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Global Warming and Household Emission: A Case Study!

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Abstract: Global warming is a situation of increase earth surface temperature due to over existence of Green House Gases (GHGs) in the atmosphere. A large part of the GHGs comes from the household sector. So, to reduce GHGs emission from the atmosphere it is important to reduce the household level emission. But, before reducing emission it is important to measure the household emission. To measure the emission we have selected the rural household,as no studies have been conducted in this regard in the district of Paschim Medinipur, west Bengal. To measure the household emission we have used specific emission factor for different components. Basically primary data have been used for the study and these data have been analysed with the help of very simple statistics like mean, percentage etc. We found from the study that per capita Carbon Footprint of the study area is 0.82 ton Carbon dioxide Equivalent (Co_2e) which is far low than average Per Capita Carbon footprint of World ($5tCO_2e$) as well India ($1.8tCO_2e$).

Keywords: Carbon footprint, household emission, Green House Gases (GHGs), Global warming, etc.

Introduction: Increase in earth's average surface temperature due to the effect of Green House Gases (GHGs) is popularly known as Global warming. Basically there are six major Green House Gases in the atmosphere. But, considering the availability and durability in the atmosphere Carbon dioxide is considered as most significant GHGs for causing Global warming. For this environmentalists are more concerned for reducing CO_2 from the environment to fight Global warming. GHGs are emitted both from the industry sector and household sector. From the previous study it is observed that about 40% of the GHGs come from the household sector. So to reduce the overall GHGs from the atmosphere it is very important to reduce the emission from the household sector. Total amount of Green House Gases produced directly or indirectly by an individual or a household or an organisation is popularly known as Carbon Footprint and it is measured in terms of equivalent tons of Carbon dioxide (tCO2e). But, before controlling the household level emission it is important to measure the household sector GHGs emission from its different household activities like cooking, food, transportation, electrification and mobile communication etc. We found from the Study of literature that no studies have been conducted in India regarding the measurement of rural household emission. In this backdrop, we have measure the rural household carbon footprint that is generated from different household activities. Household emission is generated from different household activities. We have classified the all household categories broadly in electricity, transportation, food, cooking and communication (use of mobile phones).

Literature Review:

Parikh (1997): looked into the differences in consumption pattern across income groups and their carbon dioxide implications. The main finding was that the richer

households had a more carbon intensive lifestyle with the urban emission levels being 15 times as high as those of the rural poor.

Shonali Pachauri (2004): The objectives of the study were to evaluate the variation in the pattern and quantum of household energy requirements, both direct and indirect, and the factors causing such variation. For doing this they used micro level household survey data from India for the year 1993–1994. The analysis of the data revealed that socio-economic, demographic, geographic, family and dwelling attributes of the households influence the total household energy requirements. There were also large variations in the pattern of energy requirements across households belonging to different expenditure classes. They concluded that total household expenditure or income level was the most important variable causing variation in energy requirements across households. In addition, the size of the household and the age of the head of the household were related to higher household energy requirements. In contrast, the literacy of the head of the household was associated with lower household energy requirements.

Mehdi Farsi, Massimo Filippini, Shonali Pachauri (2006): The objectives of the study were to identify the major factors responsible for choice of cooking fuels (out of kerosene, firewood, and LGP) in urban Indian households, based on micro level data. They found that income, price of the fuel, sex and age of the head of the family, family size, and education status of the family had an impact on choice of the cooking fuel. They found that easy accessibility of the cleaner fuels and opportunity cost of the firewood in the urban areas affected the choice of the cleaner cooking fuel and these choices did not change with changes of seasons. They also found that age of the head of the households and family size had positive impact on the probability of choosing cleaner cooking fuel. On the other hand, higher income households were inclined to more use of cleaner cooking fuel and women empowered households were more used to cleaner cooking fuel. The study further revealed that families with higher education were also used to cleaner cooking fuel because of increased awareness regarding health hazard associated with the uses of biomass cooking fuels.

Carbon Trust (2006): conducted a survey to know about how the households in UK used the energy and fossil fuels and how it contributed to the UKs total emission. They concluded that Households' direct energy consumption (domestic heating, private transport, and electricity for appliances) currently accounted for approximately 40 per cent of the UK's carbon emissions, the rest originating from commercial enterprises and the public sector, and consumed through food, clothing, leisure activities, etc. So, efforts must be put to reduce the emission at individual level which in turn reduced the national emission.

Jie Li and Yan Wang (2010): The objective of the study was to identify the CO_2 emission at the household level in urban and rural areas of China. They also concentrated on identifying the major factors having positive as well as negative impact on carbon emission. They concluded that there was a significant difference in carbon emission between rural and urban people. The study revealed that education and age of the head of the family and education level of the family had a positive impact on carbon emission whereas size of the households had a negative impact. They also calculated the income elasticity of the CO_2 emission and found that there was a significant difference between the income elasticities of the rural and urban people.

Database and Research Methodology:

a. Study area:

We have conducted our study in the district of Paschim Medinipur, West Bengal.

b. Period of Study

The period of study is 01.01.2015 to 31.12.2016.

c. Sample Size and Sample design:

We have adopted multistage stratified random sampling to select ultimate sample household units for our study. We have taken Paschim Medinipur district purposively. As per Census 2011 this district has 29 blocks and 9 municipalities. Households of the Blocks have been considered as the rural household. We have selected randomly 3 blocks (Keshiary, Jhargram and Salboni) (representing 10% of the population).Then we have taken 6 villages each from the selected blocks and ultimately we have selected 15 household each from the selected 6 villages. In this way our total sample size comes to 270 households.

d. Sources of Data

Basically we have use primary data and in some cases have also used secondary data. For collecting primary data we have used structured questionnaire and have followed direct interview method. For collecting the secondary data we have basically used different websites.

e. Methodology

To reach our target sample unit i.e. household we have used multistage stratified random sampling technique. To analyse the data we have used very simple statistical technique like mean, percentage etc.

Analysis and Findings:

Ultimate objective of our study is to calculate or measure carbon footprint of the rural household of the study area. From the previous study it is observed that household emission depends upon a large number of factors such as food habits, choice of cooking fuels, choice of mode of transportation etc. To calculate the household emission we have taken five most important household activities such as food, electricity, transportation, cooking and communication (use of mobile phones). We also have studied household expenditure categories, consumption of different food ingredients, choices of cooking fuel ingredients, choices of mode of transportation and uses of quantity of electricity etc.

Table no.1

Average monthly expenditure category of rural households

Sl.No.	Items of expenditure	Amount of expenditure (Rs.)	Percentage (%)	Per capita(Rs.)
1	Electricity	210.57	4.13	49.89
2	Transportation	621.48	12.18	147.27
3	Food	2891.11	56.67	685.07
4	Medical	364.07	7.14	86.27
5	Education	487.40	9.55	115.49
6	Clothing	431.85	8.47	102.33
7	Holiday	95.18	1.86	22.55

Source: Field survey

Table no. 1 shows the activity wise household expenditure percentage and per capita expenditure for different activities of the households. In this case, household activities

come in the following order if arranged on the bases of the amount of monthly expenditures (percentage) spent on the different items: food activities followed by transportation, education, clothing, medical, electricity and holiday trip respectively. Same trend is observed in case of per capita expenditures also.

Table no. 2

Average annual per capita rice and wheat consumption of households

Types of Households	Average annual per capita rice consumption (kg.)	Average annual per capita wheat consumption (kg.)
Rural households	87.40	14.33

Source: Field survey

Table no. 2 shows the average annual per capita consumption of rice and wheat of the households. Rice and wheat are consumed mainly as food grains in the study area and consumption of these food grains has significant impact on per capita carbon footprint. Rice has more emission intensity than that of wheat. So, households can reduce their per capita carbon footprints just by changing their food grain selection. From the table it is observed that consumption of wheat is very low in comparison to rice consumption. Average annual per capita consumption of rice is 87.40 kg. whereas consumption of wheat is 14.33 kg. for the study area.

Table no. 3

Average annual per capita poultry meat and red meat consumption of households

Types of Households	Average annual per capita poultry meat consumption (kg.)	Average annual per capita red meat consumption (kg.)
Rural households	4.54	0.45

Source: Field survey

Table no. 3 shows the average annual per capita consumption of Poultry meat and red meat of the households. Consumption of poultry meat and red meat has significant impact on per capita carbon footprint because of having higher emission intensity. Again, emission intensity of red meat is far greater than that of poultry meat. So, there is scope for reducing the emission by replacing the red meat with the poultry meat. Average annual per capita consumptions of poultry meat and red meat are 4.54 kg. and 0.45 kg. respectively for the study area.

Table no. 4

Average annual per capita uses of different types of cooking fuels of households

Types of Households	Average annual per capita cow dung cake consumption (kg.)		Average annual per capita firewood Consumption (kg.)		Average annual per capita kerosene consumption (ltr.)		Average annual per capita LPG consumption (kg.)	
	Total	%	Total	%	Total	%	Total	%
Rural households	84.14	30.37%	178.52	64.44%	6.31	2.28%	8.13	2.93%

Source: Field survey

Table no. 4 shows the annual average per capita consumption of cooking fuels of the households. In this study, we have considered LPG as modern cooking fuel and use of kerosene, cow dung cake, and firewood as traditional cooking fuels. It is possible to reduce the emission from cooking activities by fuel shifting i.e. from use of traditional cooking fuel to modern cooking fuel. It is observed that about 2% of the total cooking fuel consumption is modern i.e. LPG and the balance comes under traditional category. In case of traditional cooking fuel consumption about 65% is firewood consumption, 30% is cow dung cake, and the balance i.e.3% is kerosene. Analysing the fuel consumption pattern percentage consumption of modern cooking fuel use is very less and it is happening for households not having LPG connection as well as for non-use or occasional use of LPG by the households. So, there is an ample scope for reducing the emission from the cooking fuel just by fuel shifting from traditional one to modern one.

Table no. 5
Per capita annual average use of private and public transport (kilometre)

Types of Households	Per capita annual private transport(km.)	Per capita annual public transport(km.)
Rrural households	38.86	65.4

Source: Field survey

Table no. 5 shows the annual average per capita use of public and private transportation. In this study, we have considered the use of motor bike, car and use of taxi service or hired car as private transport and use of bus, train, aeroplane, and tracker or auto service as public transport. Due to having sharing benefits, public transport results in reduction of per capita carbon footprint and this benefit is not available in case of private transport and per capita carbon footprint increases with the use of private transport. From the table it is observed that per capita public transport use is 65.4 km. and it is 38.86 km.

Table no. 6
Annual average per capita electricity consumption of households

Types of Households	Annual average per capita electricity consumption (kwh.)
Rural households	119.66

Source: Field survey

Table no. 6 shows the annual average per capita electricity consumption of the households. It is observed that it is 119.66 kwh for the study area.

Table no. 7
Average annual per capita emission from different household activities of Rural and Urban households

Status of households	Electricity (mt CO_2e)		Food (mt CO_2e)		Cooking (mt CO_2e)	
Rural households	0.108107	13.12%	0.153687	18.65%	0.374945	45.5%

Source: Field survey **(Contd…..)**

Table no. 7 (Contd..)
Average annual per capita emission from different household activities of Rural and Urban households

Status of households	Transportation (mt. CO_2e)		Mobile (mt. CO_2e)		Total (mt. CO_2e)	
	Qty.	%	Qty.	%	Qty.	%
Rural households	0.150955	18.32	0.036378	4.41	0.824072	100

Source: Field survey

Table no. 7 shows the annual average per capita carbon footprint of households generating GHGs from different household activities. It is observed that highest amount of emission comes from the cooking activities (45.5%), followed by food (18.65%), transportation (18.32%), electricity (13.12%), and use of mobile (4.41%) respectively for sample households.

Conclusion:

A large part of the total emission comes from the household sector. So to reduce the total emission it is important to reduce the emission. Presently per capita carbon footprint of the world is whereas the per capita carbon footprint of India is and per capita carbon footprint is only $0.82tCO_2e$. So per capita emission of the study area is far low than that of world average as well as India also. It is possible to reduce the household emission just by changing our behaviour towards the different household activities and choices of lifestyle. Activity wise measurement of carbon footprint shows that maximum amount of emission in case of rural households comes from the cooking activities due to more use of traditional cooking fuels. So it is possible to reduce the households emission by changing choices of cooking fuels, mode of transportation, food ingredients etc.

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