Determining a Carbon Tax Rate for India in the Context of Global Climate Change

Unmilan Kalita , Nissar Ahmed Barua

Abstract*: *Global warming has been described as "the biggest externality the world has ever seen". With international policymaking gradually taking into account initiatives to tackle climate change, the idea of putting a price on carbon has also received much acclaim. Pricing carbon, in the form of a carbon tax, was put forward as a policy initiative with the commencement of the Paris Climate Summit of 2015, as such a policy, could address emissions at the sources while being the least intrusive with the lowest burden on taxpayers. India is the third largest emitter of greenhouse gases globally but has also been a pioneer in acknowledging carbon taxes. The government has claimed its high excise duties on petrol and diesel, along with the Clean Environment Cess on coal consumption, to be implicit carbon taxes. Interestingly, while a carbon tax should be linked to carbon emissions, current indirect taxes by the government are not at all linked to them while are mostly used as revenue generating measures or compensating the States as part of GST revenue losses. This paper envisages to examine the case for introducing a carbon tax regime in India vis-à-vis fossil fuel consumption in the economy, with a subsequent determination of a unique carbon tax rate for India. To achieve India's Nationally Determined Contribution (NDC) targets of Paris Summit, it is imperative that India introduces an explicit carbon tax that links fuel prices to emissions, which can have a cascading effect of reducing their consumption while switching to cleaner fuels as substitutes. Findings from the study indicate that coal faces a minimal tax burden while being the most polluting whereas natural gas faces a high tax burden even though it is cleanest among all. As part of the study, a tax rate has been derived that is expected to act as a policy benchmark and can nudge tax policies in the right way, as switching to a low-carbon economy forms a primary agenda of India, in this era of a hothouse Earth.

Keywords*: *Carbon Tax, Climate Change, Fiscal policy, Social Cost of Carbon.

I. INTRODUCTION

There was a time when Ralph Waldo Emerson cherished the exquisiteness of nature thoughtfully penning, "Earth laughs in flowers". Decades later, its significance has become relevant more than ever with forests being desertified, population growing exponentially and the planet getting 1.2^0 C warmer compared to pre-industrial levels with irreversible consequences. Accentuation of the *greenhouse effect* due to increased anthropogenic interventions and a continuous upsurge in global carbon dioxide (CO_2) emissions have brought unwanted changes in the atmosphere endangering the lives of numerous species living within.

Taking cognisance of the severity of climate change, the international community soon realised that to achieve their ambitious global and national emission reduction objectives, *putting a price on carbon is essential for decarbonising the environment* [1]. Along with the Carbon Pricing Leadership Coalition (CPLC) of World Bank and the Paris Agreement (COP21), currently there exists more than 40 national carbon pricing agreements and mechanisms implemented across the world, covering approximately 11 gigatons of CO_2 equivalent ($GtCO_2e$), representing 20.1% of global GHG emissions [2]. India has been a major stakeholder in the run against climate change since ratification of the UNFCCC in 1994. The National Action Plan for Climate Change (NAPCC) was formally launched in 2008. India also ratified the Paris Agreement in 2015, declaring its Nationally Determined Contribution (NDC) to reduce emission intensity.

The present paper entails an examination of the tax measures taken by the Government of India vis-à-vis fossil fuel consumption in India. While analyzing the basis of a carbon tax in the backdrop of its conceptual framework, this paper seeks to determine a carbon tax rate in the context of the challenges that confront the Indian economy.

(1) Literature Review

Global warming has been described as *"the biggest externality the world has ever seen"* [3]. Externalities form as a consequence of activities of individuals or industries in the form of greenhouse gas (GHG) emissions that spread across the globe and tend to persist for over a long period of time. International consensus on GHG emissions as negative externalities was observed when the Intergovernmental Panel on Climate Change (IPCC) in their Fourth Assessment Report (2007) noted that human actions have a probability of 90% or greater to be the cause of global warming. The Paris Summit of 2015 (COP21) marked a turning point for global climate actions when it decided to limit the global temperature rise to well below 1.5^0 C above pre-industrial levels. The Summit concluded with provisions in place for enhanced cooperation among nations with respect to mitigation through marked based approaches. Carbon pricing was put forward as a tool that could "reduce emissions by a magnitude greater than what is possible today" [4].

The original concept of using environmental taxes (carbon tax) to advance social welfare is generally credited to A.C. Pigou's famous publication, *The Economics of Welfare* (1920). The concept that he presented is now popularly accepted and applied within the domain of public finance and environmental economics. Such a tax can simply be applied on carbon dioxide emissions (a major GHG) or could be spread across all GHG emissions, including methane emissions [5]. Major design priorities for a carbon tax mechanism includes choosing the appropriate price, emissions coverage, the point of taxation (upstream or downstream),

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stringency (planned escalation of price over time), the flexibility of the price to change in light of new information on marginal cost of abatement, allocation of revenue generated from the tax towards general public spending or specific emissions-reducing activities, and harmonisation across boundaries beyond the tax jurisdiction [6]. A carbon tax, to be efficient, should cover all sources and be set equal to the marginal benefits of emission reduction, represented by estimates of social cost of carbon [7]

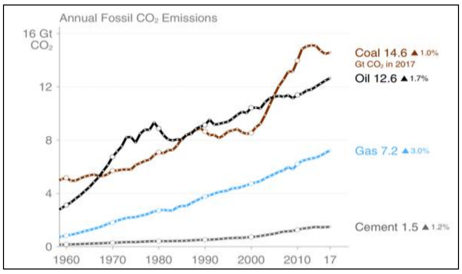
[8] estimated that a dozen nations factor in the carbon emissions treating them as externalities whenever they do policymaking analysis. Countries like USA and UK take SCC into account on an ex-ante basis so as to steer policies in a conducive manner with regard to investment decisions. It is imperative to note that although mostly developed nations undertake this practice of calculating social damage, a similar policy in a developing nation like India will immensely assist fiscal and investment policy environment.

In India's context, [9] have observed that an upstream carbon tax at ports, mine-heads, etc., will result in a rise of prices in fuel and energy corresponding to their carbon content. They estimated that a carbon tax of ₹ 2,818 per metric tonne of CO_2 will increase the average price of electricity from ₹ 3.73 (current value at the time of the study) to INR 4.67 per kWh. [10] had also vaguely traced a similar pattern as [9]. Regarding distributional impacts of a carbon tax, [11] observed that a carbon tax in India is "mildly progressive" and progressivity is higher in rural sector as compared to urban, and it varies across fuel types. It was found to be regressive for kerosene, but beneficial for LPG. They, however, noted that such effects are still unclear, until further research lights the path.

Carbon tax constitutes one of the most effective state interventions to combat climate change. However, this fiscal instrument has failed to find a significant place in Indian public finance intervention. This presents a legitimate case for highlighting strategies on carbon taxation as an effective operational tool against global climate change.

(2) Conceptual Framework

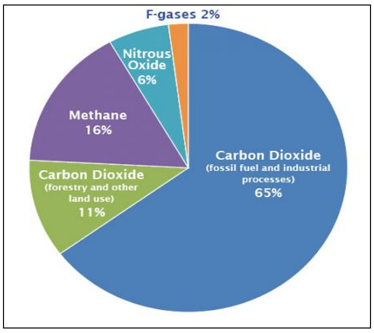
Earth is considered to be a greenhouse, housing a number of gases such as carbon dioxide (CO_2) and methane, also known as greenhouse gases (GHG), in the atmosphere. These gases are the sole reason behind Earth having a mean surface temperature of 33^0 C. If it were not for these gases and the greenhouse effect, Earth's average temperature would be a chilly -18^0 C [12]. CO_2 constitutes a major chunk (81%) of the GHGs that lend the Earth its greenhouse effect.



Source: Global Carbon Project, 2018

Figure 1: Annual CO_2 emissions from fossil fuel sources in FY 2017-18

With industrialisation and anthropogenic land-use changes over the last two centuries, CO_2 has now become the primary cause of global warming. The sources of carbon emissions comprise of desertification, wetland destruction, anthropogenic land use changes, combustion of fuels and so on [13]. From 300 parts per million (ppm) in 1950, CO_2 concentration has increased to around 420 ppm in 2019.



Source: GHG-platform India

Figure 2: Anthropogenic GHG emissions at a global level

CO_2 and its emissions form the central part of our study as it constitutes more than 75% of global GHG emissions. Therefore, CO_2 has been taken as a proxy for overall GHG emissions in our study and a tax rate based on it is derived upon.

A possible strategy for mitigating carbon emissions is a carbon tax. Considered as an indirect tax, it is referred to as a price instrument that sets a price on pollution, in general, and carbon emissions, in particular. A C Pigou proposed taxation of the goods (fossil fuels) which were the source of negative externalities (CO_2). This was done so as to precisely reflect the cost of the goods' production to society, thereby internalising the costs associated. Therefore, a carbon tax or Pigouvian tax is a tax on a negative externality which is CO_2 in our case. However, it is difficult to determine a tax rate based entirely on Pigou's idea and needs detailed modelling.

The SCC approach is the most popular method of determining carbon prices. It is estimated as the net present value of climate change impacts over the next 100 years (or longer) of one additional tonne of carbon emitted to atmosphere today [14]. It is determined using Integrated Assessment Models (IAM) such as DICE, RICE, PAGE, FUND and so on.

(3) Objectives

The objectives of the study are:

I. To assess carbon emissions in the backdrop of Indian economy
II. To examine the existing tax measures implemented by the Government of India to address the emission intensity of CO_2 vis-à-vis fuel sources.
III. To determine a carbon tax rate for India based on a statistical comparison of global estimates.

(4) Methodology

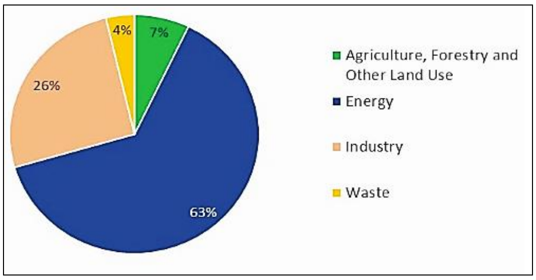
The methodology of this paper comprises of a discussion on the carbon emission scenario of India, an assessment of the tax measures taken to mitigate such emissions and a subsequent determination of a carbon tax, based on a comparative analysis of global SCC estimates. The analysis if entirely based on secondary data, collected from international agencies such as UNFCCC and several prominent research works. The statistical interpretation has been done using SPSS v23.0 and Microsoft Excel 2016.

II. MATERIALS AND METHODS

(1) Carbon emission scenario of India

India is the world's third largest emitter of GHGs, after China and the United States. India is immensely diverse, both in geographical and societal aspects, and is also endowed with rich resources of fossil fuels. As such, relying on a business-as-usual carbon-intensive economic regime has been a norm since the initiation of the era of growth and development after independence. According to a report, titled "CO_2 Emissions from Fuel Combustion" of the International Energy Agency, carbon levels in India from fuel combustion have increased from 181 million tonnes (Mt) in 1971 to 2,066 Mt in 2015- a 1,041 per cent increase.

India's carbon emissions majorly result from intensive fossil fuel use in the energy and industrial sector as India is home to a very large population and energy demand is at an all-time high currently. This has led to varied impacts such as unsustainable fuel-use, inefficient land-use, rising automobile usage, dirty coal usage and so on.



Source: GHG Platform- India

Figure 3: Sector-wise emission intensity of India

The energy sector accounts for two-thirds of the total emissions, followed by industrial and agricultural processes. This results from intensive use of conventional fuel sources by the thermal power plants including heavy automobile usage. Evidence points out that this sector emitted nearly 929 million tonnes of CO_2 in 2017-18. For the same year, India's levels were 18% of the total CO_2 emitted from all sources in the United States and 20 times more than that emitted in Finland, which has the cleanest air among all nations.

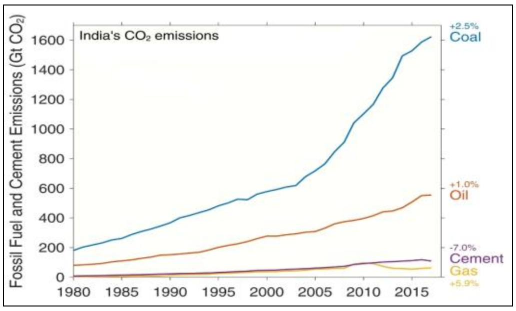
Table 1: Sector-wise consumption of fuels in India, FY 2015-16

Fuels	Transport	Energy	Industry	Agri.	Misc.	Total Fuel	Emission factors CO_2/MBtu	Total CO_2 emissions (%)
LPG	171	2.90	1,543	7.0	690	20,632	2,940	2,940
Kerosene	0.0	0.1	64	0.0	113	6,826	3,165	3,165
High Speed Diesel Oil	71,514	224.0	2,279	630	0.0	74,647	3,210	3,210
Crude Oil	380.00	430.0	5,616	57.00	0.0	6,482	3,227	3,227
Petroleum	21,847	0.0	0.0	0.0	0.0	21,847	3,105	3,105
Bitumen	0.0	0.0	5,938	0.0	0.0	5,938	3,265	3,265
Natural gas	0.0	27,340	18,200	0.0	0.0	45,540	2,808	2,808
Coking Coal	0.0	0.0	2,03,949	0.0	0.0	20,39,49,000	1,782	1,782
Thermal Coal	0.0	5,55,324	37,902	0.0	81,763	67,49,89,000	1,782	1,782
Biofuels	0.0	505	0.0	0.0	0.0	505	0.0	0.0
Biomass	0.0	0.0	0.0	0.0	0.0	3,600	0.0	0.0
Total Emissions (sector wise) $mtCO_2$	71.56	319.06	1,069.32	584.73	2.23	148.50	2,195.40	

Source: MPNG, 2017.

Table- 1 reflects that different fuels have different emission factors and more importantly, a wide diversity of usage. LPG and natural gas have comparatively lower emission factors as opposed to other sources, but do not have an apt amount of usage in transport, industry and energy sector. Among the petroleum fuels, we see a greater utility mostly in these sectors along with some usage of diesel in agriculture. This is of importance as the whole transportation system of India is based on conventional fuels and agriculture too is dependent on diesel. A similar trend is seen with coal (incl. bitumen) which has the highest emission factor among all other fuels. Coal being a cheap energy input, is widely used in industries and thermal power plants with some amount used by low-income households for energy production. Biofuels and biomass show very less usage and emissions. This is evident from their low level of production and subsequent low contribution in the overall energy mix.

With respect to carbon emissions, coal is seen to be contributing the biggest chunk of emissions. This is obvious, given its heavy usage in power sector coupled with its very high emission factor. Diesel and petrol trail behind with the greatest number of emissions which result mostly from usage in the transport and the industry sector. Interestingly, there has not been any decrease of emissions from power plants over the years. A growth of 7.4% CAGR between 2005 and 2013 is observed. Notably, coal-based plant emissions were 51 Mt CO_2e in 2005 that increased to 126 Mt CO_2e in 2013. In 2018, they emitted approximately 190 Mt CO_2e. This clearly shows that emissions have not been decreasing, rather are on an increasing trend.



Source: GHG Platform- India

Figure 4: Trend of CO_2 emissions (from energy sources) in India, FY 2017-18

(2) Assessing the Tax Measures Vis-À-Vis Carbon Emissions:

In addressing environmental problems, tax instruments have been found to contain significant benefits over other regulatory approaches. This is because, taxation measures not only *nudge* taxpayers towards paying for a particular good or a service (low-carbon product, in our case) but also generate revenue, which can then be utilised in assisting the production of such goods and services. Surprisingly, there are only two noteworthy measures to tax carbon in India:

I. ***Clean environment cess (CEC):*** The CEC was imposed as an excised duty on both imported and locally produced coal since 2010 under the Finance Act, 2010. National Clean Energy and Environment Fund (NCEEF) was created for the purpose of financing and promoting clean energy. Initially, the cess was ₹ 50 per tonne which has now been revised to ₹ 400 per tonne. This cess is considered to be an implicit carbon tax (Economic Survey. 2014-15). However, after introduction of GST, the cess proceeds have been diverted to compensating the states for losses in revenue on account of GST implementation. Earlier CEC was implemented by the Central Board of Excises and Customs (CBEC) but now the GST council has taken over it.

II. ***Taxing petrol and diesel:*** Taxes as excise duties on petrol and diesel are also considered as implicit carbon taxes (Economic Survey, 2014-15). These are intended to deal with not only usage reduction but also congestion costs, noise and local air pollution that damages community health. Interestingly, the government has explicitly stated their objective for using duty proceeds for raising revenue and other macro-economic considerations rather than prevent carbon emissions.

With respect to the CEC, statistics suggest that there has been huge diversion of funds allocated to NCEEF towards compensating states due to GST implementation. This is seen to be a gross misallocation of funds as proceeds from a cess should technically be spent on projects that supplemented the cause of the cess.

Year	Proceeds collected	Ministry of New and Renewable Energy (MNRE)	Ministry of Water Resources, River Development and Ganga Rejuv.	Ministry of Drinking Water and Sanitation	Ministry of Environment & Forests	Total allocation
2010-11	1,066	0	--	--	--	0
2011-12	2,580	160.8	--	--	59.95	220.75
2012-13	3,053	125.78	--	110.65	10	246.43
2013-14	3,472	1,218.78	--	--	0	1,218.78
2014-15	5,393	1,977.35	--	110.64	0	2,087.99
2015-16	12,676	3,989.83	1,000	--	244.97	5,234.8
2016-17	28,500	4,272	1,675	--	955.74	6,902.74
2017-18	29,700	5,341.7	2,250	--	1,111.3	8,703
Total	86,440.24	17,086.24	4,925	221.29	2,381.96	24,614.49

Source: MNRE, Government of India

Table 2- Distribution of proceeds from NCEEF (all figures in ₹ crores)

It is evident that only around 25% of proceeds have been channelized to fund projects related to environmental betterment and clean energy. Interestingly, not much data is available related to how successfully the projects have been implemented and what has been the actual outcome in terms of emission reduction. Monitoring, as can be concluded, has remained short of the objectives. Factually, of ₹ 86,440.21 crore collected as cess from 2011-18, only ₹ 20,942.29 crore was transferred to NCEEF. Of this amount, only ₹ 15,911.49 crore went to funding for clean energy projects. This allocation happened under the GST regime.

With respect to taxing petrol and diesel, these fuels suffer a very high effective tax burden. This is evident from the table below.

Table 3: Tax burden on petrol and diesel

Particulars	Petrol (₹)*	Diesel (₹)**
Price excluding taxes and dealer commission	34.19	39.52
Central taxes (incl. excise and customs duty)	18.65	14.57
State taxes (incl. VAT)	15.23	9.77
Dealer commission	3.55	2.50
Price	71.62	66.36
Effective tax burden (%)	**99.09%**	**61%**

*, **: effective at 01.06.2019 at Delhi

Data source: Ready Reckoner, June 2019, PPAC.

Petrol and taxes have high tax burdens which is in turn is a good incentive for consumers to reduce consumption of these fuels. Since such tax burden has been referred to as an implicit carbon tax, the proceeds from such taxes should have been used for financing clean fuels or clean energy projects. However, no such data is available and more importantly, the government has claimed these taxes as merely a revenue generating measure.

After GST was introduced, most of the fuels have been subsumed under it (including coal) but five petroleum products, namely, petrol, diesel, natural gas, aviation turbine fuel (ATF) and crude oil, has been left out of it.

Table 4: Effective tax burdens according to fuel types

Sl. No.	Fuel type	Coverage under GST	Tax burden (%)/ GST rate	Emission factor (kg CO_2/ MBtu)
1	Petroleum	No	90-120	71.30
2	Diesel	No	60-90	73.16
3	Natural gas	No	0-25	53.07
4	ATF	No	14-62	70.90
5	Crude oil	No	0-10	74.54

6	LPG	Yes	5 (domestic), 18 (non-domestic)	64.01
7	Kerosene	Yes	5 (fertiliser), 18 (non-fertiliser)	72.30
8	Naphtha	Yes	18	72.80
9	Coal	Yes	5 (+GST compensation cess @ ₹ 400/ton)	95.35
10	Petroleum Coke	Yes	5	102.10

Source: PPAC

As evident from the discussion above, there is no uniform approach towards taxing of fuels in India. For instance, domestic LPG has a lower GST rate than the non-domestic one. More importantly, the tax rates are not linked to the amount of carbon emissions at all. Coal and petroleum coke obviously have the highest emission factors whereas they are taxed at just 5% GST. Interestingly, government's ability to tax petrol and diesel further is also limited due to their already high tax burden. Such inconsistencies in pricing of fuels and uneven grounds of taxation is bound to reduce the effectiveness of taxation so as to tackle the problem of carbon emissions in India.

(3) Determination of the Carbon Tax

We have clarified in the first part of the study that we will be conducting a statistical comparison of SCC estimates of India derived on the basis of different models and finally derive a unique tax rate for India. This has been done because standalone SCC calculation is beyond the scope of this study. As such, we have enumerated global SCC (GSCC) estimates pertaining to the DICE 2010, 2013 and 2016 models of William Nordhaus. Additionally, estimates of FUND and PAGE model derived by the IAWG, along with IAWG's central estimate has been taken. Further, SCC estimate resulting from a prominent meta-analysis of SCC done by [15] has been taken. Table 5 displays the estimates of domestic SCC (DSCC) as per the RICE 2010, RICE 2016 and PAGE 2011 models.

Table 5: DSCC as per different models (% of global SCC)

Regions	RICE 2010,	RICE 2016,	PAGE 2011
United States	10	15	7
EU	12	15	9
Japan	2	3	na
Russia	1	3	na
Eurasia	1	5	na
China	16	21	11
India	**12**	**9**	**22**
Middle East	10	7	na
Africa	11	3	26
Latin America	7	6	11
Other High income	4	3	na
Other	12	8	16
Global total	100	100	100

Source: Nordhaus (2016)

In the following table, the GSCC estimates have been enumerated, represented in dollars. The estimates for DICE 2013 and DICE 2016 have been listed for the period 2015-2050, as has been estimated by [16]. The underlying idea for this pertains to the increase of carbon taxes in a phased manner. It can be seen that by 2050, an SCC of USD 51.5 (DICE2013) and USD 1006.2 (DICE2016) has been observed. Since DICE 2016 is considered a revised version of 2013, the cost of carbon is evidently higher. It must be noted that the models listed here estimate the SCC values based on different assumptions and scenarios. For ease of computation, the estimates taken here pertain to baseline scenarios.

Table 6: GSCC estimates as per different models (USD)

Models	GSCC (USD)				
DICE 2010	74				
DICE 2013 (2^0C limit damage)	2015	2020	2025	2030	2050
	47.6	60.1	75.5	94.4	51.5
DICE 2016 (2^0C limit damage)	184.4	229.1	284.1	351.0	1006.2
PAGE	66				
	74				
IAWG-US central estimate	40				
Ackerman and Stanton meta-analysis	21				

Using the DSCC estimates from table (5) and GSCC estimate from table (6), we have estimated a set of SCC for India in table (7), using the calculation method developed by [16]. It can be observed that the maximum corresponds to DICE 2016 and PAGE 2011, viz., USD 50.40. With respect to DICE 2016 values, for contemporariness, we have only estimated the values pertaining to the years 2015 and 2020. The minimum value corresponds to Ackerman and Stanton and RICE 2016 value. This is because the share of India in total SCC as per RICE 2016 is lower than RICE 2010. Moreover, the original meta-analysis value was very low compared to other models as it is based entirely on other studies and hence, is subject to various inherent underestimations.

Table 7: SCC for India (USD)

Models	RICE 2010		RICE 2016	PAGE 2011
DICE 2010	8.88		6.66	16.28
DICE 2013 (2^0C limit damage)	2015	2020	5.409	13.22
	5.712	7.212		
DICE 2016 (2^0C limit damage)	22.128	27.50	20.619	50.402
FUND	2.64		1.98	4.84
	22.32		16.74	40.92
PAGE	7.92		5.94	14.52
	8.88		6.66	16.28
IAWG-US central estimate	4.8		3.6	8.8
Ackerman and Stanton meta-analysis	2.52		1.89	4.62

Given the objective of our study, a specific carbon tax rate has to be obtained from among the set of SCC values estimated in table (7). As such, a set of descriptive statistics has been computed in table (8). It can be seen that the mean for PAGE2011 is highest with 26.16 and RICE2016 is lowest with 10.70. Similarly, median is highest for PAGE2011 while lowest for RICE 2016. The same trend is seen with standard deviation as well. Skewness and kurtosis have similar values across the estimates, and hence can be ignored. Regarding mean and median, [22] notes that if the sample size is large and outliers donot exist, the mean usually provides a reliable measure. In other cases, median often provides a better result compared to the mean. In our dataset, outliers exist and the data set is relatively small. Therefore, it is reasonable that we use the median value for selecting our carbon tax. The data set is complemented by box-plot diagram (figure 5).

Table 8: Descriptive statistics

Measures		RICE2010	PAGE2011	RICE2016
Mean		14.2712	26.1622	10.7028
Median		**8.4000**	**15.4000**	**6.3000**
Std. Deviation		15.02062	27.53647	11.26488
Variance		225.619	758.257	126.897
Skewness		1.788	1.788	1.788
Std. Error of Skewness		.687	.687	.687
Kurtosis		3.048	3.050	3.050
Std. Error of Kurtosis		1.334	1.334	1.334
Range		47.52	87.12	35.64
Minimum		2.52	4.62	1.89
Maximum		50.04	91.74	37.53
Percentiles	25	4.2600	7.8100	3.1950
	50	8.4000	15.4000	6.3000
	75	23.6150	43.2905	17.7098

As regards to the median values derived across the models, one must note the original variations in assumptions in each model [17]. Moreover, when the RICE and PAGE models are compared, RICE emerges as a winner in most counts [18, 19,20, 21. Therefore, as part of this study and also the descriptive statistics, the effective carbon tax rate for India is considered as USD 8.4 or approximately USD 8.

Table 9 represents the final prices of energy fuels inclusive of the carbon tax. These estimates have been derived based on current prices and are expected to show the disparity corresponding to prices and their emission intensity.

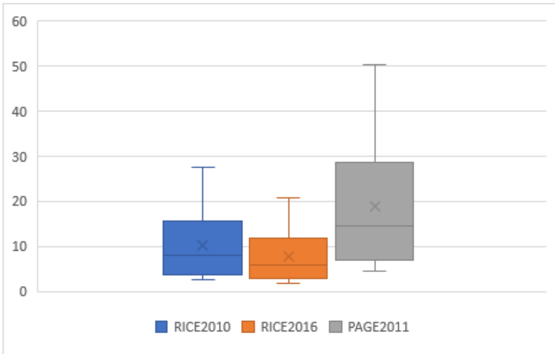


Figure 5: Box Plot of statistical interpretations

Table 9: Prices of fuels after application of USD 8 carbon tax (₹)[1]

Sl. No.	Fuels	₹/ton
1	Natural gas	10787.50
2	LPG	47817.58
3	ATF	28862.53
4	Petrol	72284
5	Crude oil	26618
6	Naphtha	38452
7	Diesel	64904
8	Kerosene	35794
9	Coal	3974
10	Petroleum coke	10274

III. FINDINGS AND DISCUSSION

India is one of the largest carbon emitters of the world and it is imperative that India takes steps to curb its emission intensity. Taking cue from the above observations, following findings have been arrived at as part of the study.

Carbon emissions from thermal power plants have been the maximum contributor to India's emissions. Natural gas is the cleanest among all fossil fuels but remains the most under-utilised in India.

The Clean Environment/Energy Cess on coal (implicit carbon tax) is not linked to carbon emissions at all. This adulterates the underlying objective of a carbon tax. Moreover, natural gas faces a higher tax burden than coal which is not fair as the former is cleanest among all fossil fuels

Petrol and diesel presently are subjected to a high tax burden. Moreover, tax rates in the indirect taxation framework are considered with revenue factors rather than emission factors.

Of the tax proceeds of ₹ 86,440.21 crore collected as cess during 2011-2018, only ₹ 20,942.29 crore was transferred to NCEEF. Of this amount, only ₹ 15,911.49 crore went to funding for clean energy projects.

[1] Computed on 12/07/19; $ 1 = ₹ 68.59

In line with the objective of our paper, estimation of a carbon tax using SCC the approach has concluded in the unique tax rate of USD 8 per tonne of CO_2 equivalent. After conversion to Indian rupees, the tax rate equals ₹ 574 per ton of CO_2e.

Calculating carbon tax inclusive price rates of fuels, it is observed that coal faces a lesser price compared to natural gas. This is unfair given their emission factors, and policymaking should address this issue by removing coal subsidies while streamlining natural gas pricing mechanisms or associated price revisions.

The carbon tax rate should cover all sources of fuels and the rate should be linked to carbon emissions. Proceeds from the tax should be deposited in a dedicated fund, say NCEEF, and be used for funding clean energy projects or subsidising low carbon technologies. It can also be implemented as the CEC by enlarging the scope of the cess. It should be noted that cess is a tax on tax and a carbon tax can also be implemented as one, if not as a standalone tax rate

IV. CONCLUSION

In light of the above discussion, it can be concluded that introduction of a carbon tax within the indirect tax regime at a rate of USD 8 per tonne of carbon and increasing it in a phased manner over the years, will have a significant impact on how India's policymaking caters to climate change needs. A proper implementation strategy should be designed based on this tax rate. Today, the world leaders on energy initiatives are calling for a *carbon dividend* policy, which would implement a rising carbon tax and refund the revenue directly to taxpayers. Implementing a carbon tax policy, thus, can propel the nation's ideals of attaining the utopian state of rising development with a sustainable environment for its inhabitants to live in. Therefore, it is high time for us to acknowledge the fight for preserving the Earth as we know it.

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