	6
CER	7.1	5.6	1.55	1.87	0.09	0.7	3.22	1.63	1.47	0.43	6.3	1
CAS	7.29	4.64	1.54	1.86	0.09	0.72	2.66	1.62	1.46	0.46	5.7	2
ANH	16.78	4.03	1.32	1.74	0.06	1.65	2.31	1.38	1.37	0.31	4.12	8
FRS	1.41	2.75	0.45	0.61	0.02	0.14	1.58	0.48	0.48	0.11	2.83	13
FSH	4.31	4.22	1.34	1.77	0.09	0.42	2.42	1.41	1.39	0.43	5.38	3
COL	7	0.91	0.83	1.21	1.06	0.69	0.52	0.87	0.95	5.34	-2.85	32
OIL	1.03	1.82	0.23	0.34	1.02	0.1	1.05	0.24	0.26	5.14	-3.21	33
GAS	11.25	1.18	0.71	0.95	1.04	1.11	0.68	0.74	0.74	5.26	-3.5	34
FBV	7.08	0.6	1.12	1.46	0.08	0.7	0.35	1.18	1.15	0.42	2.81	14
TEX	6.72	0.69	1.05	1.4	0.09	0.66	0.4	1.1	1.1	0.47	2.69	17
WOD	5.09	0.72	1.09	1.44	0.07	0.5	0.42	1.14	1.13	0.37	2.87	12
MIN	1.63	1.13	0.33	0.48	0.02	0.16	0.65	0.35	0.38	0.12	1.62	23
PET	3.35	1.8	0.38	0.57	0.62	0.33	1.04	0.39	0.45	3.13	-0.79	30
CHM	5.63	2.03	0.72	1	0.09	0.55	1.17	0.75	0.78	0.46	2.71	16
PAP	6.97	0.29	0.7	0.96	0.09	0.69	0.17	0.73	0.76	0.46	1.51	25
FER	10.52	1.82	0.71	1.01	0.21	1.03	1.05	0.75	0.79	1.05	1.57	24
CEM	42.96	0.14	0.72	1.02	0.16	4.23	0.08	0.75	0.8	0.78	-2.4	31
IRS	11.41	0.44	0.74	1.03	0.18	1.12	0.25	0.77	0.81	0.89	0.86	29
ALU	3.16	0.26	0.35	0.47	0.08	0.31	0.15	0.37	0.37	0.39	0.86	28
OMN	4.19	1.14	0.5	0.69	0.06	0.41	0.66	0.52	0.54	0.31	1.79	22
MCH	4.99	0.86	0.63	0.87	0.07	0.49	0.49	0.66	0.68	0.37	1.99	21
NHY	74.63	0.28	1.03	1.49	0.35	7.34	0.16	1.08	1.17	1.77	-5.31	35
HYD	3.83	1.29	1.25	1.71	0.05	0.38	0.74	1.31	1.35	0.27	3.66	9
NUC	13.79	0.18	0.97	1.49	0.09	1.36	0.1	1.01	1.17	0.46	1.47	27
BIO	4.21	4.18	1.3	1.73	0.06	0.41	2.4	1.36	1.35	0.32	5.35	4
WAT	5.97	0.66	1.22	1.64	0.07	0.59	0.38	1.27	1.29	0.35	3.07	10
CON	7.72	1.04	1.03	1.34	0.11	0.76	0.6	1.08	1.05	0.55	2.57	18
LTR	6.51	1.7	0.91	1.23	0.2	0.64	0.98	0.96	0.96	1	2.34	19
RLY	11.22	0.71	1.09	1.44	0.11	1.1	0.41	1.15	1.13	0.54	2.18	20
AIR	14.17	0.52	1	1.33	0.12	1.39	0.3	1.05	1.05	0.62	1.47	26
SEA	5.38	0.41	1.14	1.5	0.08	0.53	0.24	1.2	1.18	0.41	2.73	15
HLM	4.56	0.44	1.18	1.53	0.07	0.45	0.25	1.24	1.2	0.36	2.95	11
SER	4.13	4.52	1.17	1.6	0.06	0.41	2.6	1.23	1.26	0.29	5.32	5

The first 6 columns of this Table 7 show the value of various multipliers. Now as these multipliers are measured in different units, we have to make them unit free for any addition or subtraction purposes. To do this we have divided each value by their respective column total and the new values are presented in the column 7 to 12. The values shown in the column 7 to 12 reprepFrent relative influence of each sector on each indicator as compared to the overall influence. For example if this value is greater than one for any indicator, this implies impact of the corresponding sector on that indicator is more than the overall impact on that indicator in the economy. Once we get this entire unit free values we can add them to get column 13 for development indicator. However, point to be noted here that the higher values corresponding to GHG and energy use show the increase in GHG emissions and energy use. This implies negative impact in the form of climate change and resource depletion. Therefore, we have put negative sign before the GHG and energy values while adding for development indicator. Hence the formula of getting green development index is:

Green development Index = Employment + Income + GDP + Output – GHG – Energy.

The green growth index obtained in the above mentioned way are arranged in descending order and rank them to identify priority sectors for green growth in India. The column 14 of the above table shows the rank of every sector on the basis of their influence on green growth indicators.

Now for better understanding purpose we have arranged these 35 sectors into three categories namely, (1) high priority sectors (rank is less than or equal to 12); (2) Medium Priority (Rank greater than 12 to less than and equal to 24); and (3) least priority sector (Rank greater than 24) and they are presented in the following Table 8.

Table 8: Classification of sectors based on Green Development priority

Category	Sector
High priority	CER, CAS, FSH, BIO, SER, WHT, PAD, ANH, HYD, WAT, HLM, WOD
Medium Priority	FRS, FBV, SEA, CHM, TEX, CON, LTR, RLY, MCH, OMN, MIN, FER
Least priority	PAP, AIR, NUC, ALU, IRS, PET, CEM, COL, OIL, GAS, NHY

It is observed from the above table that the agriculture sector will be high priority for the government. Moreover the priority should be given to cereal, cash crop and fisheries as compared to paddy, animal husbandry and wheat production. Though the paddy and wheat are main staple food for most of Indians, the significant GHG emissions from these productions results the lower value of development score as compared to cereals. Since cropping intensity in India is 136% which can be increased up to 300% (http://www.icar.org.in/files/state-specific/chapter/3.htm), promoting cereals (other than paddy and wheat) and cash crops production can help to increase that target. Again as the profit from cereals and cash crops are higher than paddy and wheat, farmers can compensate their income loss by cultivating these crops in at least one cropping season. Furthermore, the government of India is now focusing on adoption of technologies for conservation agriculture practice especially for rice and wheat to address the livelihood and food security in India. However, the limited financial capacity to the farmers is hindering their adoption. Therefore, providing alternative source of income by promoting cereals and cash crops would increase the financial capacity to adopt those technologies. Hence, before focusing conservation agriculture in rice and wheat crops, increasing cropping intensity by providing adequate market and institutional support can be in top of the policy agenda for agricultural growth.

On the other hand the hydro electricity production in India must be given high priority as compared to nuclear and thermal electricity. Though the Nuclear electricity does not have significant direct impact on energy based GHG emission but its indirect induced impact increases GHG emission in India. By contrast, the too much dependency on coal based power plants makes thermal electricity sector under least priority category sector. Again we have seen primary energy production sectors are least priority sector as they lead to depletion of energy resources and increase in fugitive emission in India. However, this result is not surprising as energy production sectors in the India is highly energy and emission intensive (NATCOM, 2010).

Now it is evident from the studies that almost half of the Indians do not have access to electricity (Sunita Narain et.al, 2009). So providing adequate electricity through renewable sources like hydro electricity generation can be a novel step towards the green growth initiatives. Again, moving towards urbanization and industrialization may lead to increase direct and indirect induced impact on GHG emissions due to high dependency on thermal electricity sector for energy supply to achieve these objectives. Hence, first priority must be given on securing green energy supply for further structural change in the Indian economy.

It is now clear from the above discussion that, the ESAM multiplier analysis provides a clear road map to the policy maker to achieve green growth in India. However, the views expressed in the above paragraphs require further justification through policy impact evaluation. In this context we have decided to analyse the impact of fiscal reallocation, as an illustrative example, on green growth initiatives in India and the detail is given below.

6. Policy Implications

The 12th five year plan document published by Planning Commission of India has argued that government will allocate budgetary support among various sectors based on the priority basis except defence, education and health sectors (Planning Commission of India, 2012). Since government expenditure across various sectors acts as a fiscal stimulus for economic growth, we have considered this as policy instrument for our analysis. Again as we have kept government expenditure as exogenous factor in our ESAM model, it becomes easier to us to do such kind of analysis.

Now if we look at the government expenditure pattern in India of the year 2006-07, almost 80% of total government expenditure, spent on these 35 sectors, goes to health and service sectors which include public administration, defence, and education and so on. Out of remaining 20% major share are spent for chemical, land transport, and construction sectors which are considered here as medium priority sectors in terms of green growth. Therefore, the current focus of the government is different than the focus required to achieve green growth in India. The Table 9 given below gives clear understanding about this fact.

Table 9: Comparison of sectors based or government expenditure and Green Development Priority

sector	Share of Govt.expenditure	Rank	Rank of Development Score	sector	Share of Govt.expenditure	Rank	Rank of Development Score
PAD	0.24	16	7	CEM	0.00	32	31
WHT	0.13	19	6	IRS	0.00	33	29
CER	0.44	14	1	ALU	0.00	34	28
CAS	0.00	28	2	OMN	1.28	7	22
ANH	0.81	12	8	MCH	1.38	6	21
FRS	0.00	27	13	NHY	1.26	8	35
FSH	0.00	29	3	HYD	0.23	17	9
COL	0.02	24	32	NUC	0.04	23	27
OIL	0.00	30	33	BIO	0.00	35	4
GAS	0.07	21	34	WAT	1.09	9	10
FBV	0.95	11	14	CON	1.75	5	18
TEX	0.78	13	17	LTR	2.01	4	19
WOD	0.00	26	12	RLY	0.36	15	20
MIN	0.00	31	23	AIR	0.05	22	26
PET	1.00	10	30	SEA	0.11	20	15
CHM	2.16	3	16	HLM	5.20	2	11
PAP	0.19	18	25	SER	78.47	1	5
FER	0.00	25	24				

Therefore, it is evident from the above table that, government of India can change its focus according to the rank of sectors in terms of green growth and reallocate its budgetary support to achieve that. However, this argument requires empirical support and hence we have done such analysis in the following sub section.

6.1. Impact of Government Budget re-allocation on Indian economy

In this case we have followed a conservative approach by keeping aside the defence, health and education sector from budget reallocation and decided to reallocate 20% of total government expenditure among the reaming activities listed in ESAM. Here we have used the rank of the sectors as shown in Table 7 as the criteria for re-allocation. For example, sector with rank 1 according to green growth index will receive the amount same as the amount currently received by the sector which has rank 1 based on existing share of government expenditure. Once we get this re-allocated government expenditure we put this in the column of government expenditure in our ESAM and run the multiplier analysis. Results from this multiplier analysis are shown in the following Table 10.

Table 10: Impact of government expenditure reallocation on key development indicators

	Existing Condition	New Scenario	% change
GDP (Rs. Lakh)	375954398	379422539	0.92
Household Income (Rs. Lakh)	331147217	334085182	0.89
Employment (person)	391766427	401832389	2.57
GHG emission (tons)	1845745200	1825373538	-1.10
Emission Intensity (tons/Rs.lakh)	5.09	5.00	-1.91
Energy Demand (Rs. Lakh)	26701963	26282632	-1.57
Total Value of Output (Rs. Lakh)	897371524	900034205	0.30

It is observed from the above table that the reallocation of existing government expenditure according to priority sectors results positive impacts on the economy. The high impacts are observed in the form of GHG emission reduction by 1.10%; emission intensity reduction by 1.91%; the primary energy demand (intermediate as well as final demand) reduction by 1.57% and the increase in employment by 2.57%. Though the impact on GDP, household's income and value of output are not significant but these are at least higher than the existing case. Hence we can argue that the existing pattern of allocating government expenditure is suboptimal and more benefit can be drawn by efficient allocation through prioritization.

7. Conclusion

Balancing economic growth and GHG mitigation is crucial research agenda in the Indian economy. This issue is also challenging to the researcher due to the scarcity of relevant data. In this context, this paper is an attempt to bridge the gap. This ESAM provides balanced data set for the economy with integration of environmental indicators. Therefore it is highly useful for researcher working in CGE modelling for climate change policy analysis. We have also demonstrated here the method of identifying sectors and provided a solution to achieve green growth in India. The result presented in this paper reveals that even if we can reallocate 20% of government expenditure spent on various sectors we can gain almost 1% more GDP growth and substantial reduction in GHG emission and energy consumption. Therefore, government can set its priority on the basis of green growth index and reallocate its budgetary support to achieve efficient outcome.

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Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	PAD	WHT	CER	CAS	ANH	FRS	FSH	COL	OIL
PAD	3604537	56673	297765	333	45486	6	513	0	0
WHT	63062	2703447	377231	4	13612	0	6	0	0
CER	53742	128243	1813875	9	2555577	18	7	0	0
CAS	4048	14766	47603	798319	1295	0	0	0	0
ANH	586772	81354	954233	657037	26038	1	83	0	1
FRS	132	24	60	0	40	230	0	0	0
FSH	223	571	1182	0	0	0	246158	0	0
COL	47	35	74	15	202	0	0	11356	2
OIL	0	0	1	0	2590	0	0	0	54713
GAS	0	0	0	19	257	0	0	0	0
FBV	45025	6549	18793	14	272968	0	11467	0	0
TEX	21267	21413	15603	3338	2474	393	140281	88	3
WOD	81	209	433	43	236	11	6893	29899	3
MIN	1	3	9	1	503	0	0	0	16
PET	440637	197486	428076	200894	1292	3538	159517	42221	96751
CHM	3040	3257	5886	2217	19365	1043	9975	305214	68299
PAP	846	1023	1691	419	644	164	0	4436	3
FER	1551704	1351880	1533062	951908	194	44	219	0	0
CEM	0	0	0	0	33	1	0	0	857
IRS	0	1	7	1	1314	1	6856	2	1302
ALU	1	3	8	1	662	19	362	0	23
OMN	13173	8489	8675	4004	2950	3088	105725	109983	157816
MCH	63300	74441	81915	13137	6681	633	9	208316	193424
NHY	303163	292496	154790	47095	919	63	43	105965	28621
HYD	56174	54198	28682	8726	170	12	8	19635	5303
NUC	8532	8232	4356	1325	26	2	1	2982	806
BIO	62499	9197	108434	69230	13710	776	9	0	1
WAT	62	53	71	33	16	28	0	1859	0
CON	299358	186107	241647	95450	4927	3305	42	30402	299685
LTR	465228	308397	416869	214952	470359	10505	62115	145944	54946
RLY	218678	54027	77352	32208	28198	744	2773	8572	3718
AIR	33234	21421	15620	7991	2153	46	2312	697	1147
SEA	1017	1500	3189	362	32522	25	57	869	543
HLM	0	0	0	0	0	0	0	0	0
SER	848437	522990	860076	350991	2020029	9655	56472	179594	192200
Lab	3689555	2645224	13081859	4985874	7939400	155015	1870083	950571	880277
Cap	1115629	799304	3842846	1408910	7823192	166197	1535925	2387623	2272012
Land	2546449	1825601	9153113	3501862					
RNASE									
RAL									
ROL									
RASE									
ROH									
USE									
USC									
UCL									
UOH									
PVT									
PUB									
GOV									
ITX	-1139709	-1310720	-1108597	-581101	31009	11379	-202612	90587	81514
CAC									
ROW	53	31699	831853	283794	34943	626973	15046	1059286	14830033
TOT	14960001	10099591	33298342	13059415	21355984	993915	4030348	5696101	19224020

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	PAD	WHT	CER	CAS	ANH	FRS	FSH	COL	OIL
CO_2 (000'tons)	46959	30555	56342	73664		67800			
CH_4 (000'tons)									
N_2O (000'tons)									
Oil (mt)									34
coal (mt)								361	
Forest Land (Mha)									
Crop land (Mha)									
Grass land(Mha)									
Env.Theme (000'tons)									

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	GAS	FBV	TEX	WOD	MIN	PET	CHM	PAP	FER
PAD	0	480042	41	8	3	0	20196	1773	340
WHT	0	915729	74	20	1	0	36804	137	735
CER	1	3051005	7501	503	81	880	308401	19754	4427
CAS	2	5426983	2056049	341	201	1637	728827	4493	8404
ANH	3	1601763	372582	325	153	308	157594	882	2331
FRS	4	19532	290	55073	37	217	16076	50715	69
FSH	0	458661	40	2	1	0	19972	172	356
COL	957	29140	27400	5525	23948	252434	139313	53150	32516
OIL	1376	194	12	300	58	18673034	211974	556	1
GAS	5	3010	36448	183	1484	886	327777	2027	381218
FBV	2	4300382	16609	498	218	1015	479422	11745	10967
TEX	19	106573	5501608	1518	3789	4247	368217	11427	9356
WOD	2114	170905	78689	14647	2562	9784	268310	67587	24950
MIN	70	4328	6850	1884	26313	2631	193568	4602	162315
PET	11260	406413	407654	7406	63514	1020947	1182041	84364	791718
CHM	28662	1241295	2158888	38087	121069	546658	15269445	421793	1275236
PAP	325	442279	160128	19331	1797	14496	962974	617782	8541
FER	3	61026	1978	6754	80	3612	225431	525	577350
CEM	53	76	370	140	218	3105	7641	70	55
IRS	329	1671	17261	8151	12877	4515	215983	13309	3104
ALU	116	3941	11634	3771	49536	10981	225889	7481	5077
OMN	19255	49225	196681	18950	64147	20287	564638	12863	9520
MCH	25725	275599	558968	7848	33712	41103	484615	15348	23692
NHY	15172	218487	616474	13510	61600	294141	789216	97953	79410
HYD	2811	40484	114228	2503	11414	54502	146236	18150	14714
NUC	427	6149	17350	380	1734	8278	22212	2757	2235
BIO	13	94233	1534	185645	130	781	59890	172836	313
WAT	133	6695	3641	46	404	209	11973	115	1729
CON	18053	333190	411837	2372	58265	192032	328759	9861	49682
LTR	17441	1665994	2120591	44524	45926	120362	1709841	195932	258956
RLY	1848	93918	29913	4081	14546	548377	166346	24430	40166
AIR	153	106956	7532	3512	1299	15347	31377	5648	13136
SEA	114	19230	37301	242	278	3792	52835	5044	1304
HLM	0	0	0	0	0	0	0	0	0
SER	27914	5985966	4626498	126727	171480	986547	4137078	325955	592151
Lab	422077	2468376	3448211	295948	832851	306368	3575263	259182	334750
Cap	423125	3621031	3414704	215792	2092439	4606321	7319453	423864	931988
Land									
RNASE									
RAL									
ROL									
RASE									
ROH									
USE									
USC									
UCL									
UOH									
PVT									
PUB									
GOV									
ITX	13229	768166	483529	20759	61959	1554145	2787084	233237	301979
CAC									
ROW	751027	2686079	1315523	78402	8023533	3604127	8735582	820494	548325
TOT	1783816	37164725	28266621	1185711	11783655	32908109	52288252	3998014	6503117

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Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	GAS	FBV	TEX	WOD	MIN	PET	CHM	PAP	FER
CO_2 (000'tons)									
CH_4 (000'tons)									
N_2O (000'tons)									
Oil (mt)									
coal (mt)									
Forest Land (Mha)									
Crop land (Mha)									
Grass land(Mha)									
Env.Theme (000'tons)									

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	CEM	IRS	ALU	OMN	MCH	NHY	HYD	NUC	BIO
PAD	0	19	1	1578	281	1309	0	0	5115
WHT	0	30	1	3020	546	2266	0	0	3042
CER	44	378	183	16627	3852	10779	0	0	213747
CAS	111	924	729	34391	9627	16922	0	0	2881
ANH	59	1459	1161	45847	12678	4697	0	0	6689
FRS	19	643	154	35230	2603	704	0	0	1832
FSH	0	17	1	1639	343	1226	0	0	223
COL	217084	2065513	457147	574505	114056	1692816	0	0	164
OIL	2	20936	1085	91313	4544	40917	0	0	209
GAS	35930	317837	26419	70721	35564	325683	0	0	27
FBV	166	2712	2049	22239	6140	12255	0	0	24024
TEX	9504	11516	4827	180233	196041	7383	0	0	3233
WOD	28946	16799	5632	171272	227330	2250	0	0	350
MIN	368646	651084	477031	1175277	213464	0	0	6146	54
PET	126628	734155	145332	863213	521420	1654974	0	0	28271
CHM	137084	308761	232203	2018159	2645906	117745	0	1711	10884
PAP	37859	20696	9488	186071	248553	27143	7055	497	3004
FER	17	5835	198	6348	6177	3234	0	0	6528
CEM	1419	4361	1758	72661	7136	31	24	0	9
IRS	3193	3560402	176752	3869196	6330835	18877	2020	0	147
ALU	1372	3380076	935163	2161226	4271787	18924	2551	0	212
OMN	171932	1036459	217809	7001479	4244945	361252	12119	5426	23057
MCH	7106	342501	157092	2824181	12649358	797475	40206	12174	5690
NHY	248364	1113522	190742	874539	603835	4222060	832	61371	1508
HYD	46020	206328	35343	162046	111887	782319	154	11372	280
NUC	6990	31339	5368	24613	16994	118826	23	1727	42
BIO	176	2237	555	119407	8788	2418	0	0	7717
WAT	23	633	187	20829	1912	21709	0	315	211
CON	9669	103161	68902	858778	1039096	353407	21809	5453	25876
LTR	127948	611392	161034	1316451	1293680	389306	11580	5827	118111
RLY	147032	955566	161873	524171	211815	531289	12148	7897	8184
AIR	13577	51495	11825	41876	12219	53022	406	776	635
SEA	655	3886	1032	32578	33574	4699	853	81	2670
HLM	0	0	0	0	0	0	0	0	0
SER	383060	3200680	651886	5679499	7705456	2107244	139633	32654	240078
Lab	251382	2243925	786206	5060576	3681199	320002	1087917	25610	1877973
Cap	624803	3903004	350669	7187010	4935561	2711260	1466763	241362	1859180
Land									
RNASE									
RAL									
ROL									
RASE									
ROH									
USE									
USC									
UCL									
UOH									
PVT									
PUB									
GOV									
ITX	111024	1029909	356922	2600023	4055593	-1769435	-32813	834	0
CAC									
ROW	629557	3333828	7439439	30835793	11813863	0	0	0	0
TOT	3747403	29274019	13074201	76764616	67278659	14966987	2773280	421233	4481857

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	CEM	IRS	ALU	OMN	MCH	NHY	HYD	NUC	BIO
CO2 (000'tons)									
CH4 (000'tons)									
N2O (000'tons)									
Oil (mt)									
coal (mt)									
Forest Land (Mha)									
Crop land (Mha)									
Grass land(Mha)									
Env.Theme (000’tons)									

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	WAT	CON	LTR	RLY	AIR	SEA	HLM	SER	Lab
PAD	49	113	18	0	0	111	3612	718905	
WHT	93	80	1300	0	0	117	4530	397700	
CER	388	1061416	953328	0	0	712	13580	2341984	
CAS	611	800	0	0	2	0	0	146536	
ANH	178	601652	0	0	0	0	10338	1285048	
FRS	41	83419	0	9	0	0	0	2992	
FSH	50	43	0	0	0	0	0	17098	
COL	101	1970	0	4164	0	0	0	20790	
OIL	619	23	0	0	11	0	0	13295	
GAS	163	325	0	0	0	0	0	6777	
FBV	543	424	18874	0	0	837	0	2467947	
TEX	112	93123	79766	910	50	941	17421	152856	
WOD	99	919489	1068	97	0	0	0	23867	
MIN	10	3729164	0	0	0	0	0	27148	
PET	2190	3355210	12200344	268248	97767	43643	70748	950541	
CHM	6332	1141838	2324087	8258	135793	183592	2391228	1138535	
PAP	1524	36405	153476	4697	951	460	14464	287397	
FER	1241	11379	230	6	0	0	0	14203	
CEM	0	3969131	0	0	0	0	0	1738	
IRS	2159	10273278	891	409	0	0	0	207244	
ALU	57	3853	326	0	0	0	0	122373	
OMN	4979	8386495	2113947	1250215	91698	103333	133745	2538691	
MCH	4336	2366624	933154	41763	5363	12665	104722	2176907	
NHY	22460	895618	28247	695572	2400	5157	15150	647088	
HYD	4162	165952	5234	128885	445	956	2807	119901	
NUC	632	25206	795	19576	68	145	426	18212	
BIO	140	285604	4041	29	0	3	58	20010	
WAT	141549	177244	15485	320	985	18334	900	109167	
CON	116775	3790532	642021	866250	36259	36649	222340	3491684	
LTR	6722	4110131	2382395	91440	60647	77416	227590	3952304	
RLY	656	981304	532260	568506	1416	1228	1859	114131	
AIR	47	92231	142044	3437	1177	512	1043	57923	
SEA	183	25850	41715	1673	375	201	43820	103162	
HLM	0	0	0	100676	0	0	0	173246	
SER	89571	9607585	8210058	232405	112249	176900	761775	19477882	
Lab	326430	22499481	9807816	2462740	263300	578908	4692207	71922015	
Cap	363570	9461837	7531709	1774196	197957	415166	2693040	95799645	
Land									
RNASE									13686272
RAL									30655386
ROL									9597032
RASE									23604200
ROH									6014659
USE									17416862
USC									63190125
UCL									9330416
UOH									2282323
PVT									
PUB									
GOV									
ITX	8260	2468171	2627536	224044	44498	48704	414210	790126	
CAC									
ROW	0	0	478851	0	0	0	0	7888498	
TOT	1107034	90622999	51231016	8748525	1053410	1706690	11841614	219745567	175777274

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Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	WAT	CON	LTR	RLY	AIR	SEA	HLM	SER	LAB
CO_2 (000'tons)									
CH_4 (000'tons)									
N_2O (000'tons)									
Oil (mt)									
coal (mt)									
Forest Land (Mha)									
Crop land (Mha)									
Grass land(Mha)									
Env.Theme (000'tons)									

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	Cap	Land	RNASE	RAL	ROL	RASE	ROH	USE	USC
PAD			921172	1929082	465192	2615038	686698	882091	971107
WHT			527070	1103765	266169	1496249	392909	504706	555640
CER			1827586	3590841	947921	4944834	1532174	2474139	2817419
CAS			299626	627464	151311	850582	223359	286913	315868
ANH			1203885	1541555	566288	4038074	1205631	2093656	2433331
FRS			56650	106912	28156	168129	46044	38522	42409
FSH			270564	566605	136635	768082	201695	259085	285231
COL			2587	4806	1392	7050	2297	3982	4539
OIL			0	0	0	0	0	0	0
GAS			8530	15845	4591	23244	7574	13128	14966
FBV			2337903	4286378	1252981	6672925	2092675	3174404	3775280
TEX			1086663	1857987	535414	3279454	1057461	1576595	1917142
WOD			5587	5428	2970	18109	5942	11599	15773
MIN			0	0	0	0	0	0	0
PET			345403	571748	238310	1112680	650630	723282	1928089
CHM			419787	578193	220158	1431805	465963	850403	1564865
PAP			27994	36969	13736	96565	26651	56321	93756
FER			0	0	0	0	0	0	0
CEM			0	0	0	0	0	0	0
IRS			0	0	0	0	0	0	0
ALU			0	0	0	0	0	0	0
OMN			330690	364709	172486	1016206	356694	699474	968900
MCH			386716	426498	201709	1188372	417126	817979	1133052
NHY			149390	277486	80407	407068	132646	229909	262088
HYD			27681	51416	14899	75427	24578	42600	48563
NUC			4204	7810	2263	11457	3733	6471	7376
BIO			363625	686243	180725	1079176	295545	247261	272214
WAT			9931	18447	5345	27062	8818	15284	17423
CON			170198	280178	90104	537936	181655	295588	465387
LTR			1616071	2134167	792934	5560509	1538523	3251313	5412380
RLY			77718	102633	38133	288570	73988	156357	260284
AIR			18739	24745	9194	-48923	17839	37698	62755
SEA			58125	76759	28519	307632	55336	116939	194666
HLM			534718	1300190	354222	2104424	1185892	930716	1834783
SER			4613267	6644682	2597189	15922245	6145036	10965155	21129082
Lab									
Cap									
Land									
RNASE	11301847								
RAL	99289								
ROL	591941								
RASE	28570049	17027026							
ROH	17120543								
USE	19042479								
USC	4147757								
UCL	1346862								
UOH	6309825								
PVT	32937007								
PUB	9545700								
GOV	7439300		355411	0	0	4142314	1419397	0	2379634
ITX			802814	1317718	426876	2548941	867247	1406262	2238702
CAC	44737987		10554871	5666113	2167887	18770185	5912228	10750880	25845192
ROW									
TOT	183190587	17027026	29415175	36203372	11994117	81461420	27233983	42918713	79267896

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	CAP	LAND	RNASE	RAL	ROL	RASE	ROH	USE	USC
CO_2 (000'tons)									
CH_4 (000'tons)									
N_2O (000'tons)									
Oil (mt)									
coal (mt)									
Forest Land (Mha)		0.16							
Crop land (Mha)		0.45							
Grass land(Mha)		0.01							
Env.Theme (000'tons)	1769746								

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	UCL	UOH	PVT	PUB	GOV	ITX	CAC	ROW	TOT
PAD	295510	156272			102487		101482	595043	14960001
WHT	169082	89414			53035		-115959	533924	10099591
CER	662037	460271			185878		551811	742389	33298342
CAS	96119	50830			0		709321	141521	13059415
ANH	405042	396006			340150		438181	282915	21355984
FRS	12905	6825			61		4938	212218	993915
FSH	86796	45899			0		4929	656848	4030348
COL	1797	815			6326		-80482	16566	5696101
OIL	0	0			0		-6482	112740	19224020
GAS	5924	2688			27381		11623	75561	1783816
FBV	892075	647357			398033		1400206	2500625	37164725
TEX	342432	326420			328519		594522	8394477	28266621
WOD	1513	2298			107		-1003963	45794	1185711
MIN	0	0			0		-130444	4862982	11783655
PET	211808	209213			421402		-2900636	2787765	32908109
CHM	188901	230639			908608		4992972	6114416	52288252
PAP	11664	15059			80533		94443	167706	3998014
FER	0	0			213		-58531	240268	6503117
CEM	0	0			0		-330620	7135	3747403
IRS	0	0			0		1842627	2699301	29274019
ALU	0	0			0		543543	1313233	13074201
OMN	100834	150272			539350		21869319	21128635	76764616
MCH	117917	175731			580572		30745595	6497608	67278659
NHY	103738	47068			529604		0	0	14966987
HYD	19222	8721			98132		0	0	2773280
NUC	2920	1325			14905		0	0	421233
BIO	82835	43821			0		0	0	4481857
WAT	6896	3129			457828		0	0	1107034
CON	69489	84079			738347		73456402	0	90622999
LTR	673354	869322			844476		1440554	3824555	51231016
RLY	32382	41806			151856		455432	958135	8748525
AIR	7807	10080			20100		33413	106138	1053410
SEA	24218	31267			45962		197583	112451	1706690
HLM	322525	810765			2189457		0	0	11841614
SER	2307761	3926428			33042548		4512415	27110384	219745567
Lab								-251300	175777274
Cap								-2726500	183190587
Land									17027026
RNASE					3307145			1119912	29415175
RAL					4070341			1378356	36203372
ROL					1348497			456647	11994117
RASE					9158699			3101446	81461420
ROH					3061914			1036868	27233983
USE					4825346			1634026	42918713
USC					8912081			3017933	79267896
UCL					1413124			478532	12568935
UOH					1137160			385081	10114388
PVT					2163093				35100100
PUB									9545700
GOV	3975924	634321	14434600			35574693		4669800	75025393
ITX	330440.287	408564			594826		8762980	795880	35574693
CAC	1007065	227683	20665500	9545700	-7072703			-641415	148137174
ROW									106696599
TOT	12568935	10114388	35100100	9545700	75025393	35574693	148137174	106696599	

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	UCL	UOH	PVT	PUB	GOV	ITX	CAC	ROW	TOT
CO_2 (000'tons)									
CH_4 (000'tons)									
N_2O (000'tons)									
Oil (mt)									
coal (mt)									
Forest Land (Mha)									
Crop land (Mha)									
Grass land(Mha)									
Env.Theme (000'tons)									

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	CO_2 000'tons)	CH_4 (000'tons)	N_2O (000'tons)	Oil (mt)	coal (mt)	Forest Land (Mha)	Crop land (Mha)	Grass and(Mha)	Env.Theme (000'tons)
PAD	11589	3327	41						94028
WHT	8477	0	35						19420
CER	18240	0	40						30705
CAS	3615	0	25						11305
ANH	49426	10216	1						264278
FRS	0	0	0						0
FSH	1	0	0						1
COL		730			8410				15330
OIL		71		20					1495
GAS		708							14872
FBV	27626	7	0						27837
TEX	1861	26	0						2413
WOD	351	0	0						353
MIN	1460	0	0						1465
PET	33788	4	0						33886
CHM	27889	14	17						33555
PAP	5223	25	0						5780
FER	31514	3	1						31765
CEM	129920								129920
IRS	116958	15	1						117621
ALU	2729	0	0						2729
OMN	41822	1	1						42092
MCH	17662	0	0						17776
NHY	715830	980	11						739704
HYD									0
NUC									0
BIO									0
WAT									0
CON	89	0	0						90
LTR	121211	23	6						123554
RLY	6109	0	2						6845
AIR	10122	0	0						10211
SEA	1416	0	0						1431
HLM									0
SER	1568	0	0						1583
Lab									0
Cap									0
Land						0.09	1.34	0.20	0
RNASE	16306	190.189	3	21215.69					21216
RAL	29861	323	5	38226.28					38226
ROL	8866	124	2	12056.42					12056
RASE	49358	602	9	64877.3					64877
ROH	17461	320	5	25597.61					25598
USE	8403	919	4	29074.43					29074
USC	22105	1454	12	56212.31					56212
UCL	2492	284	1	8858.502					8858
UOH	2414	197	1	6943.122					6943
PVT									
PUB									
GOV									
ITX									
CAC									
ROW									
TOT									

Contd………..

Appendix 1: Environmental Social Accounting matrix of India 2006-07 (Rs. Lakhs for monetary transaction & others in physical units)

	CO_2 (000'tons)	CH_4 (000'tons)	N_2O (000'tons)	Oil (mt)	coal (mt)	Forest Land (Mha)	Crop land (Mha)	Grass land(Mha)	Env.theme (000' tons)
CO_2 (000'tons)									-275358
CH_4 (000'tons)									
N_2O (000'tons)									
Oil (mt)									
Coal (mt)									
Forest Land (Mha)									
Crop land (Mha)									
Grass land(Mha)	10490								
Env.Theme (000'tons)									