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Green Growth and The Right to Energy in India

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Abstract

Can growth in India be simultaneously made equitable and environmentally sustainable? The recent pattern of high growth in India has been inequitable even as serious questions have been raised about its ecological sustainability. In contrast to the current growth trajectory, this paper argues that an alternative growth trajectory can be developed which answers the question in the affirmative. We propose an Energy Policy with Equity (EPE), which fundamentally changes the energy mix of the Indian economy towards greener forms of energy as well as guarantees universal access to energy thus generated to the entire population, a feat that almost all the governments since independence have dreamt of but failed to deliver. This policy also fundamentally changes the energy mix of the Indian economy towards greener forms of energy as well as guarantees universal access to energy thus generated to the entire population.

This can be done by taxing carbon to control CO2 emissions. A part of the revenue thus generated can be used for a systemic overhaul of the energy mix, which to a large extent addresses the pressing problem of environmental degradation. And the other part can be used for an in-kind transfer of free electricity to the population who contribute less carbon than the economy average and issue universal travel passes to compensate for the rise in transport costs and encourage the use of public transport.

The methodology employed in this paper is an Input-Output analysis which involves two steps: calculating the carbon content (IO data) and its impact on the household budget (NSS). The level of carbon tax required for this policy to come into effect is USD 60.4 per metric ton of carbon dioxide. On the one hand, a portion of these taxes mobilised is allocated for the improvement in energy efficiency and expansion of renewable energy. On the other, the free entitlement of fuel and electricity from these taxes for a household comes out to be 2268 kWh per annum or 189 kWh per month, which is 412 kWh per year multiplied by the average size of the household (i.e. 5.5). Universal travel passes with pre-loaded balance amount of USD 17.9 can be used on any mode of public transport. While the energy mix of the growth process changes in favour of clean sources through investment in green energy as well as controlling demand for fossil fuels through a carbon tax/cap, distribution of the tax revenue in the form of universal access to energy makes the process egalitarian.

Keywords: carbon tax, right to energy, energy policy, inequality, pollution, India.
JEL Classification: Q52, Q58

1 Introduction

Can growth in India be *simultaneously* made equitable and environmentally sustainable? The recent pattern of high growth in India has been inequitous even as serious questions have been raised about its ecological sustainability. In contrast to the current growth trajectory, this paper argues that an alternative growth trajectory can be developed which answers the question in the affirmative.

One of the central questions discussed in the context of high growth in India has been its exclusive reach to a select section of the population. In fact, the then Prime Minister, Dr. Manmohan Singh, had to argue for an 'inclusive' growth as a response to this challenge. That this high growth has also not paid adequate attention to the environment is also well-known. To give a sense of the enviromental degradation that this growth process has contributed to, the greenhouse gas emissions during the relatively low growth phase of the 1990s on an average were 1.6 billion tonnes of CO_2 equivalent, which increased to 2.2 billion tonnes of CO_2 equivalent during the 2000s. By 2010, India's total greenhouse gas emissions were almost double than the levels in 1990.[1] It is imperative for us, therefore, to address the issues of inequality and environmental sustainability arising out of the Indian growth process. This paper attempts to do that. We propose an Energy Policy with Equity (EPE), which fundamentally changes the energy mix of the Indian economy towards greener forms of energy as well as guarantees universal access to energy thus generated to the entire population.

The broad contours of the policy are as follows. Any green energy policy needs to alter India's dependence on fossil fuels, which requires a systemic overhaul of its energy mix. Taking cue from an earlier paper by two of the authors (Pollin and Chakraborty [2015]), the energy mix can be changed through investments in clean renewable energy and energy efficiency that would span across all four major areas of energy usage in India i.e., residences, commercial buildings, transportation systems and industrial production.

While the energy mix of the production process can be changed by implementing supply side policies (discussed in details below), the consumption side of it can be partly addressed by these supply side policies and partly by implementing a system of carbon tax. We propose that a part of the carbon revenue thus generated can be used for an in-kind transfer of free energy to the population who contribute less carbon than the economy average (based

[1] These data are cited from World Development Indicators, World Bank

on the concept of climate injustice quotient (CIQ)). We call this the *Right to Energy* programme along similar lines as food, health or educational programmes. We question here the International Energy Agency's viewpoint that policy makers in the developing countries need to realize that energy is a commodity, and not an entitlement (International Energy Agency [2015]). The other part of the carbon revenue can be used for a systemic overhaul of the energy mix, which addresses the problem of environmental degradation and limited access to energy.

Environmentally sustainable growth has come on the agenda of the global North but the same cannot be said about the global South. In the South, these are usually presumed to be the 'problems of the North'. The number of articles, ideas, policy recommendations on this issue of environmental degradation that are coming from the respective part of the world captures the sense of this difference. This notion of a dichotomy of a pressing problem such as the environment is, however, not only counterproductive but also irresponsible towards our future in many ways.

First, even in the immediate sense, as a result of the global warming, the countries which are likely to be affected most will be the tropical countries because of their low altitudes and already high temperatures (Mendelsohn et al. [2006], Martin [2015]). Martin [2015] argues, based on a report by a U.K.-based risk analysis firm Maplecroft, that out of the top 32 countries at "extreme risk" from climate change, the top 10 are all tropical countries. According to a recent study(Im et al. [2017]), the densely populated agrarian regions of the Ganges and Indus river basins are identified as the most intense hazard affected areas from intense heat waves, expected during the end of the 21st century, from global warming. This study also suggests that climate change presents a serious threat to these areas of South Asia due to an unprecedented combination of severe natural hazard and acute vulnerability. So, it is in their own interest to take this problem seriously and contribute towards solving it. Only with a collective effort from the North and the South can this serious problem of climate change be stalled.

Second, while it is true that the *stock* of carbon has been contributed to mostly by the first world countries due to their industrial past based on fossil fuel energy, the emerging market economies are contributing a decent share to the *flows* (in absolute terms and not per capita terms). Moreover, when it comes to the environment, the argument simply cannot be that 'since you have polluted earlier, we have a right to do so today' or that by asking for a blueprint of gradually declining emissions targets, the ladder is being kicked away for the emerging market economies. In this paper, we will show that there is no either/or choice between growth and sustainability. In fact, our argument will be that green growth policy can be planned in a manner by which it delivers equitable and sustainable growth and, in the process, achieve three objectives of economic growth, sustainability and equity.

Third, hiding behind low *per capita* emissions even as the absolute emissions are high is also a bit problematic because what matters for the world is not the incremental contribution of an individual to total emissions but what we, as a humankind, are contributing to the environment. Once the temperatures rise globally, it will not choose its victims based on their individual contribution to the problem. In fact owing to the poor socio-economic conditions, high population density along coastlines, job dependence on agriculture and other allied activities in the South, the casualties of environmental degradation (arising out of rising water levels, cyclones and other devastating natural events) are going to be significantly more than the North.

Fourth, what is the point of treading the same path that the North did to reach where they have today only to realise at that point that the time to address the environment issues has now come on the agenda? That 'now' might be too late to tackle this problem as is evident from the current signs of emissions (more on which later). If due to international pressures, political and economic, rapid technological advancements take place in the North, the South should surely not wait till it has followed the same path that the North has to reach a stage of development that it is in today. In fact given the abundance of renewable natural resources in the tropics, the South should invest in developing indigenous alternative technologies based on utilizing them, which can give it an advantage in this competitive world of technological advancement. Furthermore, the fact that it controls the supply of these resources purely because of its geographical location in the world should further buttress the point to go for such a technological progress. The South should not become the victim again of a colonial pattern of trade of resources extracted from the South towards the North because of latter's exclusive rights over sustainable technology. The South should preempt that and it can only do so if it plans ahead.

Taking account of the issues raised above, this paper presents an energy proposal for India, which makes its growth process environmentally sustainable and at the same time inclusive by its very design. To do so, we propose that carbon be taxed so as to disincentivise its usage and the revenue generated through it be partly used to provide *complete access to electricity* across the country and partly to invest in *a clean green energy program*, so as to change the underlying energy mix of the country.

The paper is divided in six sections. The second section presents a brief overview of the literature. The third section discusses in detail our proposal of combining ecology and equity into a comprehensive energy policy in India. Data and methodology used for this study are discussed in the fourth section. The fifth section presents the results of our study and the final section concludes the paper.

2 Background

2.1 Inequality in Income and Limited Access to Energy

It is a well-accepted fact that there has been a significant rise in the average rate of growth of the Indian economy since the 1980s. However, its impact on poverty is debatable, at least about its extent (Sen and Himanshu [2004a,b], Deaton [2008], Sundaram and Tendulkar [2003]) with some questioning the claim of reduction itself (Patnaik [2007]). On one issue, however, there is a consensus that the inequality has increased significantly since the 1990s (Jayadev et al. [2007], Anand and Thampi [2016]). Since there is no data collected on the income of the households in India, most of the studies on inequality have based their estimates on the inequality in consumption, which by its very nature underestimates inequality.[2] Studies on wealth inequality show that it has increased significantly since the economic reforms (Subramanian and Jayaraj [2006], Jayadev et al. [2007]). A recent study shows that the share in total wealth of the top 1% has increased from 16.9% in 1991 to 27.6% in 2012 (Anand and Thampi [2016]).

Given the increase in consumption, and thereby, income and wealth inequalities, it can be inferred that there would have been a rise in inequality of carbon emissions along similar lines since the lifestyle choices of the upwardly mobile increases emissions per unit of expenditure. Some earlier studies have shown that the top 10% of the urban population account for emissions of 3416 kg per capita per annum, while the bottom 10% of the rural population account for only 141 kg per capita per annum (Parikh and Gokarn [1993]). More recent studies show the overall per capita emissions in India are low with the high emissions of the rich 'hiding behind the poor', whose emissions are quite low (Ananthapadmanabhan et al. [2007]). A more nuanced class based analysis shows the inequality of emissions of the urban/rural elite versus the working people of the country (Michael and Vakulabharanam [2016]). Ananthapadmanabhan et al. [2007] end their paper by hinting at a carbon tax system in India, which not only addresses

[2] This is so because, in comparison to the rich, the poor consume a higher proportion of their income.

the devastating environmental impact of the lifestyle of the elite but also addresses inequality in emissions.

It is not surprising that the inequality is not just seen in income and wealth but is reflected in other indices as well, one of the most interesting ones relevant for this paper being the unequal access to electricity and other energy sources in the country. As of 2014, more than 20.0% of India's population does not have access to electricity, while a substantial number of areas that are served with electricity still experience daily blackouts. In July 2012, India experienced the largest power outage ever recorded, affecting roughly 700 million people.

2.2 Enhancing Renewable Energy and Improving Energy Efficiency: A Supply Side Response

1. With vast potentials for generation of renewable energy, renewable energy needs to be made an integral part of India's development plans for future energy needs. It will help the economy to achieve energy self sufficiency, which became a priority in the policy circles since the oil shocks of the 1970s. It will also help in facilitating energy access to those sections of population who do not have any access to electricity and, thereby, lack access to any basic infrastructural facilities like clean drinking water, cooking fuels and sanitation facilities. Therefore, the eleventh five year plan formulated by the Planning Commission also argues for a case where renewable energy is expected to supplement the conventional energy sources and meet basic energy needs and provide accessibility to energy, especially in the rural and remote areas of India (Planning Commission [2008]).

2. One of the imperative problems that affected the expansion of renewable energy in the past had been the relatively expensive costs of renewable energy compared to those of the fossil fuels based energy. However, with technological advancement in the field of renewable energy, the recent cost trajectory has been very favorable to it and some recent studies show that renewable energy from most sources are already at cost parity with non-renewable sources. In India, wind, hydropower, biomass power and solar PV are all able to compete with fossil fuel power generation, with increasingly renewable energy becoming the least-cost generation option (IRENA [2017]). As argued in this paper, an affirmative action of carbon tax or a carbon cap policy, which captures the environmental costs of carbon emissions, will fur-

ther help to raise the prices of emissions-generating energy sources and make the costs of renewable energy sources more favorable relative to the fossil fuels.

3. Technological improvements in the renewable energy sector, especially in the fields of solar, wind, geothermal, small scale hydro and clean bioenergy, which constitutes of what we term the *clean* renewable energy sources have the huge potential of not only providing an energy infrastructure in these remote areas at a cheaper cost, but also bring a substantial improvement in the lives of these common people and a sense of entitlement through joint ownership of the projects in these backward communities. The increased investments in a clean green energy will help in generating jobs, ensuring decent livelihoods for the populace, and help drive India's future economic growth towards a more egalitarian path (Pollin and Chakraborty [2015]).

4. Significantly raising the bars of energy efficiency in all three major areas of energy usage -i.e. buildings (commercial as well as residential), industry and transportation - offer major opportunities for the Indian economy. Hence, along with investments in the clean renewable energy programme, an equal emphasis needs to be put on improving energy efficiency, which needs to be one of the cornerstones of our clean energy investment programme. Although there is a possibility of a 'rebound effect', whereby improved standards of energy efficiency encourage consumers to expand their energy-using activities, Pollin [2015] and Pollin et al. [2015] have argued elsewhere that the most effective way to limit these rebound effects is to combine efficiency investments with complementary measures to greatly expand the supply of clean renewables and to raise the prices of fossil fuel based energy sources through either a carbon tax or a carbon cap.

5. As noted earlier in Pollin and Chakraborty [2015], the Indian economy is operating at a high level of inefficiency measured in terms of energy intensity, which is the ratio of the amount of energy used to the value of GDP. Table 5 of Pollin and Chakraborty [2015] shows that as of 2012 India's energy intensity ratio stands at 17.0 Q-BTUs per 1 trillion USD, which is almost 140% above the global average of 7.1. Although the Indian economy has established the Bureau of Energy Efficiency (BEE), which periodically mandates regulatory standards, and formulates promotional schemes to improve energy efficiency, the abovementioned figure shows that India's energy infrastructure presently

operates at a very low efficiency level, suggesting, in turn, that especially large benefits could be generated through further expansion of energy efficiency programme (as described later in the study).

6. However, for these expansions of clean renewable energy capacity and improved standards of energy efficiency to be achieved, there needs to be substantial investment in the green energy programme. As proposed in Pollin and Chakraborty [2015], we estimate that an additional 1.5 percent of GDP above the current trend of approximately around 0.6 percent of GDP, needs to be invested over a 20 year period to achieve the right energy mix. It means this will bring the total clean energy investments to about 2.0% of GDP for a period of around 20 years.

2.3 Carbon Tax: A Demand Side Response

A carbon tax system which addresses climate change has been studied extensively in the context of the developed countries. Emissions[3] can be controlled from the demand side either directly through quantity restrictions (carbon cap) or indirectly through a carbon tax.

But given the fact that taxes increase prices and, hence, adversely affect the purchasing power of the people, a legitimate question to be asked is if there are better alternatives to a carbon tax or at least whether they can implemented alongside other alternatives available. This paper argues that a just system of carbon tax can be implemented only if it is combined with other alternatives otherwise it will end up being extremely regressive by worsening the livelihood of the poor in India. We have discussed the literature on these alternatives above, so, we focus here on carbon tax.

Carbon tax system is usually quite regressive (tax burden as a share of income) in nature. This is because of inequalities in income and higher consumption propensities of the poor (owing to their low income) even though the per capita footprints of the poor are significantly lower than those of the rich. Hence, the more unequal the society, the more regressive the burden is likely to be.[4] Is there a way to make this cost-effective carbon tax system equitable? There are two ways in which this regressive nature of this system can be addressed: 'tax/cap and spend', which indirectly compensates the

[3]The term emissions used here is from energy alone (in particular fossil fuel energy) and not emissions from non-energy sources.

[4]In certain cases, carbon tax might not be regressive if the consumption bundle of the poor is such that high carbon emitting commodities form a smaller share of their total budget. In the Indian case, as shown later, the tax system is indeed regressive.

aggrieved parties, or 'tax/cap and distribute', which directly compensates those affected by it.

Some of the earlier studies like Metcalf [1999], whose methodology has been used and cited extensively throughout this literature, argues for a 'tax and distribute' policy where distribution done through tax rebates on 'distortionary' payroll and personal income taxes nullifies the initial burden. It may even have positive macroeconomic effects through an increase in investment (corporate tax rebates) or consumption (payroll tax rebates) (Jorgenson et al. [2015], Williams et al. [2014]).

There are others who have argued for a 'cap/tax and dividend' policy of an equal distribution of the tax revenue generated among the people of the country, thereby, directly countering the regressivity of the carbon tax (Boyce and Riddle [2007, 2011], Horowitz et al. [2017], Fremstad and Paul [2017]). Such a policy is inherently progressive because while the tax burden is based on one's own expenditure, the dividend is based on everybody's expenditure. The more unequal the income, the more progressive this policy will be.

While there are many studies dealing with the tax and distributional impacts of such a policy in the North, there is a lack of research on this question within the South, one of the primary reasons of which, referred to in the introduction, is the difference in policy priorities. There are, however, a few exceptions.

There is a variation in the findings on whether carbon taxes are in themselves necessarily regressive in the context of the developing countries. While some have found it not to be so given the composition of demand of the absolute poor in the country (Brenner et al. [2007] for China, Younger [1996] and Younger et al. [1999] for Ghana and Madagascar), others have found it to be regressive (Shah and Larsen [1992] for Pakistan, Tarr and Jensen [2002] for Iran). In either case, the effect of a dividend policy is unequivocally progressive for the same reasons as in the case of the North.

2.4 Our contribution: Energy Policy with Equity

We call our proposal the Energy Policy with Equity (EPE).

The first concern is about *ecology*. How does India reduce the carbon emissions relative to current levels in order to help the world achieve its target reduction of total greenhouse gases (GHG) emissions by 80% compared to 1990s as of 2050? To target the emissions, we need to address *both* its supply and demand sides. The supply side entails an active investment programme which changes the energy mix of an economy while the demand side can be taken care of either by a carbon tax or a carbon cap. The reason why we stress *both* is that addressing it only from the demand side might put severe hardship on the poor people as well as put a brake on growth in an economy, neither of which is desirable. On the other hand, reduction of emissions through an exclusive focus on the supply side depends critically on the pace of the growth rate (exogenously given by demand side) and how fast the energy mix changes. A fast growing economy, such as India, cannot afford to focus on just one side of the problem.

Second is about *equity*. Carbon taxes/cap negatively affects the real income of the people even as the effects across different deciles of the households can be regressive or progressive depending on the manner in which carbon footprint per dollar declines or increases respectively with income. As discussed above, it can be compensated for by distributing equally the tax revenue generated as dividend across the population. We propose an alternative to this policy because of the severe limitations of cash transfer in the context of a developing country. We propose an in-kind transfer of free energy to the population who contributes less carbon than the economy average (based on the concept of climate injustice quotient (CIQ)). We call this the *Right to Energy* programme along similar lines as food, health or educational programmes. We believe that this policy has the potential of bringing electricity to every household in India irrespective of their income levels.

3 A Detailed Discussion on Energy Policy with Equity

3.1 Ecology: Caring for the Environment

3.1.1 Controlling Emissions from the Supply Side

The trajectory of green growth is much like planning the pattern of growth and development in any economy. So, to lay down the basic point about the right energy mix and its repercussions on growth, let us start with the proposition that there are two forms of energy (E) programs available: fossil fuel based F and green energy G, with carbon emissions per unit of usage is given by c and zero respectively. We also define α as the share of the growth in the fossil fuel usage, and thereby, (1-α) depicting the share of the growth of green energy. Let's say ϵ gives the efficiency of energy usage, then the potential rate of growth g_s and the carbon emission C_s in an economy can be calculated as follows,

$$
\begin{aligned}
E &= F + G \\
O^* &= \epsilon \cdot (F + G) \\
\frac{\dot{O}^*}{O^*} &= \frac{\dot{\epsilon}}{\epsilon} + \alpha \left(\frac{\dot{F}}{F} \right) + (1 - \alpha) \left(\frac{\dot{G}}{G} \right) \\
g_s &= g_\epsilon + \alpha \cdot g_f + (1 - \alpha) \cdot g_g \\
C_s &= \alpha \left(\frac{F}{\epsilon} \right)
\end{aligned}
\tag{1}
$$

For a developing country like India which has embarked on a high growth trajectory, the basic proposition is that the frontier of maximum growth should be greater than what the acceptable rate of growth is. Potential (actual emissions depend on the actual growth rate etc) carbon emissions can be controlled in three different ways. It can be done by increasing energy efficiency g_ϵ, increasing the rate of growth of production of green energy g_g and gradually moving away from fossil fuel dependence by decreasing α.

This policy can be understood in the form of a diagram, which has been borrowed from Metcalf [1999].[5] As the firms pollute more to increase their production, its marginal benefit (MB curve in figure 1) falls with production (emissions), which gives us a negatively sloped curve. The position of this curve, however, depends on the underlying energy mix in the economy. In the absence of a market price for carbon emissions, and hence a zero marginal cost for the firms, they produce the maximum possible carbon emissions (C_s in figure 1) associated with zero marginal benefits.

Supply side policy response to decrease emissions, through an overhaul of the energy mix of any economy, shifts the MB curve inward to MB' (see figure 1). So, a fall in fossil fuel dependence (α) or an increase in efficiency (ϵ), will shift the MB curve inward, thereby, decreasing the maximum possible carbon emissions from C_s to C_s'. In the hypothetical case (hopefully an actual case at some time in the future) where the fossil fuels have been completely replaced by green energy ($\alpha = 0$), the MB curve will disappear.

A detailed proposal on decreasing the dependence on fossil fuels (decreasing α) and increasing the efficiency of energy usage (increasing ϵ) for India has been presented in Pollin and Chakraborty [2015]. We present here some of the salient features of that proposal:

[5] Metcalf [1999] does not discuss the supply side policy since his major focus is on the demand side control of emissions.

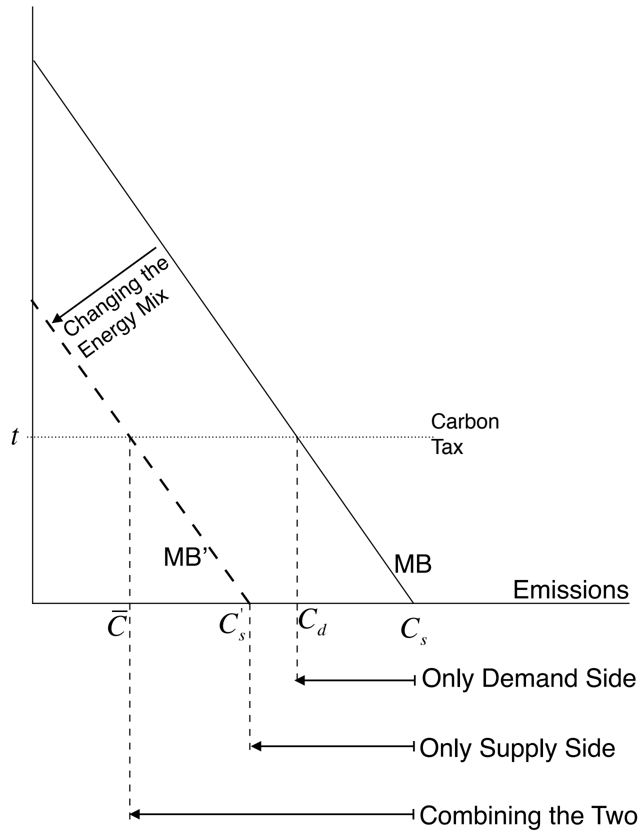

Figure 1: Dynamics of the Carbon Market

1. Raise the economy's level of energy efficiency through the operations of buildings, industry and transportation systems.

2. Among fossil fuel energy sources, increase the proportion of natural gas consumption relative to coal, since carbon emissions from burning natural gas are about one-half those from coal.

3. Invest in the development and commercialisation of some combination of the following technologies:

   (a) Clean renewables, including solar, wind, hydro, geothermal and low-emissions bioenergy;

   (b) Nuclear power;

(c) Carbon Capture and Sequestration (CCS) processes in generating coal, oil, and natural gas-powered energy.

Of these three, the primary focus should be on 1 and 3 (a) above as Pollin et al. [2015], Pollin [2015] have argued. Declining costs of production of clean renewables and, hence, favourable prices are one of the important reasons for why the transition from non-renewables to these is not altogether unrealistic even in the short run. In fact the reliance on solar energy in the rural areas in India is on a rise ever since the solar panels have become relatively inexpensive. Pollin and Chakraborty [2015] have estimated that the costs of generating electricity through clean renewables in India will be 25% lower than those in US. Based on this, they have calculated the level of investment necessary to ensure a significant shift in the energy mix of India.

For raising energy efficiency, on the other hand, Pollin and Chakraborty [2015] have assumed a conservative average figure for India of $11 billion per Q-BTU of savings. They have futher argued that the "rebound effects" i.e. increase in usage of energy on account of a fall in its cost, will cancel out across different usages and in activities where it does not, carbon tax/cap (as proposed below in detail) can be used.

Based on these estimates to fundamentally change the energy mix as well as increasing efficiency of existing sources of energy usage in India, Pollin and Chakraborty [2015] show that an additional 1.5% of the GDP (to the existing 0.5% being spent currently on green energy) is required assuming the Indian economy grows at an average of 6% over the period under consideration. This includes developing the infrastructure required to make these sources of energy accessible to those it does not reach at the moment. For this paper, we borrow this figure for estimations made below.

3.1.2 Controlling Emissions from the Demand Side

The way the demand side works is to increase the marginal cost of carbon emissions from zero to some positive number (Metcalf [1999]). There are two alternative ways in which carbon emissions can be reduced from the demand side: price rationing (carbon tax) or quantity rationing (carbon cap). Based on the position of the new MB curve (determined by the supply side response discussed above), a price rationing fixes the price of carbon (say t in figure 1) and lets the market decide the quantity of emissions whereas quantity rationing (say $\bar{C}$ in figure 1) fixes the quantity of emissions and lets the market determine the price.

On the demand side, for India, we propose the policy of a carbon tax instead of a cap at least in the initial years of the implementation of the environmental policy discussed here since it gives some room for the economy to maneuver if the growth rate rises without imposing severe hardships on the poor. When the correct energy mix has been achieved through supply side policies, the economy can switch to a carbon cap policy.

The reason why this roadmap of transition from a tax to a cap is necessary is because of its effect on growth as well as equity. It can be seen from the figure that in years when the rate of growth is higher than the average rate assumed in the policy, the marginal benefit curve shifts in the outward direction. A cap policy, by rationing the quantity of emissions, will mean that not only will it not let the growth rate rise, it will have a severe increase in the price of carbon (t), thereby, affecting the purchasing power of the people. It is akin to the concept of stagflation. On the other hand, a price rationing policy, which entails fixing the price of carbon at an exogenously given rate t while letting the market determine its quantity neither affects the growth nor equity adversely although it has an adverse impact on the environment since $\bar{C}$ rises. In this paper, we have accounted for a high 6% average annual rate of growth for the next 20 years, so, on an average an outward shift in MB as a result of higher growth rates in certain years is more likely to be matched by an inward shift of MB resulting from lower growth rates in other years. It's safe to say, therefore, that the estimate of carbon emissions, on the average, will not stray from the ones projected ($\bar{C}$) here.

3.2 Equity: The Right to Energy

As discussed above, the literature on distributional effects of carbon policy can be divided in two groups: cap/tax and dividend and cap/tax and spend. Our proposal belongs to the latter in terms of tax and spend but differs significantly in its form.

We propose the spending on two counts, one of which is on changing the energy mix as discussed in detail above. The other, which to our knowledge has not been discussed in the existing literature, is to provide *in kind* transfer by the government in the form of free energy upto a certain limit with those crossing the limit paying the full price for all the units consumed. There are many advantages to this policy over the policy of cash transfers in the context of a developing economy like India.

3.2.1 Limitations of the Dividend Policy in a Developing Country

While cash transfers, generated through policies of 'cap and distribute' or 'tax and distribute', as dividends on a per capita basis in the North is a remarkably egalitarian approach to green growth, it might not work in that particular form for a developing country such as India. Let's first see why and then propose how those issues can be addressed.

1. Controlling emissions through tax/cap: There are other sources of carbon emitting fuel consumption possible for the poor people (wood burning etc), which can't be controlled by this cap/tax policy because these resources (cow dung cakes, wood) are freely available. So, any tax or a cap policy for a resource which is not traded at all will have no effect on its usage. What is needed is *incentivising* them to move away from their current form of energy consumption and the only way that can be achieved is by providing that at the same price (which is zero) as their current forms of energy usage. There are also high opportunity costs associated with the use of wood and cow dung, which is difficult to measure. Hence alternative cleaner energy acts as a larger incentive than what market price can capture.

2. Dividend distribution, which is essentially a universal cash transfer, is not workable because:

   (a) such a policy might only reach those with financial access, in which case the policy will end up being quite regressive since, as a result of a carbon tax, the costs will rise for the poor without any commensurate increase in income.

   (b) even if this were not the case, poor might not have an incentive to move away from those sources of energy which are available to them free of cost (wood burning) as against green energy which will have a positive price.

3.2.2 Tax and Redistribute in Kind

What we propose below can be called 'tax and redistribute in kind'.

Cash vs. Kind Cash transfers, as opposed to in-kind transfers, have been debated extensively in the context of food in India. Since some of the issues raised might be of relevance to our proposal, let us briefly discuss these. Those in favour of the cash transfer and against in-kind transfers have argued that (a) it controls corruption since the money goes directly to the bank account of the recipients as opposed to large scale leakages associated with in-kind transfers; (b) it gives individuals the choice to spend on the items based on their preference rather than the government directing the preference of the recipients (Kotwal et al. [2011], Gulati and Saini [2015]).

Those opposed to cash transfers have argued that on both the counts mentioned above, cash transfers are not preferable. As a means of tackling corruption, existing cash transfer schemes in India such as old age pensions, widow pensions or maternity entitlements show that a significant part of the sum is given away as bribes to the middlemen. On the issue of corruption in public distribution system (PDS), Somanathan [2015] shows through field studies that leakages are miscalculated in government documents. On the other hand, the very notion of fungibility has a problem of self-control since the money can be spent 'unwisely', with expenditure on alcohol as the main, but not the only, concern in India (Khera [2014]).

There are some additional problems with cash-transfers.

First, at a more philosophical level, Hausman and McPherson [1997] argue that basic rights of access to resources should not be measured purely in narrow utilitarian terms. Second, the access to banks, both in terms of distance and knowledge of the system, is extremely limited in a country like India on account of the thin spread of the current banking network in rural India (one-third of the villages do not have banks within a radius of 5 kms) and illiteracy respectively.

Third, not only inflation indexation of cash transfers may not be 'technically simple' (Deaton [2008]), they might not be frequent (Sinha [2015]). Fourth, cash transfers by themselves can contribute to inflation in conditions where the supply of goods is inelastic, which might be the case if the government stops procuring food for in-kind transfers (Khera [2014]).

Fifth, countries such as Brazil where cash transfer has been quite successful, it is *complementary* to and not a substitute for in-kind transfers. It has succeeded there because the share of the rural population is significantly lower as well as income levels and literacy rates are higher as compared to India. Himanshu [2016] further argues "(g)iven the huge deficits in availability of public education and health facilities, universal basic income can only increase the demand for these services without increasing the access to these services."

Our Proposal: The Right to Energy Vs Dividend Policy From the discussion above, it's clear that the proposal of carbon dividends, which is feasible in developed countries (Boyce and Riddle [2007]) will not likely work in a developing country such as India.

What might work in India? We believe that a programme of universal access to electricity and public transport, funded by carbon revenue, will be a better substitute for a dividend policy. The broad contours of the programme can be:

1. *Upto certain units, energy usage will be free*, which the government finances from the revenue generated from carbon fee, after which the prices, determined by the market, gradually go up. The basic entitlement to energy, the cutoff point, is determined by the climate injustice quotient (CIQ), which measures the share of the carbon footprint of classes as a proportion of their share in the population. There are both economic and political basis for a CIQ based cutoff. Ananthapadmanabhan et al. [2007]'s study 'clearly illustrates the growing schism of carbon emissions between the two Indias; the poor bearing the biggest climate impact burden and camouflaging the other India's lifestyle choices'. Our policy of providing free energy to those who contribute less is a redressal to this injustice. It is shown below that as a result of this policy there is a net gain for the bottom 7 deciles and net loss for the top 3 deciles at the all-India level, which is commensurate with their respective CIQs. This cutoff limit itself turns out not to be too high in India because of gross inequality in energy usage across classes, which also limits the tax burden on households.

2. *Travel passes will be universally provided* for an amount determined by the loss on transportation budget that the bottom 70% of the population make on account of rising prices.

While all the objections raised above against cash transfers are valid in our case too, our proposal of an in-kind transfer does not even suffer from the criticisms made against the PDS in India. Both the objections of corruption and lack of choice against an in-kind transfer are invalid in our case. Sinha [2015] argues that experience of PDS from different states in India shows 'wider coverage and lower prices can contribute to lower leakages'. Our proposal takes care of both the issues of coverage, which is universal, and prices, which is zero upto a certain limit. As far as increased usage due to free availability is concerned, we have taken account of that by taking the maximum possible free usage for the country as a whole.

It also addresses the problem of choice and its effect on the general well-being of the recipient. A cash transfer in the presence of energy available from nature such as wood/cow dung cake burning would not have persuaded the poor into switching away from these sources of energy. With a zero price of energy and universal access, not only will they shift towards healthier forms of energy consumption, they will be better off even in the utilitarian sense of saving time, which can be utilised for other activities.

One of the important issue usually raised with such policy programmes is the manner in which it is to be financed. In the next section, we discuss in details how this policy programme can be financed so that it eventually balances the budget and does not put any additional expenditure on the exchequer.

3.3 Financial contours of this policy

An appropriate combination of the supply-side policy, which attempts to shift the MB curve inward, and demand-side policy, which determines the position of the economy on the curve, can control carbon emissions in an economy. Exclusive dependence on either will have higher emissions as can be seen from figure 1. An exclusive dependence of demand side policy will generate emission of C_d while an exclusive dependence on supply side policy will result in C_s', which are both higher than $\bar{C}$ arising out of a combination of these policies.

As discussed above, Pollin and Chakraborty [2015] have shown that an additional 1.5% of the GDP will be required to make the transition in energy usage in India. This will affect the position of the MB curve discussed above. Let us call this clean energy expenditure on changing the energy mix as well as improving efficiency of usage from the supply side G_f,

$$G_f = 1.5 \cdot Y \tag{2}$$

The demand component of the policy, which fixes a carbon tax t, situates the position of the economy on the MB curve. Let's say the optimal carbon path determined as a result of these two policies is $\bar{C}$ (see figure 1) and the tax rate which delivers it is given by t. We propose, like Boyce and Riddle [2007, 2011], Fremstad and Paul [2017], that the tax is collected 'upstream' where carbon enters the economy i.e. mine heads, oil refineries or ports since it has lower administrative costs while preventing leakage on account of multiple layers of administration. The administrative cost of this collection has been assumed to be 1 % of the tax revenue in the literature, so, we make the same assumption. Let us call this total net revenue R, which is given by,

$$R = t\bar{C} - 0.01t\bar{C} = 0.99t\bar{C} \tag{3}$$

Government expenditure for providing this basic level of energy and travel passes can be calculated in the following manner. Since the tax rates are endogenous to the level of free energy and travel passes provided, it can be determined in the following manner. If $\bar{e}$ is the level of the cutoff in real units of energy, say kWh, and c_e is the carbon content embodied in it, and its current price is p_e, the expenditure on providing free energy is given by: $(p_e + tc_e)\bar{e}$. Similarly, if T is the cutoff level of transport expenditure in nominal terms and c_t is the carbon content embodied in it, the expenditure on providing travel passes is given by: $(1 + tc_t)T$. Let us call the sum of the two as the government expenditure on energy policy G_e. The other component in the equation is G_f which represents the expenses for the development of a clean energy infrastructure that will be required with the provisions of universal energy usage, and thereby, an increased demand. As discussed earlier, we derive this figure from a previous study (Pollin and Chakraborty [2015]), where the authors presume additional investments in clean renewable energy and energy efficiency at a rate of 1.5% of the GDP (Y) annually over a certain time period (around 20 years). Since we are discussing a revenue neutral policy, the revenue of and the expense of the government on this energy policy and the endogenously determined tax rates is given by:

$$\begin{aligned} 0.99t\bar{C} &= G_f + G_e \\ 0.99t\bar{C} &= 1.5Y + (p_e + tc_e)\bar{e} + (1 + tc_t)T \\ t &= \frac{1.5Y + p_e\bar{e} + T}{0.99\bar{C} - c_e\bar{e} - c_tT} \end{aligned} \tag{4}$$

Since we know the values of the variables on the right-hand side of the tax equation above, this tax rate calculated endogenously enters the prices of all the commodities, which affect the budget of all the households as shown below. While the carbon tax imposes a financial burden on households, our energy policy proposal more than compensates for this loss for the bottom 7 deciles of the population (results shown in detail below). It might also induce those in the eighth decile who consume just above the cutoff limit to bring their energy consumption down, thereby, benefitting from this policy. Our results are in line with most of the literature on dividend policy which finds that high expenditure (in absolute terms) of the upper deciles (mostly the top 3) makes them net losers of this policy. But those who, to use the phrase of Ananthapadmanabhan et al. [2007], 'hide behind the poor' in carbon emissions, may have to pay for their lifestyle choices.

Alongside the domestic mobilization of the carbon tax, India, being a low-income developing country, can also seek assistance from the advanced countries and development banks in the form of unconditional, low interest rate loans which will be later repaid back. It will help to reduce the lag period of implementation of the proposed policy, which will otherwise get delayed due to the lack of sufficient funds,and with the benefits of the policy bearing immediate fruits, it will also help the progressive parties in India to mobilize opinion in favor of these policies and carbon taxes. As argued in Pollin and Chakraborty [2015], the recently established New Development Bank (NDB), whose founding members include India, along with Brazil, Russia, China and South Africa, could play a leading role in such inclusive green growth financing. With the recent political developments of the Trump administration in the United States withdrawing itself from the Paris Agreement, it provides an opportunity for the BRIC nations, particularly China, to play a leading role in the financing of the global green growth programmes, especially for the developing world and project itself as a world leader in the arena of clean green energy and climate change.

3.4 Infrastructure Development for the EPE Programme

1. So far we have not said anything about the actual implementation of this policy except in terms of how to finance it. But what this policy requires most attention to is developing the infrastructure to deliver it to the needy sections of the population. As discussed above, as of 2014, more than 20 percent of the Indian population does not have access to electricity with the scenario far more worse in the rural areas where almost 30 percent of the population does not have any access to electricity. More than 65 percent of the Indian population does not have access to clean fuels and technologies for cooking.[6] It is both because of the lack of purchasing power as also the lack of availability of electricity itself. So, while our in-kind transfer can take care of the lack of purchasing power, it cannot address the lack of infrastructure which will deliver this policy to the rural sections of the population. What is required, therefore, is a comprehensive planning to increase the infrastructure for delivering energy to every household in India. We discuss this crucial component of our policy in this section.

2. What kind of infrastructure will be required for delivery of electricity for residential (cooking, direct electricity consumption) purposes? As far as renewables are concerned, following are the sources: solar, small

[6] All statistics mentioned here are cited from World Development Indicators, World Bank

scale hydro, wind, biomass, geothermal and, if feasible, tidal energy. Sukhatme [2012] in his 'revised assessment' shows that, contrary to earlier views, it is now widely accepted that India has the potential to meet all of India's future demand for electricity from clean renewable sources, assuming that the country also undertakes major investments in energy conservation and efficiency. He makes this prediction for the year 2070 when all the energy requirements can potentially be met by renewable sources alone whereas our purpose is provision of electricity from now. Our purpose is to provide electricity *universally from now.* Therefore, infrastructural development will have to be of a kind which can deliver electricity both from renewable and non-renewable sources. Gradually the role of the latter needs to decline. In remote areas of India, where on grid is cost-prohibitive, special emphasis needs to be given to provide renewable energy, which by their nature is relatively easy to produce in the vicnity of the source of consumption.

3. But just this production is not enough, its delivery at all hours of the day according to its demand is a difficult challenge since the production of electricity from renewable sources varies through the day. Sukhatme [2012], therefore, suggests mechanisms and technological innovation as necessary conditions to ensure storage and minimum loss transmission of power generated from the plant to the household. To smoothly deliver the EPE policy, the renewable sources infrastructure will have to be supplemented with storage batteries to provide electricity throughout the day and, if required, complemented with non-renewable sources in the grid.Composition of power will have to be such that the electricity generated through non-renewables and renewables vary in a way that the overall production is evened out during a given day. To minimise carbon emissions, the grids can be so designed that the electricity generated through non-renewables kicks in only after the renewables are exhausted during a day. This might vary from day to day depending on weather conditions, for eg. lack of wind, an overcast day but since we are taking into account the backup being provided by non-renewables (at least upto that stage when technology and infrastructure is developed enough to meet the entire demand through renewables alone), delivery of electricity round the clock should not be an issue.

4. India has huge potential of renewable energy sources. According to a recent World Bank study, India has the potential of 150GW of genera-

tion capacity through renewable sources (Sargsyan et al. [2011]). The report also states that the economy's renewable energy potential is even greater than the 150 GW estimated till date since resources from sources with significant generation capacity (such as energy plantation of wastelands, offshore wind farms and tidal energy sources) have not yet been mapped. In some of the established sectors like wind, solar and small hydropower, the latest developments in engineering design and equipment technology are also likely to increase potential along with the discovery of new small hydropower sites and the development of the irrigation network. In 2011, India had the fifth largest capacity for wind energy in the world in 2011. On shore wind energy has the largest potential at 49GW, particularly in the states of Karnataka, Gujarat and Andhra Pradesh(International Energy Agency [2015]). According to IRENA's recent study, India can raise its final renewable energy use to approximately 8.8 quads by 2030, which is way higher than our earlier projections made in the paper(Pollin and Chakraborty [2015]). It shows that the targets which we have proposed in the eaerlier study can be easily achievable if these policies are put in place.

5. According to recent statistics available as of June 2017, India has installed 58.3 GW of renewable energy out of a total installed capacity of 330.3 GW which is approximately around 17.7 percent of the total installed capacity. These renewable energy sources, however,exclude large hydro, which is 44.6 GW. Within the renewable energy sources, small hydropower constitutes 4.4 GW, wind power constitutes 32.5 GW, biomass power and co-generation is 8.2 GW, waste to energy constitutes 1.1 GW and solar power makes up the remaining 13.1 GW of installed renewable energy capacity in India. So, as per the recent statistics, India has been able to utilize only one-third of it's known renewable energy capacity.[7] It shows that India has a lot of scope in expanding the renewable energy capacity whose benefits are not only confined to the provision of clean energy, but with the development of these renewable infrastructures, the benefits also spill over to other sectors of the economy as noted by some recent case studies (Mehta [2009], Baruah [2014]).

6. In a report published by the Indian Institute of Public Administration

[7] All data in this section has been cited from Central Electricity Authority, Ministry of Power, Government of India.

(IIPA), also acting as an implementing agent for the MNRE-UNDP-FRG Renewable Energy for Livelihoods Project in 14 villages in 6 districts of the states of Rajasthan and Uttar Pradesh, it reports that the development of renewable energy sources facilitated in reducing poverty through improved quality of life and increased livelihood opportunities in these remote, non-electrified villages of India that were not likely to get electricity from the grid(Mehta [2009]). In all the 14 villages studied, these developments improved the quality of life of the common people through providing clean energy for lighting, cooking and motive power and also building capacity, facilitating livelihood generation and, in many cases, enabling access to education and health facilities. With the support of local community and grass root technicians, this project implemented various new and renewable energy infrastructures like solar lanterns and cookers, solar home lightning and street lightning, small hydropower based lightning, biomass gasifier and biogas for drudgery reduction. As required under the program and due to the various linkage effects, gasifier sheds, powerhouses, solar repairing workshops, livelihood equipment sheds, water tanks, roads and schools had been constructed. As noted in the report, this aided the implementing agencies in building capacity, raising awareness, conducting training and skill provisioning, organising health camps and schools and facilitating access to income earning opportunities available through implementation of the NREGS program.

7. As suggested in the earlier study (Pollin and Chakraborty [2015]), and also, incorporating some important policies prescribed in a recent report published by the Planning Commission (Government of India [2014]), this study also proposes some areas of infrastructural development which has huge scopes of improving energy efficiency in the near future:

   (a) Building weatherisation and construction industry has huge scope for improvement in energy efficiency of the residential sector, specially in a time when 70 percent of the building stock in India by the year 2030 has been estimated to be built over the period 2011 to 2030. The strengthening of the Energy Conservation Building Code will create a policy environment which will provide further incentives to promote uptake of green buildings and opt for energy efficient options in their buildings.

   (b) Improvements in industrial energy efficiency presents an opportunity for considerable energy savings in India, especially in the iron and steel industry and the cement industry, which are the most energy intensive manufacturing sectors of the economy. The already existing Perform, Achieve and Trade (PAT) scheme, which is an outcome of the National Manufacturing Policy coupled with the National Mission on Enhanced Energy Efficiency, can be a major driver for improving energy efficiency in the energy intensive industries. As of recently available statistics till May 2017, Cycle 1 of PAT's three cycle scheme has achieved an energy savings of 0.35 quads of energy against the targeted energy savings of 0.27 quads (Bureau of Energy Efficiency [2017]). Combined with the proposed Energy Conservation Fund and a dedicated spending of 0.5 percent of GDP towards improving energy efficiency, India has a huge potential in saving energy and improving energy efficiency.

(c) The other sector which has a huge potential of improving energy efficiency in India is the transport sector, which accounts for more than half of India's petroleum consumption, and a quarter of the overall energy needs(Government of India [2014]). India's railway infrastructure is already developed and, therefore, primary emphasis should be on further increasing it's efficiency like raising frequency of the semi-high-speed trains for inter-city transport and developing freight corridors, which will help to improve it's modal share in both passenger and freight transport. The other possible areas of improvement of energy efficiency in the transportation sector include massive expansion of the public transport, dedicated lanes for public vehicles like Rapid Transit Corridor in urban areas and also dedicated bike lanes for bikes and rickshaws, promoting electric/hybrid mobility and improving the fuel efficiency of both light and heavy vehicles.

We believe that, if properly implemented, this policy proposal, in its entirety, has an immense potential of providing electricity to every household in India with a minimum consumption guaranteed without any cost to the household. Of course any consumption beyond that limit will be charged in full to avoid wastage of electricity as well as curbing carbon emissions arising out of such wastage.

3.5 Benefits of the EPE Programme

1. Every household in India will have equal access to electricity, a feat that almost all the governments since independence have dreamt about but never managed to deliver.

2. This policy also delivers on providing more employment since the employment elasticity in greener forms of energy is higher than those in fossil fuel based energy. It has been calculated elsewhere that the loss of employment in the fossil fuel based energy sectors will be more than compensated for by increase in employment in renewables-based sectors (Pollin and Chakraborty [2015])

3. Availability of free energy (upto a limit) addresses the issue of stealing of electricity for consumption since there will be no incentive left for those stealing at the moment. In India, even in 2014, about 0.8% worth of GDP is estimated to stolen electricity through corrupt means (Emerging Markets Smart Grid: Outlook 2015). Theft costs the Indian power sector almost $16.2 billion per year, which is the highest in the world. Our policy addresses such a leakage squarely.

4. Higher prices of fossil fuels as a result of the carbon tax will percolate down to commodities according to their carbon content and, hence, induce households, including the rich, to look for substitutes in green energy since even the highest price of green energy based products will more likely be lower than the increased price of fossil fuels.

5. Most importantly, it has the effect of enticing even the poor to move away from traditional forms of energy consumption because the price of energy will be *zero* for them (ensured by the fact that the *policy* sets the cutoff at a level higher that their current energy consumption) as compared to a shadow positive price, which they spend in terms of time used for collection of wood/cow dung cakes etc. So, not only does our proposal provide pecuniary benefits to the poor, it also has additional benefits in terms of improving the quality of family life and providing time for other household activities.

6. The health impact of outdoor air pollution in India costs about 3% of India's annual gross domestic product, and indoor air pollution adds significantly to this total. The World Health Organization estimates that the number of deaths from ambient air pollution stands at 621138 in 2012, the second highest in the world after China. According to the

same data, household air pollution attributable deaths totaled to more than 1.25 million deaths in 2012. Besides, 400 million Indians (90% of them women) are exposed to respiratory, pulmonary and vision hazards associated with indoor air pollution from burning traditional biofuels for cooking.[8]

7. On the supply side, the distribution of the overall energy subsidy to the providers of energy could be in proportion to their green energy mix. This will incentivise the move towards green energy, which will also have repercussions towards cheaper technological innovations.

4 Methodology and Data

4.1 Methodology

The methodology used in the paper is similar to the existing literature (Fremstad and Paul [2017]). To calculate the carbon content in individual commodities, as well as the employment potential of a given sector in the economy, the input-output tables for India, have been used. The Right to Energy programme requires two steps: calculating the carbon content and its impact on the household budget. For the former, IO data is used, and for the latter, the national sample survey (NSS) data is used to estimate the consumption of different deciles of the households. Commodities of consumption in the NSS have been recategorised to match with the IO specification available for India.

Step 1: To calculate the effect of a carbon tax on the price of a commodity, we borrow the methodology used in Fremstad and Paul [2017] to estimate the carbon content. Calculating carbon content in a commodity requires us to find the amount embodied in it of the ultimate commodity i.e. the commodity through which carbon enters the system. We can safely assume that fuel and energy and mining in the case of India are the two sectors which introduce carbon to the system. We combine these two sectors and treat them as one sector called energy in the input-output table. We need to first find the amount of energy embodied in a commodity and then multiply it by the amount of carbon emitted by a unit of energy to derive its carbon content.

Two steps are employed to find the energy content in any commodity. The *direct* content dc_{ej} is simply the amount of the energy sector going into

[8]This discussion has benefited immensely from IRENA [2017].

producing one unit of that commodity (e and j in dc_{ej} represent the energy sector and the sector which produces the commodity under consideration respectively). There is an *indirect* carbon content too, which enters a commodity through the other commodities that have gone into its production. The sum of these gives us the total content (tc_{ej}) of carbon of a commodity, which can be calculated from the Leontief inverse matrix in the following manner, where **DC** and **TC** are respectively the matrices of direct and total content of commodities as inputs to commodities as outputs and, **I** is the identity matrix.

$$\mathbf{TC} = (\mathbf{I} - \mathbf{DC})^{-1} \tag{5}$$

Each of the elements tc_{ij} in **TC** represent the amount of commodity i entering as an input for production of a unit of commodity j. By implication the tc_{ej} represent the amount of energy embodied in each commodity j, so, the energy row of the **TC** matrix gives us the total content of energy in each of the commodities. To find out the carbon content in commodity j, we multiply it by the amount of carbon (c_e) emitted by a unit of energy,

$$c_j = tc_{ej} \cdot c_e \tag{6}$$

The increase in price of a commodity j as a result of a tax t imposed on carbon can then be calculated by multiplying this tax rate with the total carbon embodied in a commodity,

$$p_j^{new} = p_j^{old} + c_j \cdot t \tag{7}$$

This increase in prices can then be used to calculate its adverse impact on the budget of a household.

Step 2: The budget of the household is derived from the NSS survey. The NSS survey gives details of expenditure for a household across a whole range of commodities defined at a very detailed level. Since our attempt is to find the carbon content of these commodities, we have recategorised them in a way which is commensurate with the IO level of disaggregation. We have divided the commodities into eight categories and found the respective industries in the IO table and the commodities in the NSS survey to match that. The exact codes used for this match from the respective sources is provided in table 8 of the appendix.

With this match, the carbon content and the price rise can now be calculated across these eight consumption categories based on equations 6 and 7. The total carbon content of these eight categories of commodities is reported in table 1.

Table 1: Carbon Content of Commodities of Consumption

Consumption Categories	Gross Output (million USD)	Carbon Content (MTCO2/USD)
Food	567657.4	0.0003
Clothing & Footwear	105377.6	0.0011
Industrial Goods	815446.8	0.0028
Housing	539160.0	0.0018
Fuel & Electricity	321455.4	0.0135
Transport	267475.4	0.0027
Medical & Education	126971.5	0.0004
Misc Services	900121.4	0.0004

Source: Authors' Calculation (see text for details)

The effect of a carbon tax varies across income categories of households, so, we divide the NSS population in deciles and study the effect of this tax on their budget and then compensate both for free energy and travel passes to see the net impact of our programme on these deciles. We also report the overlap between class and caste to show the progressive effects of our policy on the socio-economic fabric of India.

4.2 Data sources

We use the latest NSS 68th round unit level data (survey done in 2011-12) and the corresponding source for the Input-Output table is OECD database. NSS schedule 1.0 has been used for consumption related data.

5 Results

Table 2 presents the per capita annual expenditure on different consumption categories for each decile at the all India level. Certain features of the consumption pattern are noteworthy. First, there is a significant inequality in consumption with the richest (top decile) consuming almost ten times than the poorest (lowest decile). Since consumption propensities out of income fall with income, the inequality in income will be even starker (NSS does not collect information on total income). Second, the general Engel's law holds i.e. as the income rises, consumption on food as a share of total falls. Since food has the lowest carbon content among commodities (see table 1), we can expect that the carbon footprint of the poorest will be the lowest and gradually rises with income of the households. Third, other than food, fuel and electricity, the consumption inequality rises quite dramatically, which shows the deprivation of the poorest in India. Fourth, even among the richest, the top decile consumes more than double the amount than the ninth decile.

Table 2: Total Annual Per Capita Expenditure in India (in USD)

			Commodities							
Deciles	HH Size	Total Expenses	Food	Clothing	Indus. Goods	Housing	Fuel & Elec.	Trans.	Med. & Educ.	Misc
1	6.5	137.06	87.62	5.36	8.90	0.12	19.63	2.69	6.88	5.86
2	6.3	182.85	113.55	9.75	12.15	0.41	22.81	4.42	10.52	9.23
3	6.0	215.85	130.80	12.00	14.75	0.65	25.92	6.41	13.66	11.67
4	5.9	246.71	145.74	15.85	17.49	1.15	27.54	8.43	16.30	14.19
5	5.8	282.23	161.52	19.77	20.69	1.89	29.99	11.17	19.74	17.46
6	5.5	324.06	180.00	23.46	24.44	2.91	33.25	14.61	23.83	21.56
7	5.3	378.07	200.75	27.40	29.46	5.50	36.50	20.12	32.77	25.58
8	5.1	456.09	226.21	36.58	36.99	10.17	40.50	28.47	44.99	32.20
9	4.8	594.18	267.72	49.44	52.16	23.21	46.92	43.54	65.65	45.54
10	4.2	1294.55	386.39	93.84	238.17	88.23	68.26	104.99	196.54	118.13
Total	5.5	411.17	190.03	29.34	45.52	13.42	35.13	24.48	43.09	30.14

Source: Authors' Calculation based on 68th Round of NSS

Variation in the composition of total expenditure across deciles is going to affect various classes differently in terms of their net gain or loss as a result of the carbon tax and the benefits of the policy. In the Indian case, however, there is an additional layer of discrimination other than income i.e. caste, which needs to be taken into account while discussing the progressive implications of this policy. Table 3 presents the share of different castes in each of these income deciles, and the results are a stark reminder of the double discrimination that the oppressed sections of the Indian population face. Ten percent of the population (STs) has double its share in poverty. Two third of the population (STs, SCs and OBCs) constitute ninety percent of the poorest (based on the lowest decile). These figures also show that a policy, such as ours, which is progressive in terms of income will also be progressive in terms of the caste hierarchy. That is not to say that a purely income-based policy can address social oppression but it will surely improve their economic well-being.

To understand the effect of our policy in regional terms, we need to see the consumption patterns across urban and rural India. Table 4 shows the composition of consumption differentiated between rural and urban India.

Table 3: Intersectionalities of Caste and Class

Decile	Share of Each Caste (in %) Scheduled Tribes (ST)	Scheduled Castes (SC)	Other Backward Castes (OBC)	Upper Castes
1	21.9	27.6	40.7	9.8
2	13.0	24.4	44.2	18.4
3	10.9	23.6	45.8	19.8
4	9.4	20.6	47.4	22.5
5	8.1	20.3	47.0	24.6
6	7.6	18.2	48.6	25.5
7	6.5	16.8	45.8	31.0
8	5.1	16.8	44.4	33.7
9	3.9	13.2	42.6	40.3
10	2.8	9.0	34.1	54.1
Total	8.9	19.0	44.1	28.0

Source: Authors' Calculation based on 68th Round of NSS

Instead of the absolute amount, we present the share of commodities in the total consumption to make the regional comparison easier to interpret. The overall pattern of inequality of consumption remains similar but the variation is higher in the urban than the rural areas. As a share in total expenditure, the urban households spend almost fifteen times more on housing than their rural counterparts, which could be on account of the relative housing cost. Again as a share in total expenditure, the rural elite consumes almost half the amount on miscellaneous services in comparison to the urban elite. This could be on account of the shifting pattern of consumption from other consumption categories (for eg. food) to services within the richest in the urban areas in contrast to their rural counterparts.

For an analysis of the energy policy proposed here, we need to calculate the carbon charge that the households will have to bear as against the benefits they derive from this policy. To calculate the carbon charge, i.e. the increase in the cost of living of the households as a result of a carbon tax (t), we need to find out the carbon footprint of each of these deciles. It can be calculated by multiplying their expenditure on commodities (from table 2) by the carbon content embodied in each of those commodities (from table 1). This gives us the carbon footprint per capita across the deciles (table 5). Our study corroborates the existing studies on stark inequality in carbon

Table 4: Annual Per Capita Expenditure in Rural and Urban India

Deciles	Expenses (USD)	Share in Total (%)	Share of Total Expenditures in Each Decile (%)							
			Food	Clothing	Indus. Goods	Housing	Fuel & Elec.	Trans.	Med & Edu	Misc
Rural										
1	129.8	3.9	64.2	3.9	6.4	0.0	14.7	1.9	4.9	4.1
2	170.6	5.2	62.9	5.0	6.6	0.0	12.8	2.2	5.7	4.8
3	199.0	6.1	61.8	5.6	6.7	0.1	12.2	2.7	5.9	5.0
4	225.3	6.9	60.4	6.0	7.0	0.1	11.7	3.2	6.3	5.4
5	251.1	7.6	59.0	6.9	7.1	0.1	11.0	3.5	6.7	5.7
6	282.8	8.6	57.4	7.5	7.5	0.2	10.5	4.0	7.0	6.0
7	321.0	9.8	56.1	7.8	7.6	0.3	10.2	4.3	7.3	6.4
8	373.3	11.4	53.9	8.2	8.0	0.3	9.5	5.1	8.5	6.5
9	459.1	14.0	49.8	9.3	8.4	0.6	8.6	6.4	10.3	6.6
10	876.5	26.7	34.9	8.6	20.9	1.2	5.5	6.3	16.7	5.9
Total	328.9	100.0	56.0	6.9	8.6	0.3	10.6	4.0	7.9	5.6
Urban										
1	181.7	2.9	60.6	4.3	6.7	1.4	13.0	2.3	6.0	5.7
2	251.6	4.1	57.4	4.8	6.9	2.3	11.8	3.5	6.6	6.6
3	306.5	5.0	55.2	5.2	7.0	2.7	10.8	4.5	7.4	7.2
4	360.2	5.8	52.6	5.3	7.1	3.5	10.2	5.5	8.5	7.3
5	419.8	6.8	50.1	5.6	7.8	4.5	9.7	5.9	8.7	7.7
6	490.6	8.0	47.8	6.5	7.5	5.2	9.0	6.4	9.6	8.0
7	577.5	9.4	45.3	6.8	7.7	6.5	8.4	7.1	9.9	8.3
8	701.9	11.4	42.4	7.5	8.2	6.9	7.8	8.0	10.2	9.0
9	916.2	14.8	38.2	7.6	9.0	7.8	7.2	8.7	11.0	10.4
10	1964.2	31.8	25.1	6.7	18.0	10.1	4.7	9.4	15.0	11.0
Total	617.0	100.0	47.5	6.0	8.6	5.1	9.3	6.1	9.3	8.1

Source: Authors' Calculation based on 68th Round of NSS emissions in India (Michael and Vakulabharanam [2016], Ananthapadmanabhan et al. [2007]). For every dollar spent, the richest in India emit *eight times* more carbon that the poorest and within the richest the top decile emits more than double what the ninth decile does.

To determine the cut off for the distribution of our dividend policy, we need to calculate the climate injustice quotient (CIQ), which measures the ratio of carbon footprints of a section of the population to its share in total population. Here, we take the proportion of the carbon footprints of the individual deciles in the total footprint and divide it by their share in the population. The last column of table 5 gives us these figures, which shows that the bottom seven deciles emit lesser carbon than their share in the population (CIQ<1) and the top three deciles emit more than their share in the population (CIQ>1).

Table 5: Carbon Footprint and the Climate Injustice Quotient

Deciles	Footprint per capita	HH Size	Footprint per HH	Share in Footprint	CIQ
1	0.34	6.5	2.18	0.053	0.53
2	0.41	6.3	2.58	0.062	0.62
3	0.47	6.0	2.84	0.068	0.68
4	0.52	5.9	3.07	0.074	0.74
5	0.58	5.8	3.38	0.081	0.81
6	0.66	5.5	3.64	0.088	0.88
7	0.75	5.3	4.00	0.096	0.96
8	0.89	5.1	4.52	0.109	1.09
9	1.12	4.8	5.37	0.129	1.29
10	2.37	4.2	9.95	0.240	2.40

As discussed earlier, the cutoff level of free energy consumption (fuel and electricity plus transport) that this policy needs to provide for is determined by the CIQ. Our policy attempts to redress this inequality of carbon emission by providing for free fuel and electricity to those whose CIQ is less than one while those with CIQ greater than one pay the full price of fuel and electricity. So, the widening schism between the two countries co-existing side by side i.e. Bharat, which bears the climate impact burden, and India, which imposes that burden because of their lifestyle choices, is justly addressed with the latter being taxed to compensate the former for the loss. The nature of this transfer is the free energy benefit that the bottom seven deciles get.

For fuel and electricity, we use the median per capita *real* consumption of the seventh decile, which is 412 kWh per year[9], and multiply it by the average size of the household, which is 5.5. Based on this, *the free entitlement of fuel and electricity for a household comes out to be 2268 kWh per annum or 189 kWh per month.* Consumption of electricity beyond this limit is going to be charged in full. Therefore, this policy benefits only those who keep their consumption lower than this level while the others pay the higher prices for *all* units of consumption.

The rise in transport expenditure can be compensated for by providing travel passes with pre-loaded balance amount which can be used on any mode of public transport, irrespective of whether it runs as private or public initiatives. In our opinion, however, expansion of an inexpensive public transport run by the government is a must for any country which seeks to provide for a decent livelihood to its population. But this policy is not contingent on the provision of this service only by public means since these travel passes can be used on any means of public transport. The way this compensation works is that each individual will be issued travel passes carrying minimum nominal sum equivalent to the median value of transport incurred after the carbon tax has come into effect. We are aware that this aspect of our policy might be difficult to implement in rural areas where public transport infrastructure itself might be non-existent. Nevertheless, since the other part of this policy, which is the expenditure on developing a green economy, also discusses at length the provision for public transport, this discussion should be seen as a complement to that.

Through this exercise, we have got all the relevant information required on the right-hand side of equation 4, which will help us calculate the level of tax required per unit of carbon for this policy to come into effect. Unlike in the other studies in the literature on cap and dividend, where the tax rate is given exogenously, in our case, there is an endogeneity involved because the tax rate is on both sides of the equation. The level of carbon tax required for this policy to come into effect is *USD 60.4 per metric ton of carbon dioxide.* As a result of this tax, the average price of electricity rises from USD 0.08 to USD 0.10 per kWh.

The next step is to find the effect of this tax on the budget of the

[9]This has been calculated by dividing the nominal median value of energy consumption of the seventh decile i.e. USD 34, by the current price of electricity, i.e. USD 0.0825/kWh, taken from the Ministry of Power. We take median as opposed to the mean for distribution of electricity on the principle that median is representative of a majority of the household's consumption of fuel and electricity in that decile.

households i.e. the carbon charge. To calculate the carbon charge on a particular commodity, we need to know the *total* carbon content in that commodity i.e. not just the direct but also the indirect carbon content. Once this total is known, the price effect calculated is quite robust (at least in the sense of a given state of technology given by the IO coefficients) and not an approximate measure, which is what the direct content calculation would have yielded. The calculation that follows, therefore, is the closest estimate one can achieve for the effect of a carbon tax on the households. We use table 5 and the tax rate to calculate the per capita carbon charge for these deciles (see the carbon charge column in table 6). Since the footprint increases with the deciles, the absolute amount of carbon charge increases in the same manner, but it is regressive in the relative sense since the charge as a proportion of household expenses falls with income.

It is in this context that the progressive aspect of our policy kicks in. The benefit is divided into two parts of electricity and cooking and transport on the lines of the discussion above. Since free electricity is easily distributable per household unlike per capita as it avoids the identification problem usually associated with in-kind transfers, the entitlement is at the household level. So, we report the benefit figures both at the per capita as well as the household level. On the other hand, the transport benefits are distributed at per capita level. It can be seen from table 6 that the total energy benefit per household are distributed quite progressively with the highest benefit associated with the poorest, and it falls with income.[10] For the top three deciles, the only benefits they are entitled to are transport charges.

The net benefits are derived by subtracting the carbon charge associated with the respective deciles from the total energy benefits. It can be seen that it is progressive both in per capita and per household terms. At the household level, this is so for two reasons. While the total energy benefits fall with income, the carbon charge rises. It is progressive even at the per capita level because the fall in total energy benefits is more than compensated for by the rise in the carbon charge. The last three columns in table 6 represent the carbon charge, energy benefit and net benefit as a share of the total expenses of the respective households.

The calculation of benefits so far has been based on the assumption of maximum possible benefits (potential) the households can derive from this policy i.e. by consuming the maximum possible free energy available to

[10] The reason why there is a reversal in the trend of energy benefits in per capita versus household terms is because the underlying principle of distribution of electricity is at the household level, which means that benefit per capita will, by the way policy is constructed, decrease with the size of the household.

Table 6: Potential and Minimum Benefits of the Households

Deciles	Per Capita						Household			Share of Expenses		
	Expenses (in USD)	Carbon Charge (in USD)	Electricity & Cooking (in USD)	Transport (in USD)	Energy Benefit (in USD)	Net Benefit (in USD)	Size	Energy Benefit (in USD)	Net Benefit (in USD)	Carbon Charge (in %)	Energy Benefit (in %)	Net Benefit (in %)
Potential												
1	137.1	20.3	34.9	17.9	52.8	32.5	6.5	343.2	211.2	14.8	38.5	23.7
2	182.8	24.7	36.0	17.9	53.9	29.2	6.3	339.6	184.0	13.5	29.5	16.0
3	215.8	28.6	37.8	17.9	55.7	27.1	6.0	334.2	162.5	13.3	25.8	12.5
4	246.7	31.5	38.4	17.9	56.3	24.9	5.9	332.4	146.9	12.7	22.8	10.1
5	282.2	35.2	39.1	17.9	57.0	21.8	5.8	330.6	126.3	12.5	20.2	7.7
6	324.1	40.0	41.2	17.9	59.1	19.2	5.5	325.3	105.4	12.3	18.2	5.9
7	378.1	45.6	42.8	17.9	60.7	15.1	5.3	321.7	80.0	12.1	16.1	4.0
8	456.1	53.5	0.0	17.9	17.9	-35.6	5.1	91.3	-181.6	11.7	3.9	-7.8
9	594.2	67.6	0.0	17.9	17.9	-49.7	4.8	85.9	-238.4	11.4	3.0	-8.4
10	1294.6	143.1	0.0	17.9	17.9	-125.2	4.2	75.2	-525.9	11.1	1.4	-9.7
Minimum												
1	137.1	20.3	19.6	2.7	22.3	2.0	6.5	145.1	13.2	14.8	16.3	1.5
2	182.8	24.7	22.8	4.4	27.2	2.5	6.3	171.6	16.0	13.5	14.9	1.4
3	215.8	28.6	25.9	6.4	32.3	3.7	6.0	194.0	22.3	13.3	15.0	1.7
4	246.7	31.5	27.5	8.4	36.0	4.5	5.9	212.2	26.7	12.7	14.6	1.8
5	282.2	35.2	30.0	11.2	41.2	5.9	5.8	238.7	34.4	12.5	14.6	2.1
6	324.1	40.0	33.2	14.6	47.9	7.9	5.5	263.2	43.4	12.3	14.8	2.4
7	378.1	45.6	36.5	17.9	54.4	8.8	5.3	288.3	46.7	12.1	14.4	2.3
8	456.1	53.5	0.0	17.9	17.9	-35.6	5.1	91.3	-181.6	11.7	3.9	-7.8
9	594.2	67.6	0.0	17.9	17.9	-49.7	4.8	85.9	-238.4	11.4	3.0	-8.4
10	1294.6	143.1	0.0	17.9	17.9	-125.2	4.2	75.2	-525.9	11.1	1.4	-9.7

Source: Authors' Calculation (see text for details) them. However, a question could be raised that this is not in line with their current consumption. To cover that possibility, we also report the *minimum* possible benefits that the bottom seven deciles can derive from this policy by using their current actual consumption of fuel and electricity and transport.

What if they continue to consume their current levels? Will they still benefit? And the table tells us that *even* in this minimum sense, even the poorest households, despite the currently abysmal levels of energy consumption, gain as a result of this policy (see Table 2). If we add to that the implicit health and time benefits associated with our policy, which have obviously not been included in the overall structure of benefits, we can safely say that at the very least the bottom seven deciles gain from this policy even if they were to continue consuming the same level of energy as they do today.

Given the current levels of very low consumption of fuel and electricity and transport by the lower deciles, it is safe to argue that the actual consumption as a result of this progressive policy will lie somewhere between the minimum and the potential benefits. In such a situation, the real benefit structure would, by and large, remain the same as the potential benefits. It will also lift the living standards up of the lower deciles since they will now have access to clean forms of energy, whereas currently, they have to depend on wood burning, etc. for their sustenance.

We now discuss the benefits of the Right to Energy policy at a regional level (see table 7) by dividing the population into rural and urban areas. The effect of this policy across the geographical regions is varied.

First, having determined the cutoff level of free electricity available to the households based on the CIQ, we find that because electricity consumption of the urban household is relatively higher than their rural counterparts, the free cut-off limit is crossed by the sixth decile household itself in the urban area. This has the implication that while bottom 70 percent gain from this policy in the rural areas, it's only the bottom 50 percent of households in the urban areas who will be net gainers of this policy.

Second, in per capita terms, the rural poor gain more than their urban counterpart. Even in terms of net benefits, rural households fare better in both per capita and household terms. The is because of the lower per capita carbon charge in the rural areas, which means a lower footprint of a rural household in comparison to their urban counterpart.

In terms of net benefits as a share of the expenses, the rural households stand to gain more than their urban counterparts both because of higher net benefits as well as lower relative expenses.

We can safely say that our policy is not only progressive from a class perspective, it is also progressive when seen in terms of regional deprivation.

Table 7: Regionwise Potential Benefits of the Households

Deciles	Per Capita						Household			Share of Expenses		
	Expenses (in USD)	Carbon Charge (in USD)	Electricity & Cooking (in USD)	Transport (in USD)	Energy Benefit (in USD)	Net Benefit (in USD)	Size	Energy Benefit (in USD)	Net Benefit (in USD)	Carbon Charge (in %)	Energy Benefit (in %)	Net Benefit (in %)
Rural												
1	129.8	19.5	34.4	17.9	52.3	32.7	6.6	344.9	215.9	15.1	40.2	25.2
2	170.6	23.3	36.0	17.9	53.9	30.6	6.3	339.5	192.5	13.7	31.6	17.9
3	199.0	26.5	37.2	17.9	55.1	28.6	6.1	336.0	174.4	13.3	27.7	14.4
4	225.3	29.4	39.1	17.9	57.0	27.6	5.8	330.6	160.2	13.0	25.3	12.3
5	251.1	31.7	39.8	17.9	57.7	25.9	5.7	328.8	147.8	12.6	23.0	10.3
6	282.8	34.9	39.8	17.9	57.7	22.7	5.7	328.8	129.6	12.4	20.4	8.0
7	321.0	39.2	41.2	17.9	59.1	19.9	5.5	325.2	109.7	12.2	18.4	6.2
8	373.3	44.4	0.0	17.9	17.9	-26.5	5.2	93.1	-137.9	11.9	4.8	-7.1
9	459.1	52.6	0.0	17.9	17.9	-34.7	5.0	89.5	-173.6	11.5	3.9	-7.6
10	876.5	95.5	0.0	17.9	17.9	-77.6	4.6	82.3	-357.1	10.9	2.0	-8.9
Urban												
1	181.7	25.4	33.3	17.9	51.2	25.8	6.8	348.5	175.6	14.0	28.2	14.2
2	251.6	33.5	36.6	17.9	54.5	21.0	6.2	337.7	130.0	13.3	21.6	8.3
3	306.5	39.1	38.4	17.9	56.3	17.3	5.9	332.4	101.9	12.7	18.4	5.6
4	360.2	45.1	39.8	17.9	57.7	12.6	5.7	328.8	72.0	12.5	16.0	3.5
5	419.8	51.7	42.8	17.9	60.7	8.9	5.3	321.6	47.4	12.3	14.5	2.1
6	490.6	58.8	0.0	17.9	17.9	-40.9	5.1	91.3	-208.4	12.0	3.6	-8.3
7	577.5	67.7	0.0	17.9	17.9	-49.8	4.8	85.9	-238.8	11.7	3.1	-8.6
8	701.9	80.9	0.0	17.9	17.9	-63.0	4.5	80.6	-283.5	11.5	2.6	-9.0
9	916.2	104.0	0.0	17.9	17.9	-86.1	4.1	73.4	-352.9	11.3	2.0	-9.4
10	1964.2	216.1	0.0	17.9	17.9	-198.2	3.9	69.8	-773.0	11.0	0.9	-10.1

Source: Authors' Calculation (see text for details)

If we add the information available on the caste-class overlap in table 3, then the policy turns out to be progressive in three different, i.e. caste, class and region, but interdependent senses.

6 Conclusion

This paper argues that an environmental policy can be devised which by its very structure delivers equitable and sustainable growth without giving up on its pace. It draws upon the literature on green growth, tax/cap and dividend policy, which have been under extensive debate and political considerations in the advanced countries. While the energy mix of the growth process changes in favour of clean sources through investment in green energy as well as controlling demand for fossil fuels through a carbon tax/cap, distribution of the tax revenue in the form of universal access to energy makes the process egalitarian. This will also solve one of the oldest problems of low levels of electrification in India.

Our results show that protecting the environment without sacrificing growth is something entirely achievable for a developing country like India. While in the advanced economies, there are already many instances of carbon tax being levied, the developing countries are yet to experience any such real implementations of an environmental tax. The main concern among the politicians and the policymakers in developing countries is that an environmental tax will bring additional hardship to the poor given that these taxes are usually regressive in nature. However, this study shows that if the mobilised resources are equitably distributed, then this policy can be easily transformed into a progressive one. Our proposed policy immensely benefits the poorer sections of the population in India who have been deprived of any access to clean forms of energy, and even a basic facility like electricity, for ages. This policy by providing *free* electricity and access to public transport till a certain level brings a significant improvement in the lifestyle of the common people, especially the poor.

As we have argued earlier, developing countries, like India, need to address the issue of climate change with similar urgency as being done in the advanced economies. It is not something out of altruism that India, or for that matter any other developing country, needs to do; it is primarily because of protecting their economic interests. Agriculture is one of the primary occupations in this region of the world and as climate and agricultural scientists have predicted that this sector is most vulnerable to erratic climate conditions(Food and Agricultural Organization of the United Nations

[2016]). So, arguing for the protection of the environment is, in a sense, similar to defending the interests of the farmers and peasants, and thereby the food security, of these developing countries. India, which is already on a high growth trajectory since the 1990s and facing a continuously rising demand for energy, needs to simultaneously address the ecological concerns as well as the high rates of unemployment so that the future growth trajectory can be made inclusive for the majority of the population. And, our proposed policy is *a step forward* towards addressing these concerns.

Appendix

Table 8: Code Matching from Input Output Tables to NSS Categories

Consumption Categories	**IO Codes***	**NSS Codes****
Food	C01T05+C15T16	1 to 17
Clothing and Footwear	C17t19	29+30+31
Manufactured Goods	C20+C21T22+C24+C25+	21+22+23+34
	+C26+C27+C28+C29+	
	+C30T33X+C31+C34+C35+C36T37	
Housing	C45+C70+C71	26
Fuel and Electricity	C10T14+C23+C40T41	18
Transport	C60T63	25
Health and Education	C80+C85	19+32+33
Misc Services	C50T52+C55+C64+C65T67	20+24+27
	+C72+C73T74+C75+C90T93	

*Codes are taken from OECD Input-Output Tables (IOT), 2015
**Codes are serial numbers of items in the Summary of Consumer Expenditure (Level 12) of Schedule 1.0 (NSS 68th round)
Source: Compiled by authors from IO, NSS

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